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EXAMINATION OF THE SIMILARITIES AND DISSIMILARITIES BETWEEN HYPERSEXUALITY AND PROBLEMATIC PORNOGRAPHY USE

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II. Nyilatkozatok

1. A doktori értekezés szerzőjeként[2]

a) hozzájárulok, hogy a doktori fokozat megszerzését követően a doktori értekezésem és a tézisek nyilvánosságra kerüljenek az ELTE Digitális Intézményi Tudástárban. Felhatalmazom a Pszichológiai Doktori Iskola hivatalának ügyintézőjét Üveges Tímea, hogy az értekezést és a téziseket feltöltse az ELTE Digitális Intézményi Tudástárba, és ennek során kitöltse a feltöltéshez szükséges nyilatkozatokat.

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[1] A kari hivatal ügyintézője tölti ki.
[2] A megfelelő szöveg aláhúzandó.

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2. A doktori értekezés szerzőjeként kijelentem, hogy

a) a ELTE Digitális Intézményi Tudástárba feltöltendő doktori értekezés és a tézisek saját eredeti, önálló szellemi munkám és legjobb tudomásom szerint nem sértem vele senki szerzői jogait;

b) a doktori értekezés és a tézisek nyomtatott változatai és az elektronikus adathordozón benyújtott tartalmak (szöveg és ábrák) mindenben megegyeznek.

3. A doktori értekezés szerzőjeként hozzájárulok a doktori értekezés és a tézisek szövegének plágiumkereső adatbázisba helyezéséhez és plágiumellenőrző vizsgálatok lefuttatásához.

Kelt: Budapest, 2019. 01. 17.

a doktori értekezés szerzőjének
aláírása

[3] A doktori értekezés benyújtásával egyidejűleg be kell adni a tudományági doktori tanácshoz a szabadalmi, illetőleg oltalmi bejelentést tanúsító okiratot és a nyilvánosságra hozatal elhalasztása iránti kérelmet.

[4] A doktori értekezés benyújtásával egyidejűleg be kell nyújtani a minősített adatra vonatkozó közokiratot.

[5] A doktori értekezés benyújtásával egyidejűleg be kell nyújtani a mű kiadásáról szóló kiadói szerződést.

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LIST OF ABBREVIATIONS

α	Cronbach's alpha
ADHD	Attention Deficit Hyperactivity Disorder
AIC	Akaike Information Criterion
ANOVA	One-Way Analyses of Variance
ASRS	ADHD Self-Report Scale
BIC	Bayesian Information Criterion
BOLD	Blood-Oxygen-Level Dependent Signal
CCFI	Comparison Curve Fit Index
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Confidence Interval
CPUI-9	Short Version of the Cyber-Pornography Use Inventory
CPUI-31	Cyber-Pornography Use Inventory
CR	Composite Reliability
CSBD	Compulsive Sexual Behavior Disorder
DF	Degree of Freedom
DRD4	D4 Dopamine Receptor
DSM-IV	Fourth Edition of the Diagnostic and Statistical Manual of Mental Disorders
DSM-IV-TR	Fourth Revised Edition of the Diagnostic and Statistical Manual of Mental Disorders
DSM-5	Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders
fMRI	Functional Magnetic Resonance Imaging
HB	Hypersexual Behavior
HBCS	Hypersexual Behavior Consequences Scale
HBI	Hypersexual Behavior Inventory
HBI-SF	Hypersexual Behavior Inventory Short-Form
HD	Hypersexual Disorder
ICD-11	Eleventh Edition of the International Statistical Classification of Diseases and Related Health Problems
IRB	Institutional Review Board
KR-20	Kuder-Richardson Formula 20
LGBTQ	Lesbian, Gay, Bisexual, Transgender, and Queer Communities

L-Mode	Latent Mode Procedure
L-M-R Test	Lo-Mendell-Rubin Adjusted Likelihood Ratio Test
LPA	Latent Profile Analysis
M	Mean
MAMBAC	Mean Above Minus Below A Cut Procedure
MAXEIG	Maximum Eigenvalue Procedure
NPV	Negative Predictive Value
OSF	Open Science Framework
PPCS	Problematic Pornography Consumption Scale
PPU	Problematic Pornography Use
PPUS	Problematic Pornography Use Scale
PPV	Positive Predictive Value
RMSEA	Root Mean Square Error of Approximation
SCID-II	Structured Clinical Interview for DSM Disorders
SD	Standard Deviation
SE	Standard Error
SEM	Structural Equation Modeling
SSABIC	Sample-Size Adjusted Bayesian Information Criterion
TLI	Tucker–Lewis Index
UPPS-P	UPPS-P Impulsive Behavior Scale
WLSMV	Mean- and Variance-Adjusted Weighted Least Squares Estimator

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LIST OF PUBLICATIONS THAT THE DISSERTATION IS BASED UPON

Bőthe, B., Bartók, R., Tóth-Király, I., Reid, R. C., Griffiths, M. D., Demetrovics, Zs., & Orosz, G. (2018). Hypersexuality, gender, and sexual orientation: A large-scale psychometric survey study. *Archives of Sexual Behavior, 47*(8), 2265-2276. doi: 10.1007/s10508-018-1201-z

Bőthe, B., Kovács, M., Tóth-Király, I., Reid, R. C., Griffiths, M. D., Orosz, G., & Demetrovics, Z. (2018). The Psychometric Properties of the Hypersexual Behavior Inventory Using a Large-Scale Nonclinical Sample. *Journal of Sex Research*, 1-11. doi: 10.1080/00224499.2018.1494262

Bőthe, B., Tóth-Király, I., Potenza, M. N., Griffiths, M. D., Orosz, G., & Demetrovics, Z. (2018). Revisiting the role of impulsivity and compulsivity in problematic sexual behaviors. *Journal of Sex Research*, 1-14. doi: 10.1080/00224499.2018.1480744

Bőthe, B., Tóth-Király, I., Zsila, Á., Griffiths, M. D., Demetrovics, Z., & Orosz, G. (2018). The development of the problematic pornography consumption scale (PPCS). *Journal of Sex Research*, *55*(3), 395-406. doi: 10.1080/00224499.2017.1291798

Bőthe, B., Koós, M., Tóth-Király, I., Orosz, G., & Demetrovics, Z. (in press). Investigating the associations of adult ADHD symptoms, hypersexuality, and problematic pornography use among men and women on a largescale, non-clinical sample. *Journal of Sexual Medicine.*

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FOREWORD

Sexuality is one of the basic needs of humans and it is hard to draw the line between "healthy" and "problematic" sexual behaviors (Kafka, 2010). Having problems with one's sexuality may cover a wide range of sexual problems including sexual dysfunctions (e.g., hypoactive sexual desire dysfunction, orgasmic dysfunctions), sexual pain disorders (e.g., sexual pain-penetration disorder), gender incongruence (e.g., gender incongruence of adolescence or adulthood trans-sexualism), paraphilic disorders (e.g., exhibitionistic disorder, voyerism), predominantly sexually transmitted infections (e.g., syphilis, herpes simplex infection of genitalia or urogenital tract), or impulse control disorders (e.g., compulsive sexual behavior disorder) (ICD-11; World Health Organization, 2018).

Hypersexuality is one of the oldest problematic sexual behaviors that has been mentioned in human history through famous examples such as Casanova or Don Juan, and early descriptions of clinical patients (Karila et al., 2014). However, its systematic clinical and scientific examination has started to increase only a few decades ago (e.g., Carnes, 1983; Griffiths, 2001; Kafka, 2010; Kafka & Hennen, 1999). Since then, several terms have been used to describe this phenomenon (e.g., sex/sexual addiction, hypersexuality/hypersexual disorder, sexual impulsivity, out-of-control sexual behavior, excessive sexual behavior, and compulsive sexual behavior disorder) with similar but not completely overlapping definitions (for detailed reviews see Karila et al., 2014; Kingston & Firestone, 2008; Montgomery-Graham, 2017; Wéry & Billieux, 2017).

Less than a decade ago, hypersexuality was considered as a new clinical diagnosis in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* as "Hypersexual Disorder" (DSM-5; American Psychiatric Association, 2013; Kafka, 2010; Kafka, 2014), but it was ultimately rejected. However, as a result of robust empirical studies and thorough clinical investigations (Kraus, Voon, & Potenza, 2016; Reid, Carpenter, et al., 2012; Voon et al., 2014; Womack, Hook, Ramos, Davis & Penberthy, 2013), it is now included in another diagnostic manual, the eleventh edition of *International Statistical Classification of Diseases and Related Health Problems*

under the name of "Compulsive Sexual Behavior Disorder" classified as an impulse control disorder (ICD-11; World Health Organization, 2018).[6]

As a result of this official diagnostic criteria, the terminology, the definition, and the classification of hypersexuality is likely to converge in future studies; however, there are some important questions that are not addressed yet. The place of problematic pornography use among problematic sexual behaviors is still controversial in the scientific literature and clinical practice. Exploring the connection between hypersexuality and problematic pornography use may not only provide better theoretical understanding of problematic sexual behaviors (e.g., categorization of problematic pornography use in future diagnostic manuals or having differentiated knowledge on the etiology of different problematic sexual behaviors), but it can provide useful clinical implications as well (e.g., differential diagnosis or different treatment protocols). One of the main questions is whether problematic pornography use could be considered as a subcategory or a manifestation of hypersexuality (e.g., Kafka, 2010; Reid, Carpenter, et al., 2012; Werner, Stulhofer, Waldorp, & Jurin, 2018; Wéry et al., 2016; Wordecha et al., 2018). On the one hand, one of the most strongly related problematic sexual behaviors is problematic pornography use that are mentioned in relation to hypersexuality. More than 80% of the individuals with hypersexuality reported problematic pornography use in previous studies (Kafka, 2010; Reid, Carpenter, et al., 2012; Wordecha et al., 2018) indicating that problematic pornography use may be considered as one of the most prominent manifestations of hypersexuality. However, according to recent results (e.g., Werner et al., 2018; Wéry et al., 2016), it is not unambiguous whether problematic pornography use should be taken into account as a core element of hypersexuality.

Therefore, the aim of the present dissertation was to examine the similarities and dissimilarities between hypersexuality and problematic pornography use regarding the underlying psychological processes involved in the development and maintenance of these problematic sexual behavior with taking into consideration potential gender

[6]Although currently Compulsive Sexual Behavior Disorder is the official terminology to refer to hypersexuality, the term "hypersexuality" is used in the present dissertation for several reasons. This terminology is preferred in the present studies as the conceptualization of Hypersexual Disorder (Kafka, 2010) was applied as the theoretical background of the research and the Hypersexual Behavior Inventory was used to assess the level of uncontrollable sexual fantasies, urges and behaviors. Despite some differences between the two conceptualizations (i.e., Hypersexual Disorder and Compulsive Sexual Behavior Disorder) that are mentioned later, the two concepts are strongly related (correlations ranging from .82-.92 in previous studies – Reid, Garos, Carpenter, 2011; Reid et al., 2012). Thus, using the term "hypersexuality" can be appropriate in the present context.

differences as well (e.g., Wéry & Billieux, 2017; Werner et al., 2018). For this reason, in *Study 1*, the reliability and validity of the Hypersexual Behavior Inventory was examined and a potential cut-off score was aimed to be determined to have an adequate measure of hypersexuality in Hungarian. In *Study 2*, the differences of the level of hypersexuality was investigated across subgroups as it received little attention in research despite its importance (e.g., Klein et al., 2014; Parsons, 2005). In *Study 3*, the Problematic Pornography Consumption Scale was developed and psychometrically examined because no scale existed in the literature that could reliably and validly assess problematic pornography use. In *Study 4*, the impulsivity and compulsivity background of hypersexuality and problematic pornography use were investigated with taking into consideration gender differences as no previous study examined these associations given their transdiagnostic features and clinical relevance. *In Study 5*, the associations of ADHD symtoms, hypersexuality and problematic pornography use were assessed considering gender differences because ADHD is a highly prevalent comorbid disorder with hypersexuality (Reid et al., 2014), but no study examined these associations among women.

I. INTRODUCTION

I/1. CLASSIFICATION, PREVALENCE AND ASSESSMENT OF HYPERSEXUALITY

I/1.1. Classification of Hypersexuality

In 2010, Kafka (2010) proposed the diagnostic criteria for Hypersexual Disorder (HD) based on the elements of two well-established sexual disorders in the fourth revised edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR – American Psychiatric Association, 2000), namely, Hypoactive Sexual Desire Disorder and Paraphilias. Kafka's diagnostic criteria included five characteristics of hypersexual behavior from which at least three should be met to be diagnosed with hypersexual disorder. These five criteria included two motivation-related criteria (i.e., sexual urges, fantasies and behaviors appear as a result of negative emotional states or as a result of high levels of stress), two consequences-related criteria (i.e., individuals engage in sexual urges, fantasies and behaviors despite negative consequences and interference with obligations) and one impulse control-related criterion (i.e., unsuccessful efforts to reduce or stop sexual urges, fantasies or behavior). In addition, clinically significant distress and impairment has to be met without any other possible causes to be considered for the diagnosis of hypersexual disorder.

Despite the carefully prepared proposition (Kafka, 2010), hypersexuality was ultimately rejected as a new diagnostic category from DSM-V (American Psychiatric Association, 2013) as a result of criticism from different areas (e.g., forensic reviewers or psychiatrists). Criticism has posed several valid points: the main ones included insufficient scientific and epidemiological studies, potential misuse of hypersexual disorder as a diagnosis in forensic settings, and potential false-positive diagnoses (e.g., hypersexuality diagnosis as a result of social or moral disapproval of sexual behavior) (Kafka, 2014; Reid & Kafka, 2014).

Five years after the rejection of the HD diagnosis, Compulsive Sexual Behavior Disorder (CSBD) has been accepted as a new diagnostic category in the ICD-11 (World Health Organization, 2018). The diagnosis of CSBD includes several criteria from the previously described proposal of HD diagnosis, but some differences need to be mentioned. Similarly to HD, the diagnostic criteria of CSBD includes failure to control sexual urges, fantasies and behavior; their negative consequences; their interference

with goals, obligations and other important activities; clinically significant distress and impairment as a result of CSBD; unsuccessful efforts to control or reduce the activity and excludes those cases when other conditions lead to CSBD. Regarding the differences between HD and CSBD, HD diagnostic criteria described potential subcategories/manifestations of hypersexuality (e.g., masturbation, pornography, cybersex), and HD included the motivational basis of hypersexuality (i.e., in response to stress and negative emotions), while CSBD excluded them. However, additional elements were included in the CSBD diagnostic criteria: it emphasizes that CSBD is a central focus of one's life; sexual behaviors provide less or do not provide satisfaction at all for the given individual; and excludes those cases when moral judgements and moral disapproval can be accounted for CSBD.

In sum, the main elements of HD and CSBD diagnostic criteria overlap (i.e., control problems, clinically significant distress and impairment, unsuccessful reduction of sexual behaviors, negative consequences, and interference with important areas of functioning). The additional elements of CSBD diagnostic criteria (e.g., moral judgement and disapproval) addressed some previous major criticism of HD diagnosis (e.g., potential false-positive diagnosis), but other criticism still need to be given focus in future studies (e.g., potential misuse of CSBD diagnosis in forensic settings) (Kafka, 2014; Reid & Kafka, 2014). The comparison of the diagnostic criteria of HD and CSBD can be seen in I/Table 1.

I/Table 1. Comparison of Hypersexual Disorder (proposed for inclusion in DSM-V) and Compulsive Sexual Behavior Disorder diagnosis criteria (included in ICD-11)

Criteria	Hypersexual Disorder (Kafka, 2010)	Compulsive Sexual Behavior Disorder (ICD-11, 2018)
Failure to control	"Over a period of at least 6 months, recurrent and intense sexual fantasies, sexual urges, or sexual behaviors"	"persistent pattern of failure to control intense, repetitive sexual impulses or urges resulting in repetitive sexual behavior"
Interference with goals, activities and obligations	"Time consumed by sexual fantasies, urges or behaviors repetitively interferes with other important (non-sexual) goals, activities and obligations."	"neglecting health and personal care or other interests, activities and responsibilities"
Unsuccessful efforts to control or reduce	"Repetitive but unsuccessful efforts to control or significantly reduce these sexual fantasies, urges or behaviors."	"numerous unsuccessful efforts to significantly reduce repetitive sexual behavior"
Negative consequences	"Repetitively engaging in sexual behaviors while disregarding the risk for physical or emotional harm to self or others."	"continued repetitive sexual behaviour despite adverse consequences"
Clinically significant distress or impairment	"There is clinically significant personal distress or impairment in social, occupational or other important areas of functioning associated with the frequency and intensity of these sexual fantasies, urges or behaviors."	"causes marked distress or significant impairment in personal, family, social, educational, occupational, or other important areas of functioning"
Not due to other problems	"These sexual fantasies, urges or behaviors are not due to the direct physiological effect of an exogenous substance (e.g., a drug of abuse or a medication)"	"Exclusions: paraphilic disorders"
In response to negative emotions	"Repetitively engaging in sexual fantasies, urges or behaviors in response to dysphoric mood states (e.g., anxiety, depression, boredom, irritability)."	-
In response to stress	"Repetitively engaging in sexual fantasies, urges or behaviors in response to stressful life events."	-
Central focus of life	-	"repetitive sexual activities becoming a central focus of the person's life"
Little or no satisfaction	-	"deriving little or no satisfaction from sexual behavior"
Moral judgement and disapproval	-	"Distress that is entirely related to moral judgments and disapproval about sexual impulses, urges, or behaviours is not sufficient to meet this requirement."
Subcategories	"Masturbation, Pornography, Sexual Behavior with consenting adults, Cybersex, Telephone sex, Strip clubs"	

Note. The diagnostic criteria and their literal descriptions are based on the proposed, but rejected diagnosis of Hypersexual Disorder (Kafka, 2010) and the accepted diagnostic criteria of Compulsive Sexual Behavior Disorder (World Health Organization, 2018).

I/1.2. Prevalence of Hypersexuality

One of the main points in hypersexuality-related criticism is the availability of insufficient data regarding the prevalence of hypersexuality (Kafka, 2014; Reid & Kafka, 2014). Although estimations are available (Stewart & Fedoroff, 2014), the prevalence of hypersexuality in the population is not properly identified yet due to methodological problems (e.g., inappropriate measurements). It is suggested that hypersexuality could affect 1-10% of the general population (e.g., Black, 2000; Coleman, 1992; Goodman, 1993; Klein, Rettenberger, & Briken, 2014; Montgomery-Graham, 2017; Odlaug et al., 2013; Walton, Cantor, Bhullar, & Lykins, 2017), but there are higher estimations up to 17-38% in the male population (Levaque, Sawatsky, & Lalumiére, 2016). According to other studies (e.g., Seegers, 2003), more women (32%) reported higher levels of hypersexuality than men (17%). In sum, estimations are available, but further studies on nationally-representative samples are needed to determine valid and reliable prevalence rates of hypersexuality among men and women as well.

I/1.3. Assessment of Hypersexuality

To date, no scale exists that could assess hypersexuality based on the diagnostic criteria of ICD-11. Before the official CSBD diagnosis, the assessment of hypersexuality was diverse but started to converge as a result of the proposed HD diagnosis (Kafka, 2010). Clinical interviews and self-reported scales are currently the two predominant approaches to assess the level of hypersexuality (for further information see *Study 1*). According to recent reviews (e.g., Marshall & Briken, 2010; Montgomery-Graham, 2017; Stewart & Fedoroff, 2014) and psychometrics studies (e.g., Klein et al., 2014; Reid & Garos, 2007; Reid et al., 2011; Yeagley et al., 2016), the Hypersexual Behavior Inventory (HBI; Reid, et al., 2011) appears to be the most reliable and valid scale for assessing hypersexuality. Therefore, the HBI was adapted to Hungarian to assess the level of hypersexuality in the present studies.

I/1.4. Subcategories/Manifestations of Hypersexuality

In relation to hypersexuality, several sexual behaviors are investigated (e.g., Reid, Carpenter, et al., 2012; Reid, Carpenter, & Lloyd, 2009; Wéry & Billiuex, 2016). In the HD diagnosis proposal by Kafka (2010), the following sexual behaviors were mentioned as possible manifestations of hypersexuality: masturbation, pornography use,

sexual behavior with consenting adults, cybersex, telephone sex, and strip clubs. In empirical studies, similar categories appeared with also including other manifestations such as using sex massage, using sex toys or soliciting commercial sex workers habitually (e.g., Reid, Carpenter, & Lloyd, 2009; Wéry & Billiuex, 2016). Pornography use (81-100%), masturbation (78-100%), and sex with consenting adults (45-70%) were the most frequently reported sexual behaviors among patients with hypersexuality, while the frequency of engaging in cybersex (18-78%), telephone sex (8-38%), and visiting strip clubs (9-18%) showed a higher variability and were relatively low (Reid, Carpenter, et al., 2012, Wéry & Billieux, 2016; Wordecha et al., 2018). According to these studies, pornography use and masturbation could be considered as the most prominent manifestations of hypersexuality.

However, some studies suggest that pornography use and masturbation may not be considered as core elements of hypersexuality (e.g., Werner et al., 2018). According to recent results (Werner et al., 2018), pornography use (and also masturbation) were only peripherally located in both men's and women's hypersexuality network when applying a network analytic approach on an online sample. These results may indicate that the frequency of using pornography may have little contribution to the negative symptoms related to hypersexuality. These results are further corroborated in a sample of outpatient hypersexual individuals (Wéry & Billieux, 2016): although almost everyone reported pornography use (90%), approximately 30% of them reported that this sexual behavior was problematic for them. To conclude, the associations of hypersexuality and problematic pornography use are still controversial in the literature and more scientific attention should be paid to exploration of the potential dissimilarities between them.

I/2. CLASSIFICAION, PREVALENCE AND ASSESSMENT OF PROBLEMATIC PORNOGRAPHY USE

I/2.1. Classification of Problematic Pornography Use

The classification of problematic pornography use is not only controversial from the perspective of hypersexuality as described above, but it is still ambiguous in the literature whether it should be considered as a behavioral addiction or as an impulse control disorder. The Working Group on obsessive-compulsive and related disorders (World Health Organization, 2018) suggested that CSBD—and, if we rely on the proposition of Kafka (2010), problematic pornography use as well—should be included

under Impulse Control Disorders in the ICD-11 (Grant et al., 2014; Kraus et al., 2018; Stein et al., 2016; World Health Organization, 2018) due to its conceptualization and symptomatology (e.g., repeated failure to resist the impulse to engage in sexual behavior despite its adverse consequences).

However, this classification has been questioned and strongly debated because CSBD has similar neurobiological features to substance-use disorders (Potenza, Gola, Voon, Kor, & Kraus, 2017). These results may indicate that CSBD could be considered as an addictive disorder as well. Thus, despite the official classification of CSBD as an impulse control disorder, there is currently no consensus whether sexuality-related disorders or problems (such as problematic pornography use or hypersexuality) relate to impulsive or compulsive features or whether they should be considered as behavioral addictions (e.g., Gola et al., 2017; Griffiths, 2016; Kraus et al., 2016; Potenza et al., 2017). It has to be noted that these possible classifications are not mutually exclusive. Given that no prior studies have simultaneously examined impulsivity and compulsivity as related to hypersexuality and problematic pornography use, there is currently a knowledge gap in this area as to how these psychiatric transdiagnostic features relate to each of these problematic sexual behaviors. The present dissertation aimed to provide an answer also for this question (see *Study 4*).

I/2.2. Prevalence of Problematic Pornography Use

There are studies examining the prevalence of pornography use (e.g., González-Ortega & Orgaz-Baz, 2013; Ross, Mansson, & Daneback, 2012), but only a handful of them examined pornography use on nationally-representative samples (e.g., Grubbs, Kraus, & Perry, 2018; Hald, 2006; Rissel et al., 2017; Traeen, Spitznogle, & Beverfjord, 2004). According to recent nationally-representative studies from Australia (Rissel et al., 2017) and the USA (Grubbs, Kraus, et al., 2018), with respect to past year pornography consumption, a higher ratio of men used pornography than women (69-76% of men vs. 33-41% of women), men used it more frequently than women (33% of men vs. 8% of women used pornography weekly) and a higher percentage of men felt addicted to pornography than women (4-6% of men vs. 1-2% of women). Interestingly, it has to be noted that more and more women seek treatment for problematic pornography use in the recent years (Lewczuk, Szmyd, Skorko, & Gola, 2017), suggesting that the effect of gender might not be that one-sided. However, these prevalence rates may be prone to bias as they were self-reported (without clinical

diagnosis) and often applied only one item assessing the subjective feeling of pornography addiction (e.g., "You feel you are addicted to pornography." – Rissel et al., 2017) without further indicators of problems related to it. In sum, it can be assumed that problematic pornography use may affect 1.6% of the people, but further studies are needed to corroborate these findings.

I/2.3. Assessment of Problematic Pornography Use

When assessing pornography use, the most frequently used measures are often related to the quantity of pornography use (Short, Black, Smith, Wetterneck, & Wells, 2012): frequency of pornography use, duration of pornography use per each occasion, and binge pornography use (e.g., Bőthe et al., 2017; Grubbs et al., 2017; Lewczuk et al., 2017; Wordecha et al., 2018). Data deriving from quantity may only inform researchers or clinicians about the amount of pornography use without its qualitative characteristics (e.g., functioning or negative consequences of pornography use). However, in the past few years, more attention has been directed to problematic pornography use (e.g., Gola, Lewczuk, & Skorko, 2016; Grubbs, Sessoms, Wheeler, & Volk, 2010; Grubbs, Volk, Exline, & Pargament, 2015; Kor et al., 2014).

Besides the preexisting assessment tools that only assessed the quantity of pornography use (e.g., Traeen et al., 2004; Yoder, Virden, & Amin, 2005), and that concentrated on wider concepts such as hypersexuality or using the internet for sexual purposes (e.g., Carnes & Wilson, 2002; Delmonico & Miller, 2003), only three scales focused on problematic pornography use: the Cyber-Pornography Use Inventory (CPUI; Grubbs et al., 2010), the revised, shorter version of the Cyber-Pornography Use Inventory (CPUI-9; Grubbs et al., 2015), and the Problematic Pornography Use Scale (PPUS; Kor et al., 2014). These scales had theoretical and methodological limitations (see the introduction of *Study 3* for details), therefore, a new assessment tool had to be constructed to validly and reliably assess the level of problematic pornography use (Problematic Pornography Consumption Scale – PPCS, see *Study 3*).

I/3. PSYCHOLOGICAL BACKGROUND OF HYPERSEXUALITY AND PROBLEMATIC PORNOGRAPHY USE

Addictive disorders develop and maintain as a result of the interaction between the *structural characteristics* of the given activity (e.g., accessibility of pornography in the given culture), the *situational characteristics* (e.g., deprived social relations), the

psychological constitution (e.g., personality traits such as impulsivity; or motivations such as emotional avoidance), and the *genetic and biological predispositions* (e.g., suboptimal functioning of the dopamine system) of the given individual (Griffiths, 1999; Griffiths, 2005; Tóth-Király, Bőthe, & Orosz, in press). In the following, first, the structural characteristics of hypersexuality and problematic pornography use are described that may contribute to the high prevalence of these problematic sexual behaviors. Second, the situational, psychological and genetic/biological characteristics of individuals are described that can contribute to the development and maintenance of hypersexuality and problematic pornography use. It has to be noted that the scientific examination of hypersexuality and problematic pornography use is still in its infancy (e.g., Carnes, 1983; Griffiths, 2001; Grubbs et al., 2010; Kafka, 2010; Wéry & Billieux, 2016). Therefore, the first steps in this field should be the exploration of the independent roles of different characteristics in the development and maintenance of hypersexuality and problematic pornography use before the examination of complex models. In the present dissertation, the psychological background of hypersexuality and pornography use are investigated. Thus, the structural, situational, and genetic/biological characteristics are briefly summarized here, while the psychological characteristics of hypersexuality and problematic pornography use are detailed in the next chapter with focusing on personality traits and comorbid disorders.

Structural Characteristics in Relation to Hypersexuality and Problematic Pornography Use

Problematic sexual behaviors (e.g., excessive sexual behaviors or sex addiction) were anecdotally mentioned in the seventeenth century (e.g., Don Juan – Waxman, 1908) and were already well documented in the nineteenth century in clinical studies (Karila et al., 2014). Changes in sexuality-related topics can be observed (e.g., higher acceptance can be observed regarding premarital sexual behavior among younger populations or higher numbers of lifetime sexual partners were reported among younger women – Techasrivichien et al., 2016), but it might be assumed that the prevalence of hypersexuality did not drastically changed during the past decades (e.g., it was estimated that up to 3-6% of the population might be affected by hypersexuality in 2000, while 1-2% was measured in 2010-2013 among college students and general populations – Black, 2000; Odlaug et al., 2013; Winters, Christoff, & Gorzalka, 2010). Therefore, hypersexuality can be considered as a continuously present problematic

sexual behavior that has been present throughout the history under different names (e.g., sex addiction, hypersexuality, compulsive sexual behavior), but with similar characteristics (Karila et al., 2014). Thus, the appearance of online pornography is more interesting when taking into consideration structural characteristics.

A common question is why online pornographic materials are so popular and widespread among internet users and how can it result in problematic pornography use? Two decades ago, concurrently with the penetration of broadband internet, Cooper (1998) was the first to examine this phenomenon by applying the "Triple A Engine". This model highlighted three factors that could determine the increasing popularity of online pornography. The first "A" referred to the easy *accessibility* of sexually explicit materials on the internet. With the widespread prevalence of computers and internet access in various locations (e.g., at home, at work, or at school), individuals could practically watch pornography anytime and anywhere they want to. The second "A", *affordability*, referred to the economical background of online pornography as consuming online pornographic materials are either cheap or free. The third "A", *anonymity*, referred to the anonymity of the given individual. Online pornography can create a sense of freedom where people can try and experience new things and they can access videos without revealing their identity.

This model was further elaborated by researchers as King (1999) underlined another important aspect as the fourth "A", namely *acceptability*. It is widely accepted to use internet for romantic purposes such as dating and this acceptability can be extended to the use of online pornography (Carroll et al., 2008; D'Orlando, 2011). If it is widely accepted to use pornography, then most possibly, people would use it more frequently and they would more easily report about this behavior. Although the ACE model (Young, Griffin-Shelley, Cooper, O'mara, & Buchanan, 2000) can be considered as a variant of Cooper's (1998) model, it emphasizes the background of problematic pornography use. The first letter of the ACE model, *anonymity*, is the same as mentioned in the work of Cooper (1998); it refers to the secrecy of the individuals' identity. The second letter, *convenience*, refers to the convenience of using online applications as opposed to more traditional ones such as magazines with the former being more easily accessible. The third letter, *escape*, refers to the motivation of escaping from the real-life experiences to a new world, where the individual can shape her/his sexual experiences according to her/his needs.

In sum, the unlimited access and variety of pornographic materials, the convenience of viewing online pornography anonymously, and its novelty and excitement without efforts and financial investment could easily pull in the individual. Especially, if the given individual does not feel that he could shape his sexual experiences or life freely, that in turn, could result in problematic viewing patterns. These models facilitate the understanding of the popularity and high prevalence of online pornography use; however, they do not give a satisfactory answer to the question as to which genetic/biological, personality-related and situational factors might lay behind problematic pornography use.

Situational Characteristics in Relation to Hypersexuality and Problematic Pornography Use

Regarding situational characteristics, all constructs that are related to the given individual social environment could be considered (Griffiths, 2005). In the field of hypersexuality and pornography use research, there are arguably two major areas with respect to the social environment that are predominantly examined: loneliness/relatedness in general (e.g., Baltazar, Helm, McBride, Hopkins & Stevens, 2010; Butler, Pereyra, Draper, Leonhardt, & Skinner, 2018; Chaney & Burns-Wortham, 2015; Dhuffar, Pontes, & Griffiths, 2015; Yoder et al., 2005) and romantic relationship characteristics (e.g., relationship satisfaction or sexual satisfaction – Starks, Grov, & Parsons, 2013; Szymanski & Stewart-Richardson, 2014; Wright, Tokunaga, Kraus, & Klann, 2017), thus, the results of these two areas are presented here briefly.

Data regarding the associations of hypersexuality and loneliness suggest that higher levels of feelings of loneliness is associated with higher level of hypersexuality in general (e.g., university students) and in more specific populations (e.g., treatment seeking individuals with hypersexuality; gay and bisexual men) as well (e.g., Chaney & Burns-Wortham, 2015; Dhuffar et al., 2015; Stein, Black, Shapira, & Spitzer, 2001). However, this relationship may be influenced by other variables leading to positive, but weak associations (e.g., after controlling for the effect of demographic and psychological variables, the association between the hypersexuality and loneliness was still positive, but weak – Chaney & Burns-Wortham, 2015; Dhuffar et al., 2015). As hypersexuality is connected to difficulties in bonding with others and relationship insecurity, it is reasonable that individuals with hypersexuality may experience lower levels of social connectedness and social support, that in turn, may result in the

subjective feelings of loneliness (Walton, Cantor, Bhullar et al., 2017). It is also possible that the feelings of isolation and loneliness may lead to hypersexual behavior because individuals may use sexual relationships to connect to others (Guigliamo, 2006; Chaney & Burns-Wortham, 2015).

As for loneliness and problematic pornography use, the amount of time one spends with pornography use and the frequency of pornography use was positively associated with feelings of loneliness (Efrati & Amichai-Hamburger, 2018; Yoder et al., 2005). However, it has to be noted that the associations of loneliness and frequency of pornography use could be moderated by other variables (e.g., attachment styles – Efrati & Amichai-Hamburger, 2018). When focusing on problematic pornography use, loneliness had a positive but weak association with it (Butler et al., 2018). The aforementioned studies indicate that problematic pornography use could be positively associated with the feelings of loneliness but the direction of these associations might not be unidirectional (e.g., not only problematic pornography use could result in higher levels of loneliness, but higher levels of loneliness may lead to problematic pornography use – Butler et al., 2018). In sum, both hypersexuality and problematic pornography use demonstrated positive, weak-to-moderate associations with loneliness in different populations (e.g., Butler et al., 2018; Chaney & Burns-Wortham, 2015; Dhuffar et al., 2015; Stein et al. 2001).

As for the associations of hypersexuality and romantic relationships, empirical findings indicate that hypersexuality can have various negative effects on romantic relationships including such severe consequences as the termination of stable romantic relationships (approximately 40% of hypersexual patients reported that) (e.g., Langström & Hanson, 2006; Reid, Carpenter et al., 2012; Reid & Woolley, 2006; Starks et al., 2013). According to the results of a Swedish largescale study on a nationally-representative sample (Langström & Hanson, 2006), serious discussions about ending stable relationship appeared among both men and women who reported high levels of hypersexuality. However, only men with high levels of hypersexuality reported lower levels of sexual satisfaction (compared to men with low levels of hypersexuality), while there were no significant differences between women with low, moderate, and high levels of hypersexuality in terms of sexual satisfaction. However, on a community sample of adults (Blais-Lecours et al., 2016), the association of sexual satisfaction and hypersexuality was negative and weak, and was statistically identical in the case of both genders. The same relationship patterns were observed in the case of gay and bisexual

men: hypersexuality was not only negatively and weakly associated with sexual satisfaction, but it was also negatively and weakly associated with sexual communication as well (Starks et al., 2013). These results indicate that hypersexuality might not only negatively affect sexual satisfaction, but romantic relationships in general as according to self-reports, approximately 50-70% of the stress in romantic relationships derive from sexual problems (McCarthy, 2003; Reid & Woolley, 2009).

Relationship satisfaction and sexual satisfaction are among the most frequently assessed constructs in relation to pornography use (e.g., Blais-Lecours et al., 2016; Szymanski, Feltman, & Dunn, 2015; Wright et al., 2017). According to a recent meta-analysis (Wright et al., 2017), interpersonal satisfaction (including relationship satisfaction and sexual satisfaction) had a weak, negative association with pornography use but the results were moderated by gender. In the case of men, the association between pornography use and interpersonal satisfaction was still weak and negative, while among women, this association was not statistically significant. However, it has to be noted that in the analysis the frequency of pornography use and problematic pornography use were not distinguished and sexual satisfaction and relationship satisfaction were contracted. According to a recent large-scale study (Bőthe et al., 2017), problematic pornography use had weak, negative associations with relationship satisfaction and sexual satisfaction as well. Pornography use may contribute to unrealistic sexual beliefs and more concerns about sexuality (Owens, Behun, Manning, & Reid, 2012), that may result in problematic pornography use leading to sexual dissatisfaction and romantic relationship dissatisfaction (e.g., Blais-Lecours et al., 2016; Bőthe et al., 2017). Thus, complex and multivariate associations could be observed between problematic pornography use and romantic relationship outcomes (e.g., it is possible that someone turns to pornography use as a result of sexual dissatisfaction with his/her partner and not pornography use leads to sexual dissatisfaction). In sum, both hypersexuality and problematic pornography use showed negative, but only weak associations with romantic relationship characteristics (e.g., sexual satisfaction or relationship satisfaction), thus, it can be concluded that although these problematic sexual behaviors contribute to negative romantic relationship experiences, they role is relatively small.

Biological and Genetic Characteristics in Relation to Hypersexuality and Problematic Pornography Use

Although research has proliferated in the past decades with respect to hypersexuality (see Kraus et al., 2016), relatively little attention has been paid to its genetic/biological background (e.g., Gola, Wordecha, Marchewka, & Sescousse, 2016; Kowalewska et al., 2018; Kraus et al., 2016; Walton et al., 2017). Neuroscientific results on hypersexuality are often mentioned together or blended with the neuroscientific results on problematic pornography use (e.g., pornographic videos or pictures were presented in fMRI studies to examine men with and without hypersexuality – Voon et al., 2014). Thus, neurobiological results on hypersexuality and problematic pornography use cannot be separated appropriately at this stage of research. Recent reviews on this topic also covers the neurobiological aspects of hypersexuality and problematic pornography use together (e.g., Kowalewska et al., 2018; Love, Laier, Brand, Hatch, & Hajela, 2015; Stark, Klucken, Potenza, Brand, & Strahler, 2018; Walton, Cantor, Bhullar et al., 2017). As a result, in this section, neurobiological results are presented together for hypersexuality and problematic pornography use.

One of the most prominently used paradigm in neurobiological studies regarding hypersexuality and problematic pornography use is the cue-reactivity or incentive salience concept (Kowalewska et al., 2018; Stark et al., 2018). The cornerstone of this theory is that "liking" is separate from "wanting". According to this concept, at the beginning of the development of an addiction "liking" (hedonistic pleasure) is more dominant, and then it gradually turns to "wanting" (need for use) (Stark et al., 2018). This experience of "wanting" might be closely related to the dopaminergic neurotransmission in the ventral striatum, while experiencing "liking" might be related to a more complex network (Kowalewska et al., 2018). According to the results of functional magnetic resonance imaging (fMRI) studies, an increased blood-oxygen-level dependent signal (BOLD; i.e., increased activity) can be observed in the reward system among individuals with hypersexuality indicating that stronger "wanting" (craving) is present among individuals with hypersexuality regarding sexuality-related cues than among non-hypersexual individuals (e.g., Brand, Snagowski, Laier, & Maderwald, 2016; Gola et al., 2017; Seok & Sohn, 2015; Voon et al., 2014). These findings suggest that hypersexuality shares relevant similarities with substance-related addictions (e.g., drug abuse) and behavioral addictions (e.g., pathological gambling or

internet gaming disorder) in terms of altered brain processes (Kowalewska et al., 2018; Love et al., 2015; Stark et al., 2018).

In sum, increased sensitivity towards sexual stimuli or cues can be observed among individuals with hypersexuality with multiple brain regions related to it (e.g., prefrontal and frontal cortices, amygdala, ventral striatum) (Kowalewska et al., 2018). It has to be noted that the aforementioned results can only be considered preliminary and should be interpreted with caution due to methodological shortcomings such as small, homogenous samples (e.g., white, heterosexual men), different definition of hypersexuality and problematic pornography use applied in each study, and not taking into consideration the heterogeneity of hypersexuality (e.g., it can manifest in sexual behavior with a consenting adult or in pornography use) (Kowalewska et al., 2018). Thus, there are still unanswered questions in the scientific literature that require further investigation, such as whether hypersexuality (and problematic pornography use) are adequately categorized as impulsive control disorders in ICD-11 or should they be reclassified later as behavioral addictions; or whether the same neurobiological processes and neural networks lay behind the different manifestations of problematic sexual behaviors (e.g., frequent casual sexual acts with consenting adults vs. frequent pornography viewing) (Kowalewska et al., 2018; Strak et al., 2018).

As for the genetic basis of hypersexuality and problematic pornography use, even less empirical data is available than regarding the neurobiological background of them. To date, no research has directly investigated the genetic background of these problematic sexual behaviors, but a handful of studies examined polymorphisms that may be associated with dopamine function and sexual behaviors (Kraus et al., 2016; Stark et al., 2018). These studies may provide candidate genes that could be related to different sexual behaviors. For example, DRD4 polymorphism was related to higher levels of sexual desire, sexual arousal, sexual infidelity and promiscuous sexual behavior (Garcia, MacKillop, Aller, Wilson, & Lum, 2010; Zion et al., 2006) suggesting that DRD4 may play a role in the development of hypersexual behavior. Thus, larger genetic studies with directly assessing hypersexuality and problematic pornography use in line with other psychiatric disorders (e.g., alcohol dependence or depression) are needed to obtain a clearer picture about the potential genetic background of hypersexuality and problematic pornography use.

I/3.1. Psychological Characteristics of Hypersexuality and Problematic Pornography Use

According to Griffiths (2005), psychological characteristics includes several different constructs, such as personality traits, motivations, attitudes, expectations, beliefs and other psychological problems (i.e., comorbidities) as well. In this dissertation, the main focus is on the psychological constructs that can play a role in problematic sexual behaviors, particularly with focusing on personality traits and comorbidities (see I/Table. 2). Therefore, motivations, attitudes, beliefs and expectations related to hypersexuality and problematic pornography use are not summarized here (for a detailed review, see Walton et al., 2017).

Personality can be operationalized in many ways; one of the most frequently applied models of personality traits is the *Five-Factor Model of Personality* that includes five core personality dimensions: openness to experience, extraversion, conscientiousness, agreeableness, and neuroticism (Costa & McCrae, 1992). A number of studies examined the associations of these personality traits and hypersexuality with similar results. To summarize, neuroticism had positive, weak-to-moderate associations with hypersexuality, while conscientiousness and agreeableness had negative, weak associations with it. Regarding extraversion, weak positive associations, weak negative associations, and non-significant results were also demonstrated, while in the case of openness, no significant associations were shown in relation to hypersexuality (Pinto, Carvalho, & Nobre, 2013; Reid, Carpenter, Spackman, & Wiles, 2008; Rettenberger, Klein, & Briken, 2016; Walton, Cantor, & Lykins, 2017).

Regarding problematic pornography use, neuroticism had a weak positive association with problematic pornography use (Egan & Parmar, 2013; Grubbs, Volk et al., 2015). Agreeableness and conscientiousness had negative, weak associations with problematic pornography use, while openness and extraversion were not related to it (Egan & Parmar, 2013). In sum, similar relationship patterns can be observed between the five core personality dimensions and both problematic sexual behaviors (i.e., hypersexuality and problematic pornography use): conscientiousness, agreeableness and neuroticism could be considered as possible predictors of hypersexuality and problematic pornography use. However, it should be noted that the effect sizes were rather small in all studies, indicating that these personality traits explained a small variance of hypersexuality and problematic pornography use.

Impulsivity and Compulsivity in Relation to Hypersexuality and Problematic Pornography Use

Impulsivity and *compulsivity* are the most prominently examined personality traits in relation to psychiatric disorders and addictive behaviors (e.g., Billieux, Rochat, Rebetez, & Van der Linden, 2008; Deckman & DeWall, 2011; Orosz, Vallerand, Bőthe, Tóth-Király, & Paskuj, 2016; Zsila, Orosz, et al., 2017; Zsila, Bőthe, Demetrovics, Billieux, & Orosz, 2017). Previous findings suggest that hypersexuality is positively and moderately related to generalized impulsivity, but it might be assumed that hypersexual individuals are not a homogenous group regarding impulsivity levels (Miner et al., 2016; Mulhauser et al., 2014; Pachankis et al., 2014; Reid et al., 2014; Walton, Cantor, Bhullar et al., 2017).

With respect to the associations of impulsivity and pornography use, among men, the frequency of pornography use was negatively related to impulsivity, while it was unrelated among women (Carroll et al., 2008). Other studies reported that impulsivity had a weak, positive association with the frequency of pornography use (Wetterneck, Burgess, Short, Smith, & Cervantes, 2012), but no previous studies have examined the associations of impulsivity and problematic pornography use. To conclude, empirical evidence showed that hypersexuality moderately relates to impulsivity (e.g., Miner et al., 2016; Reid et al., 2014; Walton, Cantor, Bhullar et al., 2017), while no prior studies examined directly the associations of problematic pornography use and impulsivity. However, data suggest weak but complex relationships between pornography use and impulsivity that do not appear entirely consistent across studies (e.g., Beyens et al., 2015; Peter & Valkenburg, 2010; Wetterneck et al., 2012). Therefore, it is suggested that hypersexuality and problematic pornography use might not share similar background in terms of impulsivity.

Regarding the associations of *compulsivity* and hypersexuality, only a handful of studies have examined them, but these data suggest that compulsivity appears to contribute in a relatively small manner to hypersexuality (Carpenter, Reid, Garos, & Najavits, 2013; Kafka, 2015; Reid & Carpenter, 2009). With respect to the associations of compulsivity and pornography use, sexual compulsivity was more frequently assessed in relation to pornography use than general compulsivity (e.g., Grubbs, Exline, Pargament, Hook, & Carlisle, 2015). As sexual compulsivity might be considered as a rather similar construct to hypersexuality (e.g., Kafka, 2010; Karila et al., 2014), the associations of pornography use and sexual compulsivity are not discussed here. As for

general compulsivity, it had a weak, positive association with problematic pornography use among men (Egan & Parmar, 2013), but no previous studies have investigated the associations of compulsivity and problematic pornography use in the case of women. In sum, the associations between compulsivity and hypersexuality and compulsivity and problematic use appear relatively weak (Carpenter et al., 2013; Egan & Parmar, 2013).

Taking into consideration prior work (Egan & Parmar, 2013; Grubbs, Volk, et al., 2015; Pinto et al., 2013; Reid et al., 2008; Rettenberger et al., 2016; Walton, Cantor, & Lykins, 2017), the associations of the five-factor personality traits and problematic sexual behaviors (i.e., hypersexuality and problematic pornography use) are rather explored and they showed highly similar relationship patterns. Despite that (1) impulsivity and compulsivity are important transdiagnostic features in psychiatric disorders; (2) debates are present in the literature whether hypersexuality and problematic pornography use can be considered as impulse control disorders (e.g., Kraus et al., 2018; Stein et al., 2016); (3) and potential dissimilarities were identified between the associations of impulsivity and hypersexuality and impulsivity and pornography use (e.g. Reid et al., 2014; Wetterneck et al., 2012); no previous research examined simultaneously the impulsivity and compulsivity background of hypersexuality and problematic pornography use. Therefore, in *Study 4*, we aimed to explore impulsivity and compulsivity with respect to hypersexuality and problematic pornography use with taking into consideration gender and with focusing on the similarities and possible differences between hypersexuality and problematic pornography use in these domains.

Psychiatric Disorders in relation to Hypersexuality and Problematic Pornography Use

According to a recent summary on hypersexuality and psychopathology, approximately 50% of individuals with hypersexuality report some types of psychiatric disorders besides hypersexuality (Kraus et al., 2016). In the case of hypersexuality mood disorders (31-72%), anxiety disorders (33-47%), attention deficit hyperactivity disorder (17-67%), and substance use disorder (14-41%) are the most prominently examined and most prominently reported psychiatric comorbidities (Black, Kehrberg, Flumerfelt, & Schlosser, 1997; Blankenship & Laaser, 2004; de Tubino Scanavino et al., 2013; Kafka & Hennen, 2002; Kafka & Prentky, 1998; Morgenstern et al., 2011; Raymond, Coleman, & Miner, 2003; Reid, 2007; Reid, Carpenter, Gilliand, & Karim,

2011; Reid, Davtian, Lenartowicz, Torrevillas, & Fong, 2013; Wéry et al., 2016). These results indicate that disorders related to affect regulation, substance use and ADHD may play an essential part in hypersexuality. Fewer studies examined the associations of hypersexuality and personality disorders (e.g., Black et al., 1997; Carpenter et al., 2013; Raymond et al., 2003). Approximately 10% of self-diagnosed hypersexual individuals reported any type of personality disorder (Raymond et al., 2003), passive-aggressive personality disorder and borderline personality disorder had positive, moderate associations with the level of hypersexuality, while all the other personality disorders showed only positive and weak or no associations with it at all (Carpenter et al., 2013). These results may suggest that personality-based dysfunctions may play a role in the development of hypersexuality, however, they may have little explanatory power.

As for problematic pornography use, only a handful of studies investigated the psychiatric comorbidities related to problematic pornography use (e.g., Grubbs, Volk, et al., 2015; Kraus et al., 2015; Nelson, Padilla-Walker, & Carroll, 2010; Willoughby, Carroll, Nelson, & Padilla-Walker, 2014; Willoughby, Busby, & Young-Peterson, 2018). Mood disorders (71%), anxiety disorders (40%), substance use disorders (41%) are suggested to be prevalent among problematic pornography users, however; attention deficit hyperactivity disorder was reported only by 3% of the participants (Kraus et al., 2015). Regarding personality disorders, to the best of the author's knowledge, no previous studies investigated the prevalence of personality disorders among problematic pornography users.

In sum, similarities can be identified regarding the prevalence of mood disorders, anxiety disorders, and substance use disorders among individuals with hypersexuality and individuals with problematic pornography use. However, important differences can be observed regarding ADHD: while 17-67% of individuals with hypersexuality report some levels of ADHD symptoms (Reid et al., 2014), only 3% of individuals with problematic pornography use reported ADHD (Kraus et al., 2015). It has to be noted that these studies had several limitations (see *Study 5*), but the question still arises whether the associations between ADHD symptoms and the level of hypersexuality and problematic pornography use shows similarities or whether differentiated relationship patterns may be identified between ADHD symptoms, hypersexuality and problematic pornography use. Therefore, in *Study 5*, we aimed to explore the level of ADHD symptoms in relation to hypersexuality and problematic pornography use with taking into consideration gender and with focusing on the

similarities and possible differences between hypersexuality and problematic pornography use in this domain.

I/Table 2. Overview of the described psychological characteristics of hypersexuality and problematic pornography use based on previous studies

	Hypersexuality	**Problematic Pornography Use**
Personality Traits	Neuroticism: positive, weak-to-moderate associations	Neuroticism: positive, weak associations
	Conscientiousness: negative, weak associations	Conscientiousness: negative, weak associations
	Agreeableness: negative, weak associations	Agreeableness: negative, weak associations
	Extraversion: controversial associations	Extraversion: no significant associations
	Openness: no significant associations	Openness: no significant associations
	Impulsivity: positive, moderate associations	**Impulsivity: positive, weak associations**
	Compulsivity: positive, weak associations	Compulsivity: positive, weak associations
Psychiatric Disorders	Mood Disorders: 31-72% comorbidity	Mood Disorders: 71% comorbidity
	Anxiety Disorders: 33-47% comorbidity	Anxiety Disorders: 40% comorbidity
	Attention Deficit Hyperactivity Disorder (ADHD): 17-67% comorbidity	**Attention Deficit Hyperactivity Disorder (ADHD): 3% comorbidity**
	Substance Use Disorder: 14-41% comorbidity	Substance Use Disorder: 41% comorbidity

Note. Bold letters indicate important differences between hypersexuality and problematic pornography use. The described results were based on the following studies: Beyens et al., 2015; Black et al., 1997; Blankenship & Laaser, 2004; Carpenter et al., 2013; Carroll et al., 2008; de Tubino Scanavino et al., 2013; Egan & Parmar, 2013; Grubbs, Volk et al., 2015; Kafka, 2015; Kafka & Hennen, 2002; Kafka & Prentky, 1998; Kraus et al., 2015; Miner et al., 2016; Morgenstern et al., 2011; Mulhauser et al., 2014; Nelson et al., 2010; Pachankis et al., 2014; Peter & Valkenburg, 2010; Pinto, Carvalho, & Nobre, 2013; Raymond et al., 2003; Reid, 2007; Reid, Carpenter et al., 2011; Reid et al., 2008; Reid & Carpenter, 2009; Reid, Davtian et al., 2013; Reid et al., 2014; Rettenberger et al., 2016; Walton, Cantor, Bhullar et al., 2017; Walton, Cantor, & Lykins, 2017; Wéry et al., 2016; Wetterneck et al., 2012; Willoughby et al., 2014; Willoughby, Busby, et al., 2018.

I/4. AIMS OF THE DISSERTATION AND OVERVIEW OF THE INVESTIGATION

Although the number of studies on hypersexuality and problematic pornography use has started to increase recently, many questions have remained unanswered or still considered as controversial (e.g., whether the frequency of pornography use could be considered as a reliable indicator of problematic pornography use – Gola et al., 2016; Grubbs, Wilt, Exline, & Pargament, 2018; Grubbs, Wilt, Exline, Pargament, & Kraus, 2018; Kraus & Sweeney, 2018). From this increased number of scientific publications, only a relatively low number of studies examined the associations and the similarities and potential dissimilarities of different problematic sexual behaviors (e.g., hypersexuality and problematic pornography use – Werner et al., 2018; Wéry et al., 2016). Hypersexuality could manifest in different behavioral patterns, but the most frequently displayed one is arguably pornography use in research and clinical practice as well (e.g., Kafka, 2010; Reid et al., 2012; Wordecha et al., 2018). Therefore, the overarching aim of the present research was to examine the similarities and potential dissimilarities between hypersexuality and problematic pornography use in terms of transdiagnostic features (i.e., impulsivity and compulsivity) and comorbid psychiatric disorders (i.e., ADHD symptoms) (for an overview, see I/Table 3.). An improved understanding of the similarities and dissimilarities between problematic pornography use and hypersexuality may help with respect to developing improved assessment tools, diagnostic categories, and specialized interventions in the long run.

Conceptualization and measurement of hypersexuality has started to converge as a result of robust and thorough scientific studies (e.g., Montgomery-Graham, 2017; Schultz et al., 2014; Womack, et al., 2013); however, further examinations were needed to test the psychometric properties of the Hypersexual Behavior Inventory among different non-clinical populations and outside the United States. Having a valid and reliable Hungarian scale that could assess the level of hypersexuality may contribute to the examination of hypersexual behavior in non-English speaking samples and could provide the opportunity to examine its association with problematic pornography use and compare their relationship patterns with different correlates. Therefore, the aims of *Study 1* were (a) to examine the validity and reliability of the Hypersexual Behavior Inventory on a large, non-clinical sample and (b) to determine a possible cut-off score for hypersexuality. The aim of *Study 2* was (c) to systematically investigate the potential differences across subgroups (i.e., males vs. females, heterosexual vs. LGBTQ

individuals) regarding the level of hypersexuality as it received little attention in research (e.g., Klein et al., 2014; Parsons, 2005).

Problematic pornography use is considered as one of the most prevalent manifestation of hypersexuality (Kafka, 2010; Reid et al., 2012; Wordecha et al., 2018); however, previously in the literature, there was no short scale with strong psychometric properties that could assess problematic pornography use based on an overarching theoretical background (Griffiths, 2005). Therefore, the aims of *Study 3* were (a) to construct a comprehensive scale that could reliably and validly assess the level of problematic pornography use, (b) to determine a cut-off score that could reliably distinguish problematic and non-problematic pornography users, and to (c) systematically examine the potential differences between male and female pornography users as it is suggested that males are more likely to develop problematic pornography use (Grubbs, Kraus, et al., 2018; Rissel et al., 2017). Having a valid and reliable scale measuring the level of problematic pornography use may contribute to the better understanding of the potential antecedents and consequences of problematic pornography use.

Impulsivity and compulsivity can be considered as one of the most frequently assessed personality traits in relation to psychiatric disorders and as important transdiagnostic features related to clinically relevant aspects of addictions and other potentially problematic behaviors (e.g., Billieux et al., 2008; Leeman & Potenza, 2012; Orosz et al., 2016; Wetterneck et al., 2012). However, no previous study has examined the associations of impulsivity, general compulsivity (i.e., not sexual compulsivity) and problematic sexual behaviors (i.e., hypersexuality and problematic pornography use). Therefore, the aims of *Study 4* were to simultaneously examine the associations of hypersexuality, problematic pornography use, impulsivity and compulsivity with taking into consideration gender difference as men tend to have higher levels of impulsivity (e.g., Chapple & Johnson, 2007; Cross, Copping, & Campbell, 2011; Waldeck & Miller, 1997).

Besides mood disorders, anxiety disorders, and substance use disorders (Kafka & Hennen, 2002; Kafka & Hennen, 2003; Kafka & Prentky, 1992; Kraus et al., 2015; Morgenstern et al., 2011; Raymond et al., 2003; Reid et al., 2014; Scanavino et al., 2013; Smith et al., 2014; Wéry et al., 2016), attention deficit hyperactivity disorder (ADHD) is also a highly prevalent comorbid psychiatric disorders in relation to hypersexuality. However, no previous studies examined the associations of ADHD with

problematic pornography use and the only study that reported on the prevalence of ADHD and problematic pornography use demonstrated that 3% of problematic pornography users had ADHD symptoms (Kraus et al., 2015). Therefore, the aim of *Study 5* was to simultaneously examine the associations of hypersexuality, problematic pornography use and ADHD symptoms with taking into consideration gender differences as no previous studies were carried out among women.

I/Table 3. Brief overview of the studies the present dissertation is based on

Study	Running title	Aims	Samples
1	Psychometric properties of the Hypersexual Behavior Inventory (HBI)	(1) Examination of the factor structure and reliability of the HBI in a large, nonclinical sample. (2) Determination of a cutoff score for the HBI.	N = 18.034 (34% females)
2	Gender and sexual orientation-based differences on the Hypersexual Behavior Inventory (HBI)	(3) Investigation of whether men and women, or heterosexual and LGBTQ individuals respond to the HBI similarly or whether they have gender- or sexual orientation-based differences in their response patterns.	N = 18.034 (34% females)
3	Psychometric properties of and gender-based differences on the Problematic Pornography Consumption Scale (PPCS)	(4) Development of a theory-based, psychometrically strong scale that can reliably and validly assess problematic pornography use. (5) Investigation of whether men and women respond to the PPCS similarly or whether they have gender-based differences in their response patterns. (6) Determination of a cutoff score for the PPCS.	N = 772 (51% females)
4	Impulsivity and compulsivity in relation to hypersexuality and problematic pornography use	(7) Simultaneous examination of impulsivity and compulsivity in association with hypersexuality and problematic pornography use in a large, nonclinical sample with taking into consideration possible gender differences.	N = 13.778 (30% females)
5	ADHD symptoms in relation to hypersexuality and problematic pornography use	(8) Simultaneous examination of ADHD symptoms in association with hypersexuality and problematic pornography use in a large, nonclinical sample with taking into consideration possible gender differences.	N = 14.043 (34% females)

Note. LGBTQ = Lesbian, Gay, Bisexual, Transgender, and Queer Communities; ADHD = Attention Deficit Hyperactivity Disorder.

II. THE PSYCHOMETRIC PROPERTIES OF THE HYPERSEXUAL BEHAVIOR INVENTORY USING A LARGE-SCALE NONCLINICAL SAMPLE (STUDY 1)[7]

ABSTRACT

The conceptualization of hypersexuality has begun to converge as a result of proposed diagnostic criteria. However, its measurement is still diverse. The Hypersexual Behavior Inventory (HBI) is one of the most appropriate scales used to assess hypersexuality, but further examination is needed to test its psychometric properties among different clinical and nonclinical groups, including samples outside of the United States. The aim of the present study was to investigate the reliability and the generalizability of HBI and to determine a cutoff score on a large, diverse, online, nonclinical sample (N = 18,034 participants; females = 6132; 34.0%; M_{age} = 33.6 years, SD_{age} = 11.1). Confirmatory factor analysis (CFA) and reliability indices provided support for the structure of the HBI and demonstrated excellent reliability. Employing latent profile analysis (LPA), seven classes emerged, but they could not be reliably distinguished by objective sexuality-related characteristics. Moreover, it was not possible to determine an adequate cutoff score, most likely due to the low prevalence rate of hypersexuality in the population. HBI can be reliably used to measure the extent of hypersexual urges, fantasies, and behavior; however, objective indicators and a clinical interview are essential to claim that a given individual may exhibit features of problematic sexual behavior.

Keywords: hypersexuality; Hypersexual Behavior Inventory; excessive sexual behavior; compulsive sex; uncontrollable sex

[7]Bőthe, B., Kovács, M., Tóth-Király, I., Reid, R. C., Griffiths, M. D., Orosz, G., & Demetrovics, Z. (2018). The Psychometric Properties of the Hypersexual Behavior Inventory Using a Large-Scale Nonclinical Sample. *Journal of Sex Research*, 1-11. doi: 10.1080/00224499.2018.1494262

II/1. INTRODUCTION

Hypersexuality is becoming a widely studied behavior (e.g., Montgomery-Graham, 2017; Schultz, Hook, Davis, Penberthy, & Reid, 2014; Womack et al., 2013). Furthermore, the conceptualization of hypersexuality has started to converge as a result of the proposed diagnostic criteria by Kafka (2010) and subsequent *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5), field trial of the proposed criteria (Reid, Carpenter, et al., 2012). Hypersexuality refers to excessive and uncontrollable sexual fantasies, urges, and behaviors accompanied by significant personal distress and adverse consequences. Individuals with hypersexuality use sexual fantasies, urges, and behaviors to cope with stress or negative emotions, such as anxiety or depression. The excessive time spent with these sexual fantasies, urges, and behaviors leads to conflicts in other important aspects of the individual's life (e.g., obligations or goals) and can cause physical and/or emotional harm to the individual with hypersexual behavior or others. In some extreme cases it could lead to suicidal behavior (Chatzittofis et al., 2017). Although individuals with hypersexuality try to control or reduce their sexual fantasies, urges, and behavior, they experience multiple unsuccessful efforts, often returning to previous behavioral patterns (Kafka, 2010).

Nevertheless, the assessment of hypersexuality is diverse and mainly focuses on males with hypersexuality (e.g., Montgomery-Graham, 2017; Reid, Garos, & Carpenter, 2011; Yeagley, Hickok, & Bauermeister, 2014), although recent studies have started to examine hypersexuality in female samples (e.g., Dhuffar & Griffiths, 2014, 2015; Kelly, Bimbi, Nanin, Izienicki, & Parsons, 2009; Klein, Rettenberger, & Briken, 2014). Clinical interviews and self-reported scales are currently the two predominant approaches to assessing hypersexuality, both with advantages and disadvantages. Clinical interviews assessing hypersexuality (e.g., Hypersexual Disorder Diagnostic Clinical Interview [Reid, Carpenter, et al., 2012]; Diagnostic Interview for Sexual Compulsivity [Morgenstern et al., 2011]) are usually conducted by clinicians, and these kinds of measures assess symptoms and consequences of excessive and uncontrollable sexual fantasies, urges, and behaviors. However, they do not provide detailed information on each criterion. They are more objective than self-reported scales, but they are more time-consuming and require clinician involvement. In contrast, self-report scales (e.g., Compulsive Sexual Behavior Inventory [Coleman, Miner, Ohlerking, & Raymond, 2001]; Sexual Addiction Screening Test—Revised [Carnes, Green, & Carnes, 2010]; Sexual Symptom Assessment Scale [Raymond, Lloyd, Miner, & Kim,

2007]; Hypersexual Disorder Questionnaire [Reid et al., 2012]) can provide a more widespread overview of the hypersexuality criteria and can be used quickly and easily. However, these measures have limitations, as individuals might not fully understand all questions and statements, leading to invalid results (Womack et al., 2013).

Several scales were created to assess hypersexuality before the establishment of the broadly accepted criteria of Kafka (2010). Consequently, these scales do not assess all the necessary information to measure the extent of hypersexual fantasies, urges, and behaviors (e.g., Marshall & Briken, 2010; Montgomery-Graham, 2017; Womack et al., 2013). Moreover, to fully grasp the complex nature of hypersexuality, psychometric scales that focus on only one aspect of hypersexuality (e.g., cybersex, masturbation, visiting strip clubs) or those scales that use one item to assess each criterion of hypersexuality are limited in their scope. According to recent reviews (e.g., Marshall & Briken, 2010; Montgomery-Graham, 2017; Stewart & Fedoroff, 2014), the Hypersexual Behavior Inventory (HBI; Reid et al., 2011) appears to be the most reliable and valid scale for assessing hypersexuality based on Kafka's (2010) criteria.

The HBI is both theoretically and psychometrically robust, and assesses hypersexuality via three factors: control, coping, and consequences. The *control* factor refers to perceived diminished ability to self-regulate sexual fantasies, urges, and behaviors. Individuals with hypersexuality feel that their sexual behavior is uncontrollable, and they repeatedly return to this behavior. The second factor, *coping*, refers to the mood and feeling modifying aspects of sexual behavior, such as using sex to forget about daily problems, to relieve stress, or to reduce negative feelings (e.g., anger, anxiety, or frustration). The final factor, *consequences*, describes the potential negative effects that individuals with hypersexuality experience due to their sexual behavior. This factor includes interference with education or work-related tasks, sacrifice of important things in order to engage in sexual behavior, and neglect of duties. The HBI's three-factor, first-order model of hypersexuality has shown strong psychometric properties in terms of confirmatory factor analysis (CFA), high internal consistency, and high test-retest reliability (e.g., Klein, Rettenberger, Boom, & Briken, 2014; Reid et al., 2011; Yeagley et al., 2014). Moreover, the HBI has been demonstrated to have strong concurrent, criterion, discriminant, and clinical validity in previous studies (e.g., Montgomery-Graham, 2017; Reid, Dhuffar, Parhami, & Fong, 2012; Yeagley et al., 2014).

Despite the psychometric strengths of the HBI, research is needed to further consolidate the results of previous studies across cultures and non-treatment-seeking individuals (Montgomery-Graham, 2017; Reid et al., 2011). To the best of the authors' knowledge, apart from the original validation studies (i.e., Reid & Garos, 2007; Reid et al., 2011), only two studies have examined the psychometric properties of the HBI in terms of factor structure and reliability among non-English-speaking populations or in nonclinical settings. Klein et al. (2014) used an online sample of German men and women to assess whether the HBI could be reliably used in a non-English-speaking sample. Their results showed that the HBI had acceptable structural validity, high internal consistencies, and strong convergent, divergent, and clinical validity, indicating that the HBI can be used to assess hypersexuality symptoms and consequences in non-English-speaking populations. In the second study, Yeagley and her colleagues (2014) examined the psychometric properties of HBI among young non-heterosexual males in a nonclinical setting. They revised the scale and removed several items due to cross-loadings. However, the three-factor, first-order factor structure remained intact. On the basis of these two studies, it can be argued that the three-factor, first-order model of the HBI is theoretically and psychometrically plausible, and the scale can also be used in nonclinical populations.

Among clinicians and researchers, there is a strong need to use a psychometrically robust measure of hypersexuality with a valid cutoff score to identify individuals with hypersexuality (Montgomery-Graham, 2017). Over a decade ago, Reid and Garos (2007) suggested a possible cutoff score of 53 (out of the maximum 95) for the HBI using a sample of men on the basis of guidelines suggested by Jacobson and Truax (1991). The scale with this cutoff score showed excellent sensitivity (.92). However, there was only moderate specificity (.62), and the scale's positive predictive value (PPV), negative predictive value (NPV), and accuracy were not reported. These results suggest that a score of 53 on the HBI might be an acceptable cutoff score for males, but as yet there is no cutoff score for the general population.

On the basis of previous literature, the aims of the present study were twofold: (a) to examine the factor structure and reliability of the HBI in a large, nonclinical sample, and (b) to determine the cutoff score for the HBI on the basis of latent profile analysis (LPA), sensitivity, specificity, PPV, NPV, and accuracy.

II/2. METHOD

II/2.1. Participants and Procedure

The present study was conducted in accordance with the approval of the institutional review board (IRB) of the related university and following the Declaration of Helsinki. The research was conducted via an online questionnaire that took approximately 30 minutes to complete. Data collection occurred in January 2017. Prior to enrollment, consent was obtained from those 18 years of age and older before they began completing questionnaires via one of the largest Hungarian news portals. A total of 31,883 participants visited the website, with 7,256 individuals declining to participate in the study. A further 145 individuals were removed because they were underage, and 110 individuals were removed for inconsistent responses.

Two major types of analyses were used to identify inconsistent responses. The first type of analysis was based on the standard deviation of the responses. When given participants chose the same response categories for each item on each scale (e.g., the participants scored 5 for each item, even if the scales contained reverse items), then their responses were excluded from further analysis. The second type of analysis was based on the content of the responses. In this case, it was examined whether the responses made sense. For example, individuals were excluded from further analyses if they indicated a higher age for their first sexual experience than their actual age (e.g., first sexual experience at the age 23 but said they were currently age 20). Out of 24,372 participants, 18,034 participants had sexual experiences; therefore, they filled out the HBI.

Consequently, a total of 18,034 participants (females = 6,134 [34.0%], males = 11,792 [65.4%], other = 110 [0.6%]) aged between 18 and 76 years (M_{age} = 33.6, SD_{age} = 11.1) were included in the final data set. Previous studies (e.g., Klein, Schmidt, Turner, & Briken, 2015; Reid et al., 2011; Sutton, Stratton, Pytyck, Kolla, & Cantor, 2015) have demonstrated that older participants (i.e., 60 years or older) can experience hypersexuality; therefore, it was decided to include older participants in the present study. Participants reported their place of residence as the capital city (53.9%), county towns (15.3%), towns (21.4%), or villages (9.3%); their highest level of education as primary (2.7%), secondary (36.5%), and higher education (60.8%).

II/2.2. Measures

Hypersexual Behavior Inventory. The HBI is a 19-item scale that assesses hypersexuality via three factors. Participants indicated their answers on a 5-point Likert scale (1 = *Never*; 5= *Very often*). The coping factor (seven items) assesses sex and sexual behaviors as a response to emotional distress such as sadness, restlessness, or daily life worries. The control factor (eight items) assesses the lack of self-control in sexuality-related behaviors, such as an individual's attempt to change his or her sexual behavior fails. The consequences factor (four items) assesses the diverse consequences of sexual thoughts, urges, and behaviors, such as sexual activities that interfere with educational or occupational duties (Reid et al., 2011). The HBI was translated into Hungarian on the basis of Beaton, Bombardier, Guillemin, and Ferraz's (2000) protocol. The Hungarian version of the scale is reproduced in online supplemental file 1.

Sexuality-Related Questions. In addition to standard demographic questions (e.g., age, gender, education) further topic-relevant questions were asked (Bőthe, Bartók et al., 2018). These included number of sexual partners, number of casual sexual partners, frequency of sex with the partner, frequency of sex with casual partners, and frequency of masturbation. Respondents were also asked about the frequency of viewing pornographic videos online and about the time spent accessing pornography.

II/2.3. Statistical Analysis

For the statistical analysis, SPSS 21 and Mplus 7.3 (Muthén & Muthén, 1998–2015) were used. CFA was used to assess the dimensionality of the HBI. The items were treated as categorical indicators, because they had severe floor effects (on the basis of skewness and kurtosis); thus, the mean- and variance-adjusted weighted least squares estimator (WLSMV) was used (Finney & DiStefano, 2006). In the structural assessment, commonly used goodness-of-fit indices (Brown, 2015; Kline, 2011) were observed (Bentler, 1990; Brown, 2015; Browne & Cudeck, 1993; Hu & Bentler, 1999; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Tabachnick & Fidell, 2001). More specifically, the analyses examined the comparative fit index (CFI; ≥ .95 for good, ≥ .90 for acceptable), the Tucker–Lewis index (TLI; ≥ .95 for good, ≥ .90 for acceptable), and the root mean square error of approximation (RMSEA; ≤ .06 for good, ≤ .08 for acceptable) with a 90% confidence interval (CI).

Reliability was assessed using Cronbach's alpha (Nunnally, 1978). However, due to its potentially decreased appropriateness (e.g., Sijtsma, 2009), one additional

index was used (i.e., composite reliability), because it may better represent the construct as it takes into account the factor loadings with their respective measurement errors, which was computed based on the formula of Raykov (1997) (> .60 acceptable, > .70 good; Bagozzi & Yi, 1988).

To identify possible groups of individuals with high levels of hypersexuality—whose activity may be considered problematic—LPA was used (such as in the case of problematic pornography use [Bőthe, Tóth-Király, Zsila et al., 2018]; or in the case of Internet gaming disorder [Pontes, Király, Demetrovics, & Griffiths, 2014]). LPA is a person-centered mixture modeling technique that can classify subgroups of individuals who gave similar responses to the three dimensions of HBI (Collins & Lanza, 2010). The analysis was performed with two to eight classes on the full sample. To determine the number of latent classes, the following indices were used: the Akaike information criterion (AIC), the Bayesian information criterion (BIC), and the sample-size adjusted Bayesian information criterion (SSABIC), where lower values indicate more parsimonious models. Entropy was also examined, indicating the accuracy of the classification process. Higher values indicate higher accuracy, with .40 being low, .60 being medium, and .80 being high entropy (Clark & Muthén, 2009). Finally, the Lo-Mendell-Rubin adjusted likelihood ratio test (L-M-R test) was also used, which compares the estimated model (e.g., three classes) with a model having one less class (e.g., two classes). A statistically significant p value ($p < .05$) suggests that the model with more classes fits the data better (Muthén & Muthén, 1998– 2015).

To determine the cutoff point for the HBI, a sensitivity analysis was carried out based on membership in the high-risk group in the LPA. Considering membership in this group as the gold standard, sensitivity, specificity, PPV, NPV, and accuracy values for all HBI cutoff points were calculated. Sensitivity was defined as the proportion of true positives belonging to the most problematic group based on the LPA, while specificity was defined as the proportion of the true negatives (Altman & Bland, 1994a; Glaros & Kline, 1988). PPV was defined as the proportion of the individuals with positive test results that was correctly diagnosed as hypersexual individuals, while NPV was defined as the proportion of participants with negative test results that were correctly diagnosed as nonhypersexual individuals (Altman & Bland, 1994b; Glaros & Kline, 1988). Moreover, taxometric analysis was conducted to investigate the latent structure of hypersexuality (Ruscio, Ruscio, & Carney, 2011). The detailed description of the taxometric analysis is in online supplemental file 2.

II/3. RESULTS

II/3.1. Descriptive Statistics

Regarding the participants' relationship status, 4,080 were single (22.6%), 7,847 were in a relationship (43.5%), 731 were engaged (4.1%), 4,505 were married (25.0%), 505 were divorced (2.8%), 87 were widows/widowers (0.5%), and 279 indicated the "other" option (1.5%). Regarding their sexual orientation, 15,080 were heterosexual (83.6%), 1,724 were heterosexual with homosexuality to some extent (9.6%), 486 were bisexual (2.7%), 121 were homosexual with heterosexuality to some extent (0.7%), 458 were homosexual (2.5%), 20 were asexual (0.1%), 93 were unsure about their sexual orientation (0.5%), and 52 indicated the "other" option (0.3%).

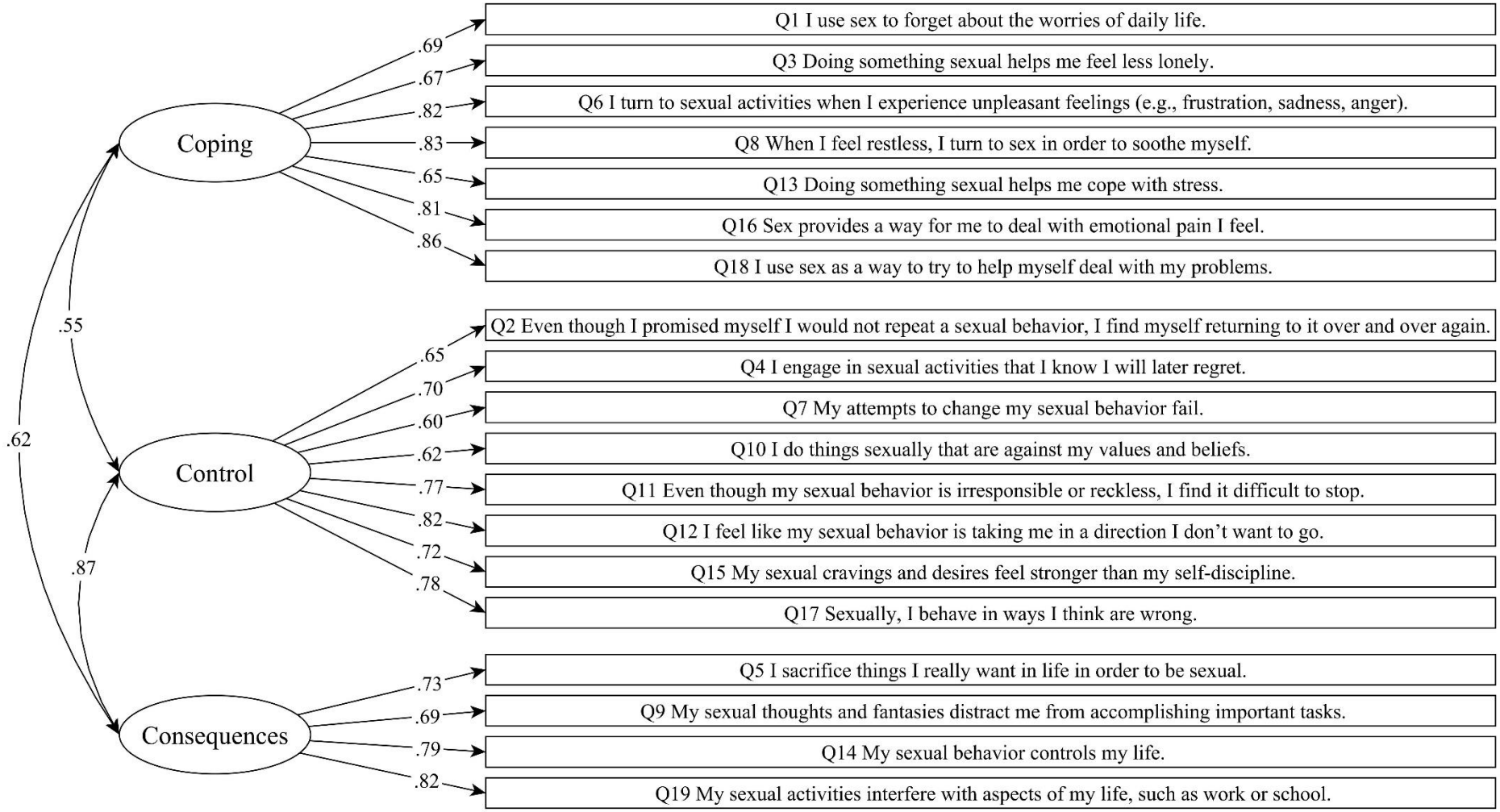
On average, participants had seven sexual partners in their lifetime, of which four were casual partners. Regarding past-year sexual behavior, they masturbated once a week, watched online pornography two or three times a month, and spent 26 minutes per session using it (*SD* = 20.9).

II/3.2. Dimensionality and Structural Validity

CFA was performed to test the hypothesized dimensionality of the HBI on the nonclinical sample. The CFA results showed that the first-order, three-factor model had acceptable fit (CFI = .940, TLI = .931 RMSEA = .071 [90% CI = .070–.072]). Factor loadings were adequate (ranging from .60 to .86) (see Figure 1).

II/3.3. Reliability

Descriptive statistics and reliability measures are described in II/Table 1. All Cronbach's alpha coefficients and composite reliability values were good, apart from the Cronbach's alpha coefficient of the consequences factor, which was in the acceptable range. The means on each factor were relatively low; the control and consequences scales had higher skewness and kurtosis values, indicating a violation of normal distribution. The correlation between the factors was positive and moderate, apart from the association between control and consequences.



II/Figure 1. The factor structure of the Hypersexual Behavior Inventory. *Note.* Standardized loadings are indicated on the arrows. All loadings are significant at $p < .001$.

II/Table 1. Means, reliability indices and inter-factor correlation between the dimensions of the Hypersexual Behavior Inventory

Factors	Range	Mean (SD)	Skewness (SE)	Kurtosis (SE)	α	CR	1	2
1. Coping	1-5	2.06 (0.78)	0.82 (0.02)	0.32 (0.04)	.86	.91	−	
2. Control	1-5	1.64 (0.64)	1.56 (0.02)	2.78 (0.04)	.82	.89	.45*	−
3. Consequences	1-5	1.55 (0.64)	1.67 (0.02)	3.27 (0.04)	.75	.84	.48*	.67*

Note. HBI = Hypersexual Behavior Inventory; α = Cronbach's alpha; CR = composite reliability; SE = standard error. *p < .001.

II/3.4.Latent Profile Analysis

LPA was performed on the three factors of the HBI to differentiate between the possible latent classes regarding hypersexuality. The AIC, BIC, and SSABIC values continuously decreased as more latent classes were added. Regarding entropy, all solutions had high levels of accuracy. The nonsignificant p value of the L-M-R test suggested that the eight-class solution should be rejected in favor of the seven-class solution (see II/Table 2). Based on these criteria, the seven-class solution was accepted as the best model.

II/Table 2. Fit indices for the latent profile analysis on the Hypersexual Behavior Inventory

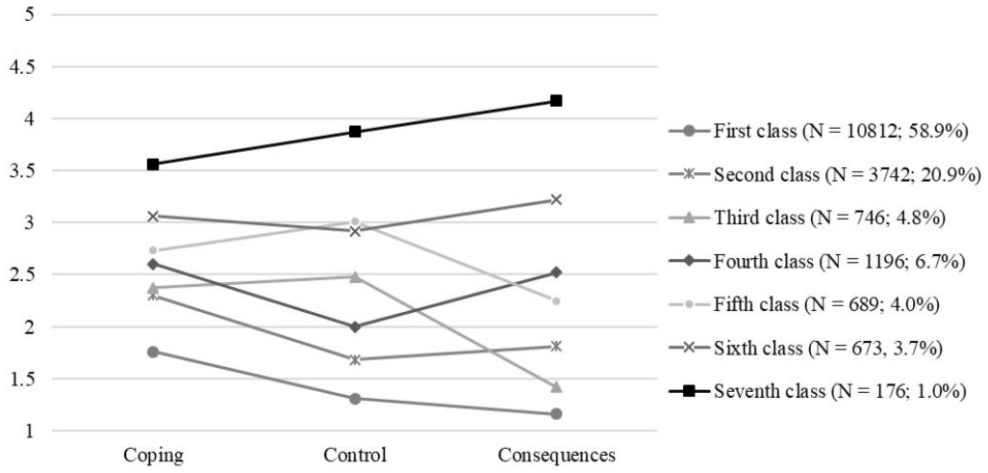
Classes	AIC	BIC	SSABIC	Entropy	L-M-R Test	p
2	95627	95705	95673	.911	16685	< .001
3	90478	90588	90543	.881	5028	< .001
4	88366	88506	88449	.880	2068	< .001
5	86753	86924	86854	.881	1581	<.001
6	85602	85805	85722	.869	1130	.010
7	**84516**	**84750**	**84654**	**.873**	**1067**	**.004**
8	83710	83975	83867	.874	794	.075

Note. Classes = number of latent classes; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SSABIC = Sample-Size Adjusted Bayesian Information Criterion; L-M-R test = The Lo-Mendell-Rubin Adjusted Likelihood Ratio Test; p = p value associated with the L-M-R Test. Bold letters indicate that the seven-class solution was selected as the final model.

The seven latent classes with their respective relationship patterns are outlined in Figure 2. In the case of the control [F (6, 18,033) = 8204.00; p < .001] and

consequences [F (6, 18,033) = 23576.40; p < .001] factors, all post hoc tests were significant, indicating that there are significant differences between the seven classes in the control of sexual behavior and its consequences. However, in the case of coping [F (6, 18,033) = 1151.38; p < .001], the post hoc tests between the second and the third class, and between the fourth and the fifth class, were not significant, indicating that these groups cannot be differentiated on the basis of their coping scores. The coping factor of HBI did not differentiate perfectly among the seven groups, while the control and consequences factors differentiated more clearly.

Those in the first (10,812 individuals, 58.9%), second (3,742 individuals, 20.9%), third (746 individuals, 4.8%), fourth (1,196 individuals, 6.7%), fifth (689 individuals, 4.0%) and sixth classes (673 individuals, 3.7%) represented individuals with little differentiated sexual behavior patterns (see II/Table 3). These individuals (a) use sex infrequently to cope with negative feelings or emotions, (b) control their sexual behavior most of the time, and (c) rarely experience negative consequences of their sexual behavior. However, the seventh class (176 individuals, 1.0%) represented individuals with high risk of serious hypersexuality. These individuals often (a) use sex frequently to reduce negative feelings, emotions, and stress, (b) cannot control their sexual behavior, and (c) experience negative consequences of their sexual behavior. The seven latent classes and their characteristics are described in II/Table 3. Overall, individuals in the seventh class masturbated and viewed pornography more frequently than the other six classes, and they spent more time with it on each occasion. However, they did not have more sexual partners in their lives and they did not have sex more frequently than individuals in the other classes.



II/Figure 2. Latent classes based on the dimensions of the Hypersexual Behavior Inventory

II/Table 3. Comparison of latent classes on the objective indicators of hypersexuality

	Range	(1) First class (N = 10812; 58.9%)	(2) Second class (N = 3742; 20.9%)	(3) Third class (N = 746; 4.8%)	(4) Fourth class (N = 1196; 6.7%)	(5) Fifth class (N = 689; 4.0%)	(6) Sixth class (N = 673; 3.7%)	(7) Seventh class (N = 176; 1.0%)	Wald χ^2
Number of sexual partners	1-16[a]	$7.96^{2,3,4,5,6,7}$ (0.04)	$8.72^{1,4,5,6}$ (0.08)	$8.66^{1,5,6}$ (0.17)	$9.09^{1,2,6}$ (0.14)	$9.43^{2,3}$ (0.19)	$9.65^{1,2,3,4}$ (0.19)	9.42^{1} (0.37)	160.38*
Number of casual sexual partners	1-16[a]	$3.58^{2,3,4,5,6,7}$ (0.05)	$3.95^{1,4,5,6,7}$ (0.08)	$4.31^{1,6,7}$ (0.16)	$4.38^{1,2,6,7}$ (0.14)	$4.75^{1,2,7}$ (0.18)	$5.13^{1,2,3,4}$ (0.18)	$5.68^{1,2,3,4,5}$ (0.39)	151.13*
Frequency of having sex with the partner	1-10[b]	$7.12^{3,5,6,7}$ (0.02)	$7.12^{3,5,6,7}$ (0.04)	$6.77^{1,2,4,5}$ (0.10)	$7.02^{3,5,6,7}$ (0.07)	$6.47^{1,2,3,4}$ (0.11)	$6.67^{1,2,4}$ (0.11)	$6.56^{1,2,4}$ (0.22)	77.63*
Frequency of having sex with casual partners[#]	1-10[b]	$3.75^{2,4,5,6,7}$ (0.04)	$4.08^{1,4,5,6}$ (0.06)	$3.90^{4,5,6,7}$ (0.10)	$4.34^{1,2,3}$ (0.09)	$4.35^{1,2,3}$ (0.10)	$4.50^{1,2,3}$ (0.11)	$4.45^{1,3}$ (0.22)	80.45*
Frequency of masturbation	1-10[b]	$6.43^{2,3,4,5,6,7}$ (0.02)	$7.26^{1,3,4,5,6,7}$ (0.04)	$7.54^{1,2,5,6,7}$ (0.08)	$7.63^{1,2,5,6,7}$ (0.07)	$7.88^{1,2,3,4,6,7}$ (0.08)	$8.36^{1,2,3,4,6,7}$ (0.08)	$8.74^{1,2,3,4,5,6}$ (0.13)	1068.57*
Frequency of pornography viewing	1-10[b]	$5.50^{2,3,4,5,6,7}$ (0.03)	$6.53^{1,3,4,5,6,7}$ (0.05)	$6.84^{1,2,5,6,7}$ (0.10)	$7.10^{1,2,5,6,7}$ (0.09)	$7.41^{1,2,3,4,6,7}$ (0.11)	$7.79^{1,2,3,4,5,7}$ (0.11)	$8.25^{1,2,3,4,5,6}$ (0.20)	942.04*
Duration of pornography viewing per occasion	0-180[c]	$23.84^{2,3,4,5,6,7}$ (0.20)	$27.73^{1,4,5,6,7}$ (0.42)	$27.38^{1,4,5,6,7}$ (0.87)	$31.75^{1,2,3,6,7}$ (0.84)	$31.05^{1,2,3,6,7}$ (1.09)	$36.73^{1,2,3,4,5,7}$ (1.38)	$47.31^{1,2,3,4,5,6}$ (3.16)	216.77*

Note. The class cells (1-7) contain the mean and standard errors (in parenthesis) of the corresponding variable row. Superscript numbers (1, 2, 3, 4, 5, 6, 7) indicate significant differences between the given class and the indexed classes according to the Wald χ^2 test. [a] = 1: 0 partner; 2: 1 partner; 3: 2 partners; 4: 3 partners; 5: 4 partners; 6: 5 partners; 7: 6 partners; 8: 7 partners; 9: 8 partners; 10: 9 partners; 11: 10 partners; 12: 11-20 partners, 13: 21-30 partners; 14: 31-40 partners; 15: 41-50 partners; 16: more than 50 partners; [b] = 1: never; 2: once in the last year; 3: 1-6 times in the last year; 4: 7-11 times in the last year; 5: monthly; 6: two or three times a month; 7: weekly; 8: two or three times a week; 9: four or five times a week; 10: six or seven times a week; [c] = participants indicated their responses in minutes; [d] = number of partnered respondents; [e] = number of respondents who had casual sexual partners. [#] The frequency of having sex with a casual partner were only assessed among those respondents who indicated that he/she had casual partner(s) in the last year. * $p < .001$.

II/3.5. Determination of a Potential Cutoff Score to Be Classified as Hypersexual: Sensitivity and Specificity Analysis

Based on the membership in the seventh class (i.e., the high-risk group) as a gold standard, the sensitivity, specificity, PPV, NPV, and accuracy of the HBI at all possible cutoff scores were calculated. The results are outlined in II/Table 4. On the basis of this analysis, it was not possible to determine a reliable cutoff score. For example, if 59 is selected as a possible cutoff score, all the indices would be excellent except for PPV, which would be low (27%). This low level of PPV indicates that if this cutoff score was used, only 27 out of 100 would be reliably identified as having problems with their sexual behavior, while 73 would be false-positive cases. Increasing the cutoff score leads to more false-negative cases (i.e., individuals highly engaged in hypersexuality with serious consequences would be mistakenly diagnosed as having nonproblematic sexual behavior), while decreasing the cutoff score results in more false-positive cases (i.e., individuals with nonproblematic sexual behavior would be mistakenly diagnosed as individuals having high levels of hypersexuality with serious consequences).

Moreover, the results of taxometric analysis did not indicate definitive evidence toward either a dimensional or a categorical latent structure for hypersexuality in the present sample (for details, see online supplemental file 2). Although the results of the taxometric analysis suggested a more dimensional structure for hypersexuality, some requirements of taxometric analysis were violated (e.g., within-group correlations between some indicators exceeded the suggested threshold). The results depended on the applied methods (e.g., MAMBAC versus MAXEIG) and on the applied indicator sets (HBI versus HBI-SF). Therefore, further research is needed to determine whether hypersexuality is a dimensional or a categorical construct. It is possible that the aforementioned contradictions regarding the latent structure of hypersexuality could explain why a reliable cutoff value could not be determined for the HBI (e.g., Graham, Walters, Harris, & Knight, 2016; Ruscio, Haslam, & Ruscio, 2006).

II/Table 4. Calculation of cut-off thresholds for the Hypersexual Behavior Inventory

cutoff score	true positive	true negative	false positive	false negative	sensitivity (%)	specificity (%)	PPV (%)	NPV (%)	accuracy (%)
50	174	16355	1503	2	98.86%	91.58%	10.38%	99.99%	91.65%
51	174	16521	1337	2	98.86%	92.51%	11.52%	99.99%	92.58%
52	173	16660	1198	3	98.30%	93.29%	12.62%	99.98%	93.34%
53	173	16797	1061	3	98.30%	94.06%	14.02%	99.98%	94.10%
54	172	16928	930	4	97.73%	94.79%	15.61%	99.97%	94.82%
55	171	17033	825	5	97.16%	95.38%	17.17%	99.97%	95.40%
56	171	17136	722	5	97.16%	95.96%	19.15%	99.97%	95.97%
57	168	17237	621	8	95.46%	96.52%	21.29%	99.95%	96.95%
58	167	17338	520	9	94.89%	97.09%	24.31%	99.95%	97.07%
59	166	17408	450	10	94.32%	97.48%	26.95%	99.94%	97.45%
60	158	17467	391	18	89.77%	97.81%	28.78%	99.90%	97.73%
61	156	17529	329	20	88.64%	98.16%	32.16%	99.89%	98.06%
62	155	17584	274	21	88.07%	98.47%	36.13%	99.88%	98.36%
63	152	17630	228	24	86.36%	98.72%	40.00%	99.86%	98.60%
64	147	17669	189	29	83.52%	98.94%	43.75%	99.84%	98.79%
65	144	17706	152	32	81.82%	99.15%	48.65%	99.82%	98.98%
66	141	17734	124	35	80.11%	99.80%	53.21%	99.80%	99.12%
67	131	17766	92	45	74.43%	99.48%	58.74%	99.75%	99.24%
68	128	17784	74	48	72.73%	99.59%	63.37%	99.73%	99.32%
69	122	17798	60	54	69.32%	99.66%	67.00%	99.70%	99.37%
70	115	17804	54	61	65.34%	99.70%	68.05%	99.67%	99.36%
71	109	17822	36	67	61.93%	99.80%	75.17%	99.63%	99.43%
72	102	17834	24	74	57.95%	99.87%	80.95%	99.59%	99.46%
73	97	17846	12	79	55.11%	99.93%	88.99%	99.56%	99.50%
74	87	17849	9	89	49.43%	99.95%	90.63%	99.50%	99.46%
75	76	17853	5	100	43.18%	99.97%	93.83%	99.44%	99.42%

II/4. DISCUSSION

According to the results of the present study, the HBI has strong psychometric properties in terms of internal consistency, composite reliability, dimensionality, and structural validity. The results also indicate that the HBI can be used in diverse, nonclinical populations. However, a general, reliable cutoff score could not be determined on the basis of LPA and alongside the sensitivity and specificity analysis.

According to CFA, the first-order model with three factors demonstrated an acceptable fit. Furthermore, the factor loadings were adequate, and the correlations between the factors were acceptable. In comparison to the original validation study of the HBI (i.e., Reid et al., 2011), the fit indices and the factor loadings were lower. These

lower values may be caused by the diversity of the present largescale sample. Reid and colleagues (2011) conducted their analysis on treatment-seeking males only, while Yeagley et al. (2014) and Klein et al. (2014) employed more diverse samples and, like the present study, achieved lower fit indices and factor loadings. In line with previous studies (Klein et al., 2014; Reid et al., 2011; Yeagley et al., 2014), the internal consistencies of the coping and control factors in the present study were the highest, and the internal consistency of the consequences factor was the lowest (but still within acceptable range).

These results also indicated that the coping and control factors of hypersexuality represent a narrower and more strongly connected concept than the consequences factor. This latter factor covers a broader range of symptoms, including work- and education-related problems, feeling distracted from important tasks due to sexual behavior, and/or sacrificing important things in life to engage in sexual fantasies, urges, and behavior. Moreover, in the case of consequences, it is possible that some of these are not so frequently experienced as the others, resulting in lower internal consistency of this factor. Alternatively, individuals may develop difficulty regulating their sexual behavior for some period of time before the consequences begin to arise. Subsequently, they would be more likely to endorse items on the coping and control subscales compared to items on the consequences subscale.

To get a clearer view of the consequences of hypersexuality, Reid and colleagues (2012) developed the Hypersexual Behavior Consequences Scale (HBCS) to assess a broader variety of consequences related to hypersexuality. Items on the HBCS query consequences associated with work, educational activities, commitment, legal, health, self-esteem, well-being, and social problems due to engagement in sexual activities. All things considered, the HBI could be used as the first step of the diagnostic process, while the HBCS could be used later in the development of the treatment process or as an outcome measure of treatment effectiveness.

The correlations between HBI factors were moderate, apart from the association between control and consequences factors, which was strong. In previous studies (Klein et al., 2014; Reid et al., 2011; Yeagley et al., 2014), this association was also strong, and in most of the cases, it was the strongest one between factors (Klein et al., 2014; Yeagley et al., 2014). This strong association between controlling one's behavior and having negative consequences of one's behavior is not surprising. In the case of hypersexuality, if individuals cannot control their sexuality-related fantasies, urges, and

behaviors (having high levels of impulsivity, e.g., Bőthe et al., 2018; Reid, Bramen, Anderson, & Cohen, 2014), they will engage in sexuality-related activities more frequently, which in turn can lead to frequent mild or severe consequences. Therefore, if the individual learns how to control sexual activities, the negative consequences will decrease or even disappear.

Although the HBI has good theoretical underpinnings and robust psychometric properties, a reliable cutoff score cannot be determined using the results of LPA alongside sensitivity and specificity analysis. On the one hand, LPA was unable to fully differentiate groups according to either severity of the problem or other patterns. In the case of previous studies using LPA to identify at-risk problematic user groups or individuals with a given behavior in diverse activities, three to five groups emerged in which individuals had different, distinguishable behavioral patterns (e.g., Bőthe et al., 2018; Demetrovics et al., 2012; Mueller et al., 2010; Pontes et al., 2014; Steuwe, Lanius, & Frewen, 2012; Wartberg, Kriston, Kammerl, Petersen, & Thomasius, 2015). In the present case, seven groups emerged as a statistically acceptable solution. However, the behavioral patterns of individuals in these groups could not be differentiated on the basis of HBI scores. Moreover, the comparison of these groups using objective indicators of sexuality did not lead to the demonstration of distinguishable behavioral patterns.

On the other hand, according to the calculations of Maraz, Király, and Demetrovics (2015), when the prevalence of a behavior or addiction is low in the population (e.g., approximately 1% or lower in the population), the sensitivity and the specificity can be high (even 99%). However, the PPV will be low, indicating that even if the screening measure showed a positive test result, there would be a high probability of having no problems at all. Although estimations of up to 3% in general populations are available (Stewart & Fedoroff, 2014; Sussman, Lisha, & Griffiths, 2011), the prevalence of hypersexuality in the population has yet to be properly established. Therefore, it might be assumed that the low prevalence rate of this behavior led to the low PPV of the HBI when the sensitivity and specificity rates were adequate. In cases when the prevalence rate of a behavior or addiction is low, the most appropriate use of screening measures is to rule out a condition, not to establish a diagnosis (Streiner, 2003).

Therefore, in the clinical evaluation of hypersexuality a multistep approach is ideal. The first step of such a diagnosis would include valid and reliable self-report

scales of typical symptoms based on the hypersexuality criteria, followed by objective indicators of hypersexuality (e.g., frequency of masturbation, visits to strip clubs, having sex with consenting adults, frequency of pornography use). Finally, a clinical interview should be administered. Using this stepped approach, a more comprehensive and accurate view of the individual's condition can be assessed.

Another possible explanation why it was impossible to determine a reliable cutoff is that the coping factor did not differentiate appropriately between the participants in the present study. Coping can be seen more as a motivational factor than as a problem factor, and as such it describes having sex or having sex-related urges and fantasies to reduce negative feelings, emotions, and stress. However, this motive is not directly associated with problems in contrast to the other two factors. Losing control over the activities as well as negative consequences of the behavior are purely symptomatic of the problematic behavior, while using sex to cope with negative feelings might lead to problematic behavior or not. However, all this means is that coping might not be an ideal factor to directly assess severity of the problems, especially in isolation from the other factors of the HBI. It is possible that other motivational dimensions (such as escapism in the case of problematic online gaming; Király et al., 2015) may differentiate more clearly according to problem severity. This could be the topic of further research that focuses on the association between motivational factors and problem severity. Moreover, further discussion is needed to determine how severity should be best characterized (Reid, 2015).

The present study had some limitations. The data were cross-sectional and the sample was self-selecting and nonrepresentative (although the sample size was very large). Participants were recruited via the Internet, where the real identity of the respondents can be questioned, although anonymous data collection could be beneficial in sexuality-related studies (especially if participants are asked about behaviors that are both problematic and sensitive in nature). The anonymity of responding online is likely to alleviate stress levels and could result in more honest responses when it comes to sexually-related behavior (Griffiths, 2012). The scales utilized assess self-reported ratings, which can distort reality; for example, participants may perceive their behavior as problematic even though there is no objective evidence for it being problematic. Biases concerning recall and social desirability may have also been present. In the present study, participants indicated the frequency of sexuality-related variables according to predetermined categories (such as frequency of masturbation or frequency

of viewing pornographic videos online) that might have led to socially desirable responding (e.g., if the highest option for pornography viewing is six to seven times a week, it is possible that people report less frequent behavior because the highest value might make them feel abnormal). Moreover, the categories regarding sexuality-related variables did not allow participants to record their own values (which could have been much higher than the closed choices they were given) that might have indicated the severity of hypersexuality more precisely. Therefore, open-ended questions would be preferable in future hypersexuality studies regarding sexuality-related variables. Taxometric analysis did not yield reliable results as to whether hypersexuality has a categorical or a dimensional latent structure; therefore, further research is needed to examine the latent structure of hypersexuality on diverse samples with different indicator sets. Although participants were aged between 18 and 76 years, the study excluded those who did not use the Internet. Future research should try to recruit individuals using a wider range of recruitment strategies, as well as try to increase the representativeness of the sample. Finally, although the frequency and duration of several sexuality-related activities were referred to as "objective" indicators of hypersexuality, self-report biases relating to these particular behaviors may also have occurred.

II/5. CONCLUSIONS

Hypersexuality is becoming a widely studied behavior, but as yet there is no consensus as to which measure is the most reliable to assess the severity of hypersexuality. According to previous reviews (Marshall & Briken, 2010; Montgomery-Graham, 2017; Stewart & Fedoroff, 2014) and the results of the present study, the Hypersexual Behavior Inventory (HBI) is a reliable instrument to assess hypersexuality that can be employed in clinical and nonclinical settings across diverse populations. However, when the prevalence of a behavior or addiction is low, as is likely in the case of hypersexuality, the most appropriate use of screening measures is to rule out a condition (rather than to rule it in). Therefore, the HBI can be used as the first step of a diagnostic process, but objective indicators and a clinical interview are essential to establish that a given individual's behavior is truly pathological.

III. HYPERSEXUALITY, GENDER, AND SEXUAL ORIENTATION: A LARGE-SCALE PSYCHOMETRIC STUDY (STUDY 2)[8]

ABSTRACT

Criteria for hypersexual disorder (HD) were proposed for consideration in the DSM-5 but ultimately excluded for a variety of reasons. Regardless, research continues to investigate hypersexual behavior (HB). The Hypersexual Behavior Inventory (HBI) is one of the most robust scales assessing HB, but further examination is needed to explore its psychometric properties among different groups. Therefore, the aim of the present study was to examine the generalizability of the HBI in a large, diverse, non-clinical sample (N = 18,034 participants; females = 6132; 34.0%; M_{age} = 33.6 years, SD_{age} = 11.1) across both gender and sexual orientation. Measurement invariance testing was carried out to ensure gender- and sexual orientation-based comparisons were meaningful. Results demonstrated when both gender and sexual orientation were considered (i.e., heterosexual males vs. LGBTQ males vs. heterosexual females vs. LGBTQ females), LGBTQ males had significantly higher latent means on the HBI factors. Results also demonstrated LGBTQ males had the highest scores on other possible indicators of hypersexuality (e.g., frequency of masturbation, number of sexual partners, or frequency of pornography viewing). These findings suggest LGBTQ males may be a group most at risk of engaging in hypersexual behavior, and LGBTQ females are at a higher risk of engaging in hypersexual activities due to coping problems. Given the large-scale nature of the study, the findings contribute to the currently growing body of the literature on hypersexuality.

Keywords: gender; hypersexuality; measurement invariance; pornography; sexual orientation; DSM-5

[8]Bőthe, B., Bartók, R., Tóth-Király, I., Reid, R. C., Griffiths, M. D., Demetrovics, Z., & Orosz, G. (2018). Hypersexuality, gender, and sexual orientation: A large-scale psychometric survey study. *Archives of Sexual Behavior, 47*(8), 2265-2276. doi: 10.1007/s10508-018-1201-z

III/1. INTRODUCTION

Hypersexual behavior (HB) is generally considered non-paraphilic dysregulated sexual behavior consisting of diminished control over sexual urges, fantasies, and behaviors, accompanied by negative consequences and significant personal distress for at least 6 months (Kafka, 2010). Despite Kafka's (2010) specific diagnostic criteria, HD was not included in the latest edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013) due to the lack of high-quality studies examining hypersexuality and a variety of other reasons (e.g., Kafka, 2010; Reid, 2015; Reid & Kafka, 2014; Stark, Kruse, Klucken, Strahler, & Wehum-Osinsky, 2017). Furthermore, most studies have focused on male samples with HB, with females often being neglected (e.g., Dhuffar & Griffiths, 2016; Montgomery-Graham, 2017; Reid et al., 2011; Yeagley et al., 2014). The role of sexual orientation in hypersexuality research is another relevant demographic factor that has received little attention in research to date with a few exceptions (e.g., Cooper, Delmonico, & Burg, 2000; Missildine, Feldstein, Punzalan, & Parsons, 2005). Therefore, the aim of the present study was to further investigate hypersexuality and its possible indicators alongside gender and sexual orientation utilizing a large-scale sample in hopes of adding to the existing knowledge-base of HB. Such information can aid researchers in examining the utility of classifying HB as a possible diagnosis among psychiatric disorders.

Hypersexual behaviors are typically characterized as nonparaphilic and can manifest in several different forms such as masturbation, sexual behavior with consenting adults, cybersex, pornography use, cybersex, telephone sex, visiting strip clubs, and/or other sex-related behaviors (Kafka, 2010; Wéry et al., 2016). According to previous studies, there is a 70% prevalence rate of uncontrollable masturbation in a clinical sample of males with paraphilias and paraphilia-related disorders. Furthermore, 50% of these males report pornography dependence which was positively associated with telephone sex dependence and compulsive masturbation (Kafka & Hennen, 1999). Recent studies report similar findings. For instance, in a study by Reid, Carpenter, and Lloyd (2009), more than half of the males receiving clinical treatment for hypersexual behaviors reported compulsive masturbation (59%) and pornography dependence (51%), while one-fifth of them reported extra-marital affairs (21%). The DSM-5 field trial for hypersexual disorder also found compulsive masturbation (78.3% of participants) and excessive pornography consumption (81.1% of participants) to be the

most frequently endorsed problematic sexual behavior (Reid, Carpenter et al., 2012). Therefore, masturbation and pornography use appear to be two important manifestations of hypersexuality with repeated visits to strip clubs being an alternative form of live visual pornography (Kafka, 2010).

To date, epidemiologic data regarding hypersexuality are sparse, and most published studies have mainly focused on HB among males (e.g., Kinsey, Pomeroy, & Martin, 1948; Kraus, Martino, & Potenza, 2016; Levaque et al., 2016), with a paucity of studies investigating female HB (e.g., Dhufar & Grifths, 2014; Klein, Rettenberger, Boom et al., 2014). Moreover, studies examining gender differences have proved inconclusive. For instance, some studies (e.g., Langström & Hanson, 2006; Winters et al., 2010) suggest that males are more likely to report hypersexuality-related behaviors, while other studies (e.g., Seegers, 2003) suggest that females report more hypersexuality-related behaviors than males.

There is a paucity of studies examining HB among sexual minority groups (i.e., lesbian, gay, bisexual, transgender, and queer communities—LGBTQ)—presumably due to the relatively small proportion of LGBTQ individuals in the general population (i.e., Cooper et al., 2000; Missildine et al., 2005). According to these studies, higher levels of sexual compulsivity appear to occur among LGBTQ individuals than heterosexuals. These are preliminary findings, but there are possible explanations as to why LGBTQ individuals may have higher levels of HB. Firstly, sexual content is easily accessible to everyone online; therefore, it is possible that this accessibility makes it easier for LGBTQ individuals to engage in risky sexual behavior (e.g., problematic pornography use or finding casual sexual partners online) (Montgomery-Graham, 2017; Parsons, 2005; Parsons, Kelly, Bimbi, Muench, & Morgenstern, 2008). Secondly, there is evidence suggesting that experiencing homophobia—even to a small extent within a given society— could lead to the internalization of this homophobic experience which in turn leads to anxiety, romantic relationship development, and sexuality-related problems, potentially causing hypersexual tendencies (Montgomery-Graham, 2017; Muench, & Parsons, 2004). Despite these existing theories and evidence, further research is needed in the field of hypersexuality among different sexual orientations.

Several scales have been developed to assess hypersexual behavior (for comprehensive reviews, see Hook, Hook, Davis, Worthington, & Penberthy, 2010; Montgomery-Graham, 2017; Womack et al., 2013). One of the most reliable, valid, and frequently used self-report scales being the Hypersexual Behavior Inventory (Reid et

al., 2011) which has been used in numerous studies (e.g., Marshall & Briken, 2010; Montgomery-Graham, 2017; Stewart & Fedoroff, 2014). The three-factor model of HBI has also shown strong psychometric properties in terms of high internal consistency, high test–retest reliability, confirmatory factor analysis and construct validity in English and non-English speaking samples and among males and females (Klein et al., 2014; Reid et al., 2011; Yeagley et al., 2014). The results of the previous validation studies of the HBI are detailed in III/Table 1. Moreover, the HBI has been demonstrated to have strong concurrent, criterion, discriminant, and clinical validity in several previous studies (e.g., Montgomery-Graham, 2017; Reid, Dhuffar et al., 2012; Yeagley et al., 2014).

Although this scale has a strong theoretical background and robust psychometric properties, little scientific attention has been paid to the application of large samples to examine whether men and women, or heterosexual and LGBTQ individuals, respond to the HBI similarly or whether they have gender- or sexual orientation-based differences in their response patterns. In the literature, there are conflicting findings (e.g., Cooper et al., 2000; Winters et al., 2010) as to whether gender or sexual orientation has more influence on the development and maintenance of hypersexuality. Therefore, the aim of the present study was to systematically investigate these potential differences across different subgroups (males vs. females, heterosexual vs. LGBTQ individuals) via tests of measurement invariance. These tests are preferable to other group-based comparisons because, instead of scale scores, fully latent variables are used which are naturally corrected for measurement errors (Marsh & Hau, 2007). Moreover, the generalizability of the findings can also be verified across distinct samples.

III/Table 1. Prior validity and reliability characteristics of the Hypersexual Behavior Inventory†

Authors (year)	Nation	Sample	Analysis	Characteristics	Coping	Control	Consequences	CFI	TLI	RMSEA	Final model
Klein et al. (2014)	Germany	N = 1749 (57% females) M_{age} = 24.42 (SD = 4.38)	CFA	Number of items	7	8	4	.90	—	.07	3-factor
				Average loadings	—	—	—				
				Cronbach's alpha	.86	.83	.78				
Reid et al. (2011)	United States of America	N = 324 (0% females) M_{age} = 32 (SD = —)	EFA	Number of items	7	8	4	—	—	—	3-factor
				Average loadings	.72	.67	.67				
				Cronbach's alpha	.90	.94	.87				
	United States of America	N = 203 (0% females) M_{age} = 33 (SD = —)	CFA	Number of items	7	8	4	.95	—	.06	3-factor
				Average loadings	.82	.84	.80				
				Cronbach's alpha	.91	.95	.89				
Yeagley et al. (2014)	United States of America	N = 366 (0% females) M_{age} = 21.46 (SD = 1.95)	CFA	Number of items	4	5	2	.99	—	.05	3-factor
				Average loadings	.81	.83	.86				
				Cronbach's alpha	.88	.92	.83				

Note. † = Literature search was performed on February 05, 2018; M_{age} = mean age; N = number of participants; CFA = confirmatory factor analysis; EFA = exploratory factor analysis; N of items = number of items; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root-mean-square error of approximation.

III/2. METHOD

III/2.1. Participants and Procedure

The present research was conducted in accordance with the approval of the institutional review board of the research team's related university and carried out under the Declaration of Helsinki. The research was conducted via an online questionnaire that took approximately 30 min to complete. Data collection occurred in January 2017. Prior to enrollment, participants received detailed information about the study, read and provided informed consent, and indicated being 18 years or older. Participants were invited to take part in the study via one of the largest Hungarian news portals. A total of 31,883 participants visited the Web site with 7256 individuals declining to participate in the study. A further 145 individuals were removed because they were under-aged, and 110 individuals were removed for inconsistent survey responses.

Out of 24,372 participants, 18,034 participants had sexual experiences before; therefore, they filled out the Hypersexual Behavior Scale. Consequently, a total of 18,034 participants (females=6132, 34.0%, males=11,792, 65.4%, other=110, 0.6%) aged between 18 and 76 years (M_{age}=33.6, SD_{age}=11.1) took part in the study. Of these participants, 9727 lived in a capital city (53.9%), 2760 in county towns (15.3%), 3868 in towns (21.4%), and 1679 in villages (9.3%). Regarding their sexual orientation, 15,080 were heterosexual (83.6%), 1724 were heterosexual with homosexuality to some extent (9.6%), 486 were bisexual (2.7%), 121 were homosexual with heterosexuality to some extent (0.7%), 458 were homosexual (2.5%), 20 were asexual (0.1%), 93 were unsure about their sexual orientation (0.5%), and 52 indicated the "other" option (0.3%). In order to simplify the analysis of sexual orientation-based groups, the research team merged the "heterosexual with homosexuality to some extent," the "bisexual," the "homosexual with heterosexuality to some extent," the "homosexual," the "asexual," and the "unsure" groups into a "LGBTQ" group.

III/2.2. Measures

Hypersexual Behavior Inventory (HBI; Reid et al., 2011). The HBI is a 19-item scale which assesses hypersexual behavior via three dimensions. Participants indicated their answers on a five-point Likert scale (1=never; 5=very often). The Coping factor (α=.86; seven items, e.g., "Sex provides a way for me to deal with emotional pain I feel.") refers to sex and sexual behaviors as a response to emotional distress such as sadness or daily life worries. The Control factor (α=.82; eight items, e.g., "I feel like my

sexual behavior is taking me in a direction I don't want to go.") refers to perceived diminished ability to self-regulate sexual fantasies, urges, and behaviors. The Consequences factor (α = .75; four items, e.g., "My sexual activities interfere with aspects of my life, such as work or school.") refers to the diverse consequences of sexual thoughts, urges, and behaviors such as sexual activities interfere with educational and occupational duties or interpersonal relationships. The HBI was translated into Hungarian on the basis of Beaton et al.'s (2000) protocol.

Sexuality-Related Questions. In addition to the demographic questions (e.g., gender, age, sexual orientation) further topic-relevant questions were asked, including number of sexual partners: "How many sexual partners have you had in your life (in a relationship or out of a relationship)?" (16-point scale, 1="0 partners" to 16="more than 50 partners"); number of casual sexual partners: "How many casual sexual partners have you had in your life?" (16-point scale, 1="0 partners" to 16="more than 50 partners"); frequency of sex with the partner: "Last year, how often did you have sex with your partner?" (10-point scale, 1="never" to 10="6 or 7 times a week"); frequency of sex with casual partners: "Last year, how often did you have sex with a casual partner?" (10-point scale, 1="never" to 10="6 or 7 times a week"); frequency of masturbation: "Last year, how often did you masturbate?" (10-point scale, 1="never" to 10="6 or 7 times a week"). Respondents were also asked about the frequency of viewing pornographic videos online (10-point Likert scale, 1="never" to 10="6 or 7 times a week") and the time spent accessing pornography per session: "When you watch porn, how much time do you spend with it per each session?" (from "0 min" to "180 min").

III/2.3. Statistical Analysis

For the statistical analysis, SPSS 21 and Mplus 7.3 (Muthén & Muthén, 1998–2015) were used. Confirmatory factor analysis (CFA) was used to assess the dimensionality of the Hypersexual Behavior Inventory. The items had severe floor effects (on the basis of skewness and kurtosis); therefore, they were treated as categorical indicators and the mean- and variance adjusted weighted least squares estimator (WLSMV) was used (Finney & DiStefano, 2006). In the structural assessment, commonly used goodness of fit indices (Brown, 2015; Kline, 2011) were observed (Bentler, 1990; Brown, 2015; Browne & Cudeck, 1993; Hu & Bentler, 1999; Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2001): the comparative fit index

(CFI ≥.95 for good, ≥.90 for acceptable), the Tucker–Lewis index (TLI ≥.95 for good, ≥.90 for acceptable), and the root-mean-square error of approximation (RMSEA ≤.06 for good, ≤. 08 for acceptable) with a 90% confidence interval.

To test structural invariance between groups based on gender (male vs. female), sexual orientation (heterosexual vs. LGBTQ) and combination of gender and sexual orientation (heterosexual males vs. LGBTQ males vs. heterosexual females vs. LGBTQ females), several multi-group CFAs were carried out (Meredith & Teresi, 2006; Tóth-Király, Bőthe, Rigó, & Orosz, 2017; Vandenberg & Lance, 2000). First, the models were estimated freely for both male and female subgroups. Second, nested models with increasingly constrained parameters were estimated: (1) factor loadings and thresholds were freely estimated (configural invariance), (2) factor loadings were set to be equal (metric invariance), (3) factor loadings and thresholds were set to be equal (scalar invariance), (4) factor loadings, thresholds, and residual variances were constrained to be equal (residual invariance), (5) factor loadings, thresholds, uniqueness, and variance–covariances were constrained to be equal (latent variance and covariance invariance), and (6) factor loadings, thresholds, residual variances, latent variance invariances, latent covariances, and latent means were constrained to be equal (latent mean invariance). Testing invariance on higher levels (e.g., latent invariance and covariance invariance, latent mean invariance) can be relevant for the generalizability of the construct. When comparing the increasingly constrained models, relative change in fit indices was observed (Chen, 2007; Cheung & Rensvold, 2002; Marsh et al., 2009): ΔCFI≤.010; ΔTLI≤.010; and ΔRMSEA≤.015.

One-way analyses of variance (ANOVA) with Bonferroni post hoc tests was conducted to investigate whether the gender and sexual orientation-based groups were different in their number of sexual partners, number of casual sexual partners, frequency of masturbation, frequency of viewing online pornographic videos, and the time spent with pornography use per session.

III/3. RESULTS

III/3.1. Measurement Invariance

In order to ensure meaningful comparisons based on gender, sexual orientation, and gender–sexual orientation, measurement invariance was carried out to examine the factor structure of the HBI across two subgroups (i.e., male vs. female, heterosexual vs. LGBTQ), then across four subgroups (heterosexual male vs. LGBTQ male vs.

heterosexual female vs. LGBTQ female). The results of the invariance analyses are shown in III/Table 3. Firstly, in step zero, the baseline models were estimated for both males and females, showing acceptable ft. Then, parameters were gradually constrained and changes in ft indices were observed. Although all $\chi 2$ tests were significant, other fit indices (ΔCFI, ΔTLI, ΔRMSEA) changed in the acceptable range, indicating gender invariance on the level of latent means. The results of the sexual orientation-based invariance testing were highly similar, indicating sexual orientation-related invariance on the level of latent means. In the case of the gender and sexual orientation-based invariance testing, all $\chi 2$ tests were significant. However, other fit indices did not decrease more than the recommended cutoff value, indicating gender–sexual orientation-based invariance on the level of latent variance–covariance matrix. Latent mean invariance could not be achieved in these groups, suggesting the presence of latent mean differences (III/Table 2).

When the latent means of the LGBTQ males were set to be zero for the purpose of identification, the inspection of the latent means revealed that all other groups' (LGBTQ females, heterosexual males, and heterosexual females) latent means were significantly lower (differences ranging from − 1.05 to −0.11) on all the three factors (Coping, Control, Consequences). When the latent means of the heterosexual females were set to be zero, it was demonstrated that all other groups' latent means were significantly higher on all factors (differences ranging from 0.15 to 1.05). Only one non-significant difference was identified, in the case of the Control factor where latent means of LGBTQ females and heterosexual males were not significantly different. In summary, LGBTQ males scored the highest, while heterosexual females had the lowest scores on each dimension of hypersexuality. In the case of LGBTQ females and heterosexual males, a more diverse pattern was evident. There was no difference in the Control dimension; however, LGBTQ females scored higher on the Coping dimension, while heterosexual males had higher scores on the Consequences dimension. For the latent mean differences, see III/Table 3, and for a visual representation, see Figure 1.

III/Table 2. Tests of gender and sexual orientation invariance on the Hypersexual Behavior Inventory

Model	WLSMV χ^2 (df)	CFI	TLI	RMSEA	90% CI	Comparison	$\Delta\chi^2$ (df)	ΔCFI	ΔTLI	ΔRMSEA
CFA 3-factor first-order model	13718.625* (149)	.940	.931	.071	.070-.072	—	—	—	—	—
Gender invariance										
Baseline male	9539.656* (149)	.941	.932	.073	.072-.074	—	—	—	—	—
Baseline female	4858.204* (149)	.927	.917	.072	.070-.074	—	—	—	—	—
M1. Configural	14248.170* (298)	.939	.929	.072	.071-.073	—	—	—	—	—
M2. Metric	14717.090* (314)	.937	.931	.072	.071-.073	M2-M1	555.101* (16)	-.002	+.002	.000
M3. Scalar	13678.440* (368)	.941	.946	.064	.063-.064	M3-M2	485.325* (54)	+.004	+.015	-.008
M4. Residual	12918.392* (387)	.945	.951	.060	.059-.061	M4-M3	339.467* (19)	+.004	+.005	-.004
M5. Latent variance-covariance	6889.346* (393)	.971	.975	.043	.042-.044	M5-M4	33.539* (6)	+.026	+.024	-.017
M6. Latent means	**9087.688* (396)**	**.962**	**.967**	**.049**	**.049-.050**	**M6-M5**	**708.128* (3)**	**-.009**	**-.008**	**+.006**
Sexual orientation invariance										
Baseline heterosexual	10854.656* (149)	.940	.931	.069	.068-.070	—	—	—	—	—
Baseline LGBTQ	2939.128* (149)	.938	.929	.08	.077-.082	—	—	—	—	—
M1. Configural	13694.847* (298)	.938	.928	.071	.070-.072	—	—	—	—	—
M2. Metric	13879.712* (314)	.937	.931	.069	.068-.070	M2-M1	201.713* (16)	-.001	+.003	-.002
M3. Scalar	12784.658* (368)	.942	.946	.061	.060-.062	M3-M2	177.672* (54)	+.005	+.015	-.008
M4. Residual	1135.205* (387)	.949	.955	.056	.055-.057	M4-M3	75.627* (19)	+.007	+.009	-.005
M5. Latent variance-covariance	5481.281* (393)	.976	.979	.038	.037-.039	M5-M4	26.778* (6)	+.027	+.024	-.018
M6. Latent means	**7337.040* (396)**	**.968**	**.972**	**.044**	**.043-.045**	**M6-M5**	**570.744* (3)**	**-.008**	**-.007**	**+.006**
Gender and sexual orientation invariance										
Baseline heterosexual male	7781.602*(149)	.942	.933	.070	.069-.072	—	—	—	—	—

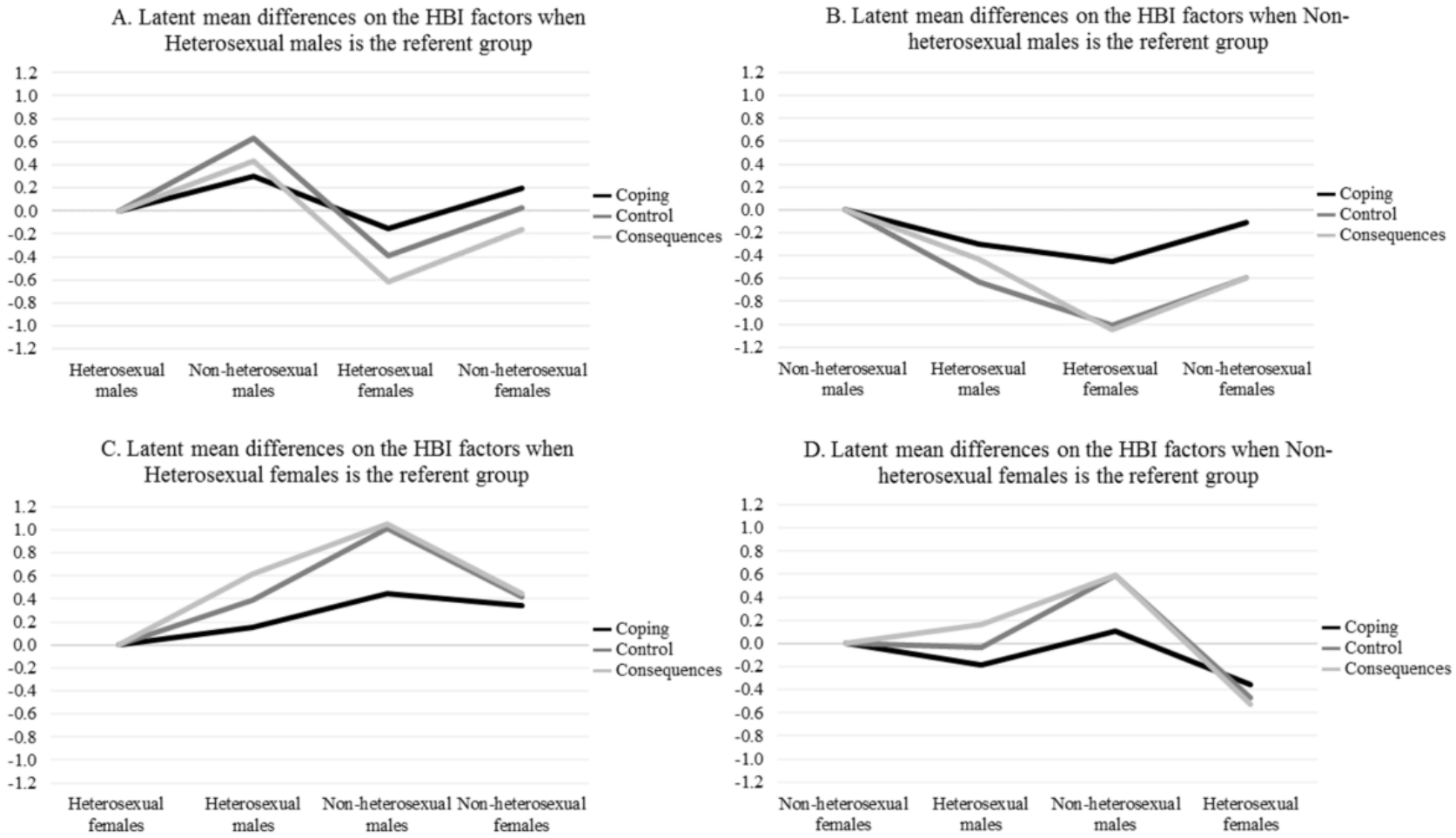
Baseline LGBTQ male	1748.908*(149)	.936	.927	.087	.083-.090	—	—	—	—	—
Baseline heterosexual female	3597.855*(149)	.921	.909	.071	.069-.073	—	—	—	—	—
Baseline LGBTQ female	1435.119*(149)	.933	.923	.076	.072-.080	—	—	—	—	—
M1. Configural	14238.264*(596)	.936	.927	.071	.070-.072	—	—	—	—	—
M2. Metric	14905.906*(644)	.934	.929	.070	.069-.071	M2-M1	788.817* (48)	-.002	+.002	-.001
M3. Scalar	13907.647*(806)	.939	.948	.060	.059-.061	M3-M2	803.312* (162)	+.005	+.019	-.010
M4. Residual	12857.928*(863)	.944	.956	.056	.055-.057	M4-M3	425.574* (57)	+.005	+.008	-.004
M5. Latent variance-covariance	**6814.007*(881)**	**.972**	**.979**	**.039**	**.038-.040**	**M5-M4**	**78.145* (18)**	**+.028**	**+.023**	**-.017**
M6. Latent means	11520.841*(890)	.950	.962	.052	.051-.052	M6-M5	1496.022* (9)	-.022	-.017	+.013

Note. WLSMV = weighted least squares mean- and variance-adjusted estimator; χ^2 = Chi-square; df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root-mean-square error of approximation; 90% CI = 90% confidence interval of the RMSEA; ΔCFI = change in CFI value compared to the preceding model; ΔTLI = change in the TLI value compared to the preceding model; ΔRMSEA = change in the RMSEA value compared to the preceding model; Bold letters indicate the final levels of invariance that were achieved. *$p < .001$.

III/Table 3. Latent means comparison between groups based on gender and sexual orientation

Latent variables	Heterosexual males	LGBTQ males	Heterosexual females	LGBTQ females
HBI Coping	0.00	**+0.30 (.03)**	**-0.15 (.02)**	**+0.20 (.03)**
HBI Control	0.00	**+0.63 (.03)**	**-0.39 (.02)**	+0.03 (.03)
HBI Consequences	0.00	**+0.43 (.04)**	**-0.62 (.02)**	**-0.16 (.04)**
HBI Coping	**-0.30 (.03)**	0.00	**-0.45 (.03)**	**-0.11 (.04)**
HBI Control	**-0.63 (.03)**	0.00	**-1.01 (.04)**	**-0.59 (.04)**
HBI Consequences	**-0.43 (.04)**	0.00	**-1.05 (.04)**	**-0.59 (.05)**
HBI Coping	**+0.15 (.02)**	**+0.45 (.03)**	0.00	**+0.34 (.03)**
HBI Control	**+0.39 (.02)**	**+1.01 (.04)**	0.00	**+0.42 (.04)**
HBI Consequences	**+0.62 (.02)**	**+1.05 (.04)**	0.00	**+0.45 (.04)**
HBI Coping	**-0.19 (.03)**	**+0.11 (.04)**	**-0.36 (.03)**	0.00
HBI Control	-0.03 (.03)	**+0.59 (.04)**	**-0.47 (.04)**	0.00
HBI Consequences	**+0.16 (.04)**	**+0.59 (.05)**	**-0.53 (.05)**	0.00

Note. Latent means are reported with their standard errors in parentheses. Significant differences are depicted in bold ($p < 0.05$). Latent means are fixed to zero in one referent group for identification purposes and latent means estimated in the other three groups reflect deviations from this referent groups expressed in standard deviation units. HBI Coping = Hypersexual Behavior Inventory Coping factor; HBI Control = Hypersexual Behavior Inventory Control factor; HBI Consequences = Hypersexual Behavior Inventory Consequences factor



III/Figure 1. Visualization of latent mean comparisions between groups based on gender and sexual orientation. *Note.* Latent means are fixed to zero in one referent group for identification purposes and latent means estimated in the other three groups reflect deviations from this referent groups expressed in standard deviation units.

III/3.2. Gender and Sexual Orientation-Based Comparisons

In the next step of the analysis, one-way ANOVA with a Bonferroni post hoc tests were conducted in order to investigate whether gender and sexual orientation-based groups differed in other possible indicators of hypersexuality (see III/Table 4). According to the results, LGBTQ males significantly differed from all the other groups on all dimensions, except for the frequency of having sex with casual partners. LGBTQ males had an average of ten sexual partners, while heterosexual males, LGBTQ females, and heterosexual females had approximately seven sexual partners in their lifetime. Regarding casual sexual partners, LGBTQ males had eight to nine casual sexual partners, while the members of the other three groups had approximately three to five casual sexual partners. Regarding the frequency of having sex with the partner, LGBTQ males indicated the lowest frequency (approximately having sex two or three times a month), followed by heterosexual males (weekly), LGBTQ females (weekly), and heterosexual females (weekly). Although LGBTQ males had the highest frequency of having sex with casual sexual partners followed by heterosexual males, LGBTQ females and heterosexual females, the differences between the groups were small and in most of the cases they were not statistically significant.

LGBTQ males masturbated approximately two to five times a week, heterosexual males masturbated one to three times a week, LGBTQ females masturbated weekly, and heterosexual females masturbated two or three times a month. Regarding the frequency of pornography viewing, LGBTQ males viewed it two or three times a week, heterosexual males viewed it weekly, LGBTQ females viewed it monthly, and heterosexual women viewed it seven to eleven times in the last year. Considering the duration of pornography viewing per each occasion, LGBTQ males watched it approximately for 36 min per session, while heterosexual males watched it for 28 min, LGBTQ females watched it for 24 min, and heterosexual females watched it for 22 min. In summary, LGBTQ males had the highest number of sexual partners in their lifetime, had the highest number of casual partners, masturbated and watched pornography videos most frequently, and they spent the longest time with it each session.

III/Table 4. Comparison of gender and sexual orientation-based groups on the indicators of hypersexuality

	Range	(1) Heterosex. males (N = 11052 N_d = 8163 N_e= 3869)	(2) LGBTQ males (N = 740 N_d = 391 N_e = 505)	(3) Heterosex. females (N = 5664 N_d = 4149 N_e = 1890)	(4) LGBTQ females (N = 468 N_d = 301 N_e = 219)	ANOVA F	ANOVA *p*	ANOVA η^2
number of sexual partners	1-16[a]	8.39 (4.40)[2,3]	10.85 (4.52)[1,3,4]	7.96 (4.02)[1,2,4]	8.63 (4.25)[2,3]	100.71	<.001	.017
number of casual sexual partners	1-16[a]	5.62 (4.62)[2,3]	9.52 (5.10)[1,3,4]	4.87 (3.97)[1,2,4]	5.82 (4.45)[2,3]	242.62	<.001	.039
freq. of having sex with the partner	1-10[b]	6.95 (1.82)[2,3]	6.67 (2.17)[1,3,4]	7.31 (1.70)[1,2]	7.15 (1.76)[2]	42.56	<.001	.010
freq. of having sex with casual partners	1-10[b]	4.07 (2.03)[3]	4.28 (1.95)[3]	3.79 (1.83)[1,2]	3.96 (2.00)	12.38	<.001	.006
freq. of masturbation	1-10[b]	7.43 (2.14)[2,3,4]	8.47 (1.66)[1,3,4]	5.60 (2.18)[1,2,4]	6.77 (1.98)[1,2,3]	1039.16	<.001	.150
freq. of pornography viewing	1-10[b]	7.13 (2.36)[2,3,4]	8.12 (1.92)[1,3,4]	3.87 (2.33)[1,2,4]	5.18 (2.40)[1,2,3]	2459.82	<.001	.309
duration of porn. viewing per occasion	0-180[c]	27.83 (21.18)[2,3,4]	35.76 (28.89)[1,3,4]	21.82 (16.51)[1,2]	24.48 (20.20)[1,2]	130.75	<.001	.026

Note. [a] = 1: 0 partner; 2: 1 partner; 3: 2 partners; 4: 3 partners; 5: 4 partners; 6: 5 partners; 7: 6 partners; 8: 7 partners; 9: 8 partners; 10: 9 partners; 11: 10 partners; 12: 11-20 partners, 13: 21-30 partners; 14: 31-40 partners; 15: 41-50 partners; 16: more than 50 partners; [b] = 1: never; 2: once in the last year; 3: 1-6 times in the last year; 4: 7-11 times in the last year; 5: monthly; 6: two or three times a month; 7: weekly; 8: two or three times a week; 9: four or five times a week; 10: six or seven times a week; [c] = participants indicated their responses in minutes; [d] = number of partnered respondents; [e] = number of respondents who had casual sexual partners. η^2 = Eta-squared. Superscript numbers ([1, 2, 3, 4]) indicate significant ($p < .05$) difference between the given group and the indexed group within the same variable.

III/4. DISCUSSION

The Hypersexual Behavior Inventory (HBI) has previously demonstrated robust psychometrics in terms of reliability and validity (e.g., Klein et al., 2014; Reid et al., 2011, 2012; Yeagley et al., 2014). According to the present study, the HBI had strong psychometric properties in terms of factor structure and measurement invariance along several subgroups. In the case of tests of invariance based on gender and sexual orientation, latent mean invariance was not achieved, indicating that the latent means of the groups were different with LGBTQ males having the highest latent means and they also reported highest scores regarding the other possible indicators of hypersexual behaviors.

According to measurement invariance testing, if individual's gender or sexual orientation is considered separately, measurement invariance was achieved at the level of latent means, indicating that there were no latent means differences between males–females and heterosexual–LGBTQ individuals. However, if gender and sexual orientation are considered together (i.e., heterosexual males, LGBTQ males, heterosexual females, and LGBTQ females), then the latent means of the respective groups differed. LGBTQ men and LGBTQ women had significantly higher latent means on the *Coping* dimension than heterosexual men and heterosexual women. Thus, LGBTQ individuals use sex and sex-related fantasies and behavior in order to cope with their negative feelings or negative life events. It is plausible that LGBTQ individuals may experience more negative feelings and emotions (such as anxiety, depression or stress) in relation to sexual orientation as others have noted (Parsons et al., 2008). Furthermore, their sexual orientation can sometimes be stigmatized and sex or sex-related activities can act as an effective way to reduce such feelings (Grubbs et al., 2017; Montgomery-Graham, 2017; Muench & Parsons, 2004).

Furthermore, the present results also demonstrated that LGBTQ men scored significantly higher than any other groups on the *Control* and *Consequences* dimensions. LGBTQ males had the lowest level of capability in controlling sexual urges and fantasies, and therefore, they experienced the negative consequences of their behavior most frequently. On the basis of previous preliminary findings (Muench & Parsons, 2004; Parsons, 2005; Parsons et al., 2008), it is possible that the easy accessibility, infinite variety, and arguably inexhaustible amount of LGBTQ sexual content on the Internet could contribute to the uncontrollable engagement in risky sexual activities. According to Parsons et al. (2008), LGBTQ-oriented sexual venues

and outlets (such as sex parties or sex Web sites) might make it easier for LGBTQ males at risk of developing hypersexuality to actually develop hypersexual behavior. They claim that the availability of sexual outlets functions similarly to the way in which higher incidences of problematic gambling appear in populations with elevated access to gambling opportunities (Volberg, 1994). However, it should be noted that heterosexual content is as available and accessible on the Internet as LGBTQ content. Therefore, this content can serve as a trigger for LGBTQ or heterosexual males and females who are also at risk of developing hypersexuality to actually developing hypersexuality.

From these findings, it can be concluded that LGBTQ men are a group most at risk of developing and maintaining hypersexual behavior. These results are in line with previous studies, suggesting that hypersexuality is more prevalent among men than women, and more prevalent among LGBTQ men than heterosexual men (e.g., Cooper et al., 2000; Kafka, 2010; Langström & Hanson, 2006; Missildine et al., 2005). Moreover, it is important to note that LGBTQ women are also a group at risk of engaging in sex or sex-related activities to cope with unwanted feelings and stress and that this behavioral pattern can lead to serious consequences but in the long-term.

According to the previous literature (e.g., Grubbs et al., 2017), in addition to the subjective indicators of hypersexuality (e.g., self-report scales), more objective indicators, but still self-reported measures of hypersexuality should be examined. More objective, but still self-reported indicators can be assessed by the number of sex partners, the frequency of having sex, masturbation, pornography viewing, cybersex, visiting strip clubs, and the duration of engagement in these activities (Grubbs et al., 2017; Kafka, 2010).

In the present study, the self-reported characteristics of sexual life were observed as more objective indicators of hypersexuality that demonstrated that LGBTQ males had the highest number of sexual partners and casual sexual partners in their lifetime. Moreover, they had the highest frequency of having sex with casual sex partners, masturbation, pornography viewing and they spent the most time with pornography viewing per session. Additionally, they had the lowest frequency of having sex with their significant other. These more objective (although still self-reported) indicators of hypersexuality might also imply that LGBTQ males are a group most at risk of developing hypersexuality because they had the least frequent sex in their relationship, but they were the most sexually active outside the relationship.

However, it should be noted that among LGBTQ males, that as well as monogamous relationships, monogamish and open relationships are also prevalent which can explain the higher frequency of casual partners. LGBTQ males in monogamish and open relationships are similarly satisfied with their relationship, and there are also no significant differences in other relationship qualities as well compared to LGBTQ males in monogamous relationships (Parsons, Starks, Garamel, & Grov, 2012; Rubel & Bogaert, 2015; Séguin et al., 2017; Whitton, Weitbrecht, & Kuryluk, 2015). Moreover, it should be taken into consideration that according to previous results (Parsons et al., 2013), there are more highly sexually active LGBTQ males without hypersexuality (approximately 80%) than highly sexually active LGBTQ males with hypersexuality (approximately 20%). Furthermore, according to a large-scale, comparison study of hypersexual men (i.e., Štulhofer, Jurin, & Briken, 2016), men with high sexual desire, and other participants, in some characteristics (e.g., frequency of masturbation and frequency of pornography use), there were no significant differences between hypersexual men and men with high sexual desire. However, in other characteristics of sexual life (e.g., frequency of sexual activity) men with high sexual desire had significantly higher scores than men with hypersexuality. Another study reported that hypersexuality was not related to the frequency of having sex with the partner in a sample of gay men (Starks et al., 2013). Therefore, the characteristics of sexual life (e.g., frequency of sexual activities or number of sexual partners) are not reliable indicators of hypersexuality without the negative affect and the consequences of the given behavior.

A possible reason for the high scores of hypersexuality among LGBTQ men could be that these men have to face more obstacles when dating and forming romantic relationships than heterosexuals; therefore, it is easier to them to masturbate, to access pornography, and/or to have casual relationships (Montgomery-Graham, 2017; Muench & Parsons, 2004). Another explanation could be related to the stereotypes, negative discrimination, and critiques LGBTQ men have to deal with in their everyday life. Consequently, they may consider sex-related activities as a coping strategy that provides fast, easily accessible, affordable, and anonymous ways of stress relief and negative emotion reduction (Cooper, 1998). Furthermore, it should also be noted that the frequency of different sexual activities or number of sexual partners per se are not reliable indicators of hypersexuality (Parsons et al., 2013; Štulhofer et al. 2016). This information should be viewed as complementary data alongside the scores on

hypersexuality measures because a wide range of variability in type and frequency of sexual activities can be considered healthy (e.g., Balon, Segraves, & Clayton, 2007; Winters, 2010).

In the literature, cognitive-behavioral therapy, acceptance and commitment therapy, experiential therapy, motivational interviewing, art therapy, mindfulness, relational therapy, peer support groups, or pharmacotherapy has been described as effective approaches to reduce the level of hypersexual disorder and its consequences (e.g., Franqué, Klein, & Briken, 2015; Grubbs et al., 2017; Stewart & Fedoroff, 2014; Van Gordon, Shonin & Griffiths, 2016). However, to the present authors' best knowledge, no previous research examined whether these psychotherapeutic techniques are similarly effective in different groups of individuals with hypersexual disorder. According to the findings of the present study, for LGBTQ individuals, more emphasis should be put on the promotion of other, more adaptive coping strategies, especially in the case of LGBTQ women, who had relatively higher scores on the Coping dimension than on the other ones. In previous studies (Hook et al., 2015; Reid, Bramen et al., 2014; Reid, Temko, Moghaddam, & Fong, 2014), individuals with HB reported lower levels of mindfulness, self-compassion, and self-forgiveness indicating that interventions focusing on mindfulness, self-compassion, and self-forgiveness-related coping strategies could contribute to more adaptive responses to stressful life events and, therefore, could lead to the reduction of HB (Grubbs et al., 2017; Van Gordon et al., 2016).

Despite the study being comprehensive and large-scale, it is important to note that the present study has some limitations. The study is a single, cross-sectional, non-representative survey. Due to the use of this methodology, causality cannot be inferred. Although anonymous data collection is beneficial in sexuality-related studies, considering the fact that anonymity could decrease stress and could result in more honest responses, participants were recruited online, where the real identity of the respondents can perhaps be questioned. The scales assessed self-reported ratings, which may distort the reality (e.g., individuals can perceive their behavior as problematic, even though there is no objective evidence for it being problematic). In future studies, the examination of problematic behaviors (e.g., problematic pornography use, Bőthe et al., 2018) instead of the frequency of the given activity might be beneficial. Although participants were aged between 18 and 76 years, the survey excluded those who did not use the Internet. It would be useful for non-Internet users to be surveyed in future

research. A further bias that could distort the results was the inclusion of asexual individuals in the LGBTQ group in the present study. Because asexuality is defined as the lack of sexual attraction (Bogaert, 2004), it is possible that the inclusion of asexual individuals might have decreased the levels of hypersexuality and sexuality-related variables (e.g., frequency of pornography viewing, number of sexual partners). However, the ratio of asexual individuals was very low (0.1%).

III/5. CONCLUSIONS

Hypersexuality is becoming a widely studied problematic behavior, but further research is needed to confirm and consolidate the existing findings in the field. According to previous reviews (Marshall & Briken, 2010; Montgomery-Graham, 2017; Stewart & Fedoroff, 2014) and the present findings, the Hypersexual Behavior Inventory can be reliably employed in diverse populations to assess the extent of hypersexuality. LGBTQ males are a group most at risk of developing hypersexual disorder, but it should be noted that LGBTQ females are also at risk of engaging in hypersexual activities most likely due to coping problems.

IV. THE DEVELOPMENT OF THE PROBLEMATIC PORNOGRAPHY CONSUMPTION SCALE (PPCS) (STUDY 3)[9]

ABSTRACT

To date, no short scale exists with strong psychometric properties that can assess problematic pornography consumption based on an overarching theoretical background. The goal of the present study was to develop a brief scale, the Problematic Pornography Consumption Scale (PPCS), based on Griffiths's (2005) six-component addiction model that can distinguish between nonproblematic and problematic pornography use. The PPCS was developed using an online sample of 772 respondents (390 females, 382 males; M_{age} = 22.56, *SD* = 4.98 years). Creation of items was based on previous problematic pornography use instruments and on the definitions of factors in Griffiths's model. A confirmatory factor analysis (CFA) was carried out—because the scale is based on a well-established theoretical model—leading to an 18-item second-order factor structure. The reliability of the PPCS was excellent, and measurement invariance was established. In the current sample, 3.6% of the users belonged to the at-risk group. Based on sensitivity and specificity analyses, we identified an optimal cutoff to distinguish between problematic and nonproblematic pornography users. The PPCS is a multidimensional scale of problematic pornography use with a strong theoretical basis that also has strong psychometric properties in terms of factor structure and reliability..

Keywords: behavioral addiction; pornography use; Problematic Pornography Consumption Scale (PPCS); psychometric assessment; scale development

[9]Bőthe, B., Tóth-Király, I., Zsila, Á., Griffiths, M. D., Demetrovics, Z., & Orosz, G. (2018). The development of the problematic pornography consumption scale (PPCS). *Journal of Sex Research, 55*(3), 395-406. doi: 10.1080/00224499.2017.1291798

IV/1. INTRODUCTION

Online pornography consumption is a widespread phenomenon (Edelman, 2009; Haggstrom-Nordin, Hanson, & Tydén, 2005; Hald & Mulya, 2013; Stulhofer, Busko, & Landripet, 2010). Pornography websites are among the top 50 most visited websites worldwide (Alexa. com, 2016; Similarweb.com, 2016), and more than 90% of adults have viewed pornography in their lives (Hald, 2006; Traeen et al., 2004). In 2016, one of the most popular pornography websites, Pornhub.com, reported that 4.599 billion hours of pornographic videos were watched worldwide. Their statistics also showed that the website was visited approximately 23 billion times, meaning that around 44,000 people visited the site every minute (Pornhub. com, 2017). In most cases, viewing is not problematic and appears to have little or no negative impact in a person's life. However, it can become problematic and can have negative effects, such as problems in romantic relationships or losing a job, as has been reported in previous studies (e.g., Bergner & Bridges, 2002; Bostwick & Bucci, 2008; Ford, Durtschi, & Franklin, 2012). In light of these numbers and findings, it appears to be important to have a multidimensional, theory-driven instrument with strong psychometric properties that can assess individual differences in online pornography use to distinguish between problematic and nonproblematic users and the potential negative consequences of pornography consumption on different groups.

Pornography may mean different things to both researchers and research participants. Therefore, a working definition of pornography is needed prior to assessment (Ayres & Haddock, 2009). However, according to a relatively recent review by Short et al. (2012), 84% of the scientific research studies into pornography either did not define pornography and/or did not report whether the research had provided a definition of pornography for their participants. Hald (2006) used a definition that includes the role of pornography in the creation or enhancement of sexual feelings and thoughts while genitals and/or sexual acts are explicitly shown. This definition was used and refined in later research (Hald & Malamuth, 2008; Reid, Li et al., 2011) and was employed in the present research. According to this definition, "pornography should be defined as material that (i) creates or elicits sexual feelings or thoughts and (ii) contains explicit exposure or descriptions of sexual acts involving the genitals, such as vaginal or anal intercourse, oral sex, or masturbation" (Reid, Li, et al., 2011, p. 364).

The assessment of problematic online pornography use is inconsistent, indicating that findings in the area are not comparable (Wéry & Billieux, 2017).

According to a recent systematic review (Short et al., 2012), 95% of researchers used scales and questions that were generated by the authors. Most of the preexisting psychometric scales did not have a strong theoretical underpinning, and they assessed only frequency of pornography use and/or time spent using it (e.g., Lam & Chan, 2007; Lo & Wei, 2005; Meerkerk, Eijnden, & Garretsen, 2006; Stack, Wasserman, & Kern, 2004; Traeen et al., 2004; Yoder et al., 2005). In the early 2000s, questionnaires and scales were created that included the topic of problematic online pornography use. However, these instruments mainly concentrated on wider concepts such as sexual addiction, cybersex, or the use of Internet for sexual purposes (e.g., Carnes & Wilson, 2002; Delmonico & Miller, 2003; Laier, Pawlikowski, Pekal, Schulte, & Brand, 2013). Furthermore, hypersexuality, compulsive pornography use, and compulsive sexual behavior were assessed using several different scales (e.g., Coleman et al., 2001; Noor, Rosser, & Erickson, 2014; Reid, Garos, & Carpenter, 2011; Womack et al., 2013), and only three instruments focused on the narrower concept of problematic pornography use. The nine-item Cyber Pornography Use Inventory (CPUI-9) was created on the basis of the CPUI-31; therefore, the psychometric properties and the factor structure of the CPUI-9 are the only ones taken into consideration here (Grubbs et al., 2010; Grubbs, Volk et al., 2015; Kor et al., 2014; Wéry & Billieux, 2017). The CPUI-9 (Grubbs et al., 2015) has three factors (compulsivity, effort, distress), and the Problematic Pornography Use Scale (PPUS; Kor et al., 2014) has four factors (distress and functional problems, excessive use, control difficulties, and use to escape/avoid negative emotions). Kor et al. (2014) integrated previous problematic pornography, Internet use, and hypersexual disorder questionnaires to identify these factors. However, as a result of the rather inductive research design, neither the CPUI nor the PPUS has a very strong theoretical background in contrast to other forms of behavioral addiction or problematic online behaviors. Furthermore, neither the CPUI nor PPUS included all of the potential dimensions of problematic pornography use (e.g., withdrawal or relapse). The present study aimed to fill this gap by using a deductive strategy and Griffiths's (2005) components model to assess problematic online pornography use because it has been used in the development of many psychometrically robust instruments assessing excessive problematic behavior, including social networking (Bányai et al., 2017), gaming (Lemmens, Valkenburg, & Peter, 2009), exercise (Terry, Szabo, & Griffiths, 2004), shopping (Andreassen et al., 2015), television series watching (Orosz, Bőthe, &

Tóth-Király, 2016), work (Andreassen, Griffiths, Hetland, & Pallesen, 2012), and use of Tinder (Orosz, Tóth-Király, Bőthe, & Melher, 2016).

Building on the previous problematic use conceptualizations and scales, the multidimensional Problematic Pornography Consumption Scale (PPCS) was developed on the theoretical basis of Griffiths's addiction components model (Griffiths, 2001, 2005). However, it is important to note that the PPCS was established to assess problematic pornography use, not addiction, because addiction cannot be assessed on the basis of self-report alone without an in-depth clinical interview (Ross et al., 2012). Accordingly, problematic pornography use included six core elements. The first element is *salience*, referring to the high importance of pornography in the person's life, such that it dominates his or her thinking, feelings, and behaviors. The second component refers to *mood modification* as a subjective experience that users report as a consequence of viewing pornography. This experience can be either arousing or relaxing depending on the desired emotional state. The third dimension is *conflict*, including interpersonal conflicts between problematic users and their significant others, occupational or educational conflicts (depending upon the individual's age), and intrapsychic conflicts (e.g., knowing the activity is causing problems but feeling unable to cut down or cease). The fourth dimension is *tolerance* and refers to the process whereby increasing amounts of the activity are required to achieve the same mood-modifying effects. In the present study, similarly to other arousal behavioral addictions, the quantitative and qualitative aspects of tolerance were our focus. The quantitative dimension refers to the growing amount of pornography use over time, whereas the qualitative aspect refers to consuming more diverse and extreme pornographic content. According to Zimbardo and Duncan (2012), this qualitative aspect of arousal-based behavioral addictions is related to seeking constantly novel and surprising content. In the case of pornography this can be related to moving from soft-core pornography toward its more extreme, hard-core forms. The fifth dimension is related to *relapse* and is the tendency for repeated reversions to earlier patterns of pornography use and returning to it quickly after abstinence or control. The sixth factor is *withdrawal*, referring to unpleasant feelings and emotional states that occur when the particular activity is discontinued or suddenly reduced.

As withdrawal and tolerance are usually understood as a consequence of "dependence" (O'Brien, Volkow, & Li, 2006), addiction is a broader construct involving all six components described, in line with diagnostic addiction criteria

employed in modern psychiatric nosology (American Psychiatric Association, 2013; World Health Organization, 1992). As dependence and addiction are usually viewed as different constructs, the frequency of pornography use and time spent engaging in the activity alone cannot be considered as a satisfactory definition of pornography addiction. It is probable that some individuals visit online pornography websites on a very regular basis, but they can stop the activity when it is necessary and they experience few, if any, negative or detrimental effects (Kor et al., 2014). Recent research has confirmed this, because the relationship between the frequency and duration of pornography use and problematic behavior itself is positive but only moderate (e.g., Brand et al., 2011; Grubbs et al., 2015; Twohig, Crosby, & Cox, 2009). Addiction and problematic use are overlapping concepts along the same continuum. However, it is more appropriate to use the term *problematic use* instead of *addiction*, when clinical evidence of an actual addiction cannot be provided with the use of self-reported data (Ross et al., 2012).

Considering (a) the pervasive presence of pornography use, (b) the lack of a strongly theory-driven psychometric scale regarding problematic pornography use, and (c) the lack of potentially important components of problematic pornography use in previous instruments, the goal of the present study was to create a comprehensive psychometric scale that addresses the weakness of previous instruments. Consequently, the aim of the present study was to develop a short, valid, reliable, multidimensional scale that encompasses the most important aspects of problematic pornography use based on the most extensively tested model of behavioral addictions and problematic online behaviors.

IV/2. METHOD

IV/2.1. Participant and Procedure

Declaration of Helsinki and with the approval of the institutional review board of the research team's university. The research was conducted via an online questionnaire, and completing it took approximately 15 minutes. Data collection occurred in June 2016 on a public, topic-irrelevant Facebook page that has approximately 217,000 members. Therefore, the collected data were not representative of the population of Hungary. Before starting the questionnaire, participants received detailed information about the study. Subsequently, participants read and approved the informed consent, and they also had to indicate that they were 18 years or older.

A total of 1,102 participants were recruited for this research using this online sampling method. Before the analyses, the data were screened and participants were removed for the following reasons: They did not wish to participate in this study (37 individuals); they were underage (30 participants); or they had the same answer to every questionnaire item (15 individuals). In addition, those individuals were also excluded who indicated that they had not used pornography in the past six months (248 individuals).

Therefore, a total of 772 participants (females = 390, 50.5%; males = 382, 45.5%) were retained for further analyses who were between ages 18 and 54 (M_{age} = 22.58, SD_{age} = 4.89). Of these participants, 279 lived in a capital city (36.1%), 89 in county towns (11.5%), 286 in towns (37.0%), and 118 in villages (15.3%). Regarding their level of education, 91 had a primary school degree (11.8%), 532 had a high school degree (68.9%), and 149 of them had a degree in higher education (i.e., bachelor's, master's, or doctorate) (19.3%). Regarding their relationship status, 394 were single (51.0%), 360 were in a relationship (46.6%), and 18 were married (2.3%). Regarding sexual orientation, 621 respondents were heterosexual (80.4%), 82 were heterosexual with homosexuality to some extent (10.6%), 37 were bisexual (4.8%), 10 were homosexual with heterosexuality to some extent (1.3%), 13 were homosexual (1.7%), two were asexual (0.3%), and seven were unsure about their sexual orientation (0.9%). In the past six months, the average frequency of viewing online pornographic videos was weekly, and the average time spent viewing pornography per occasion was 16 to 30 minutes.

IV/2.2. Measures

Problematic Pornography Consumption Scale. To match Griffiths's (2005) components, the definitions of each component were taken into account. Following this, previous pornography addiction items were considered as potential items in the new instrument (i.e., Grubbs et al., 2010; Kor et al., 2014). However, the strategy of pooling the preexisting items and analyzing them was not chosen, because the available items (i.e., Grubbs et al., 2010; Grubbs et al., 2015; Kor et al., 2014) did not include two important components (withdrawal and relapse) and other components were also underrepresented. Finally, to have similar wording to other specific and psychometrically robust problematic behavior scales (e.g., Andreassen et al., 2012; Orosz, Bőthe, et al., 2016, Orosz, Tóth-Király, et al., 2016), the items of these scales

were considered as a basis of the items of the PPCS. On the basis of these guidelines, a focus group of psychologists (two men and two women, M_{age} = 27.5 years, SD_{age} = 4.65) created four items per component. To minimize group decision-making biases, an iterative approach was applied. Members first discussed their thoughts in pairs and then in the focus group. Each item had to be (a) close to the everyday language used when talking about pornography; (b) easy to understand; (c) concise; (d) clearly belonging to the given dimension but not to the others; (e) not double-barreled; (h) not suggestive; and (i) adjusted to the scaling. To include items that matched Griffiths's (2005) components, no previous items from alternative problematic pornography instruments remained unchanged. In addition, no previous items in the Griffiths's model kept the original wording because the subject of the items was replaced with the word *porn*, but all other content in the items remained the same. After the focus group created the items, two experts in the addictive behavior field refined the items. In the final step of item creation, six individuals (young men and women, not psychologists) pretested the items to determine whether they were understandable and close to everyday language use. The final items of the PPCS can be seen in the appendix.

UCLA Loneliness Scale Version Three. The Revised UCLA Loneliness scale (Russell, 1996) includes 20 items (nine items are reverse-coded) and assesses feelings of social isolation, lack of connectedness, and subjective feelings of loneliness (e.g., "How often do you feel that you are no longer close to anyone?"). In the present study, a pretested shortened version of eight items—including reverse-coded items as well—with acceptable validity was used (comparative fix index [CFI] = .973; Tucker-Lewis index [TLI] = .962; root mean square error of approximation [RMSEA] = .074 [90% confidence interval (CI) = .060 to .089]) and reliability (α = .90) (Bőthe, 2016). Respondents rated each item on a 4-point scale (1 = *Never*; 4 = *Always*). Higher scores on the scale indicate higher levels of loneliness-related feelings (α = .91).

Sexuality- and Pornography-Related General Questions. In addition to standard demographic variables, some topic-relevant questions were asked. Sexual satisfaction was asked with one item: "In general how satisfied with your sexual life?" (5-point Likert scale, 1 = *Not satisfied*; 5= *Very satisfied*). Frequency of masturbation was asked with one item: "How often do you masturbate?" (9-point Likert scale, 1 = *Never*; 9 = *Several times a day*). In addition, they were asked: "How often do you watch pornography when you masturbate?" (5-point Likert scale, 1 = *Never*; 5= *Very often*). Respondents were also asked about the age of their first sexual and pornographic

experience. Finally, they were asked about the frequency of reading sexuality-related online stories, viewing pictures, and watching videos (9- point Likert scale, 1 = *Never*; 9 = *Several times a day*).

IV/2.3. Statistical Analysis

For the statistical analysis, SPSS 21 and Mplus 7.3 (Muthén & Muthén, 1998–2012) were used. The initial version of the PPCS comprised 24 items. Each of these items was examined based on three criteria (Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013): (a) corrected item-total correlations, (b) skewness and kurtosis values for normality, and (c) content validity compared to other items and the definitions of each problematic use dimension.

After the item selection, confirmatory factor analysis (CFA) was used to assess the dimensionality of the scale. Because the items had severe floor effects in terms of skewness and kurtosis, they were treated as categorical indicators, and the mean- and variance adjusted weighted least squares estimator (WLSMV) was used (Finney & DiStefano, 2006). In the structural assessment, commonly used goodness of fit indices (Brown, 2015; Kline, 2011) were observed with their acceptable or good cutoff values (Bentler, 1990; Brown, 2015; Browne & Cudeck, 1993; Hu & Bentler, 1999; Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2013): the CFI (≥ .95 for good, ≥ .90 for acceptable), the TLI (≥ .95 for good, ≥ .90 for acceptable), and the RMSEA (≤ .06 for good, ≤ .08 for acceptable) with a 90% CI. Reliability was assessed using Cronbach's alpha (Nunnally, 1978).

To test structural invariance between gender groups (male versus female), several multigroup CFAs were carried out (Meredith, 1993; Vandenberg, 2002; Vandenberg & Lance, 2000). First, the models were estimated freely for both male and female subgroups. Second, four nested models with increasingly constrained parameters were estimated: (a) factor loadings and thresholds were freely estimated (configural invariance), (b) factor loadings were set to be equal (metric invariance), (c) factor loadings and thresholds were set to be equal (scalar invariance), and (d) factor loadings, thresholds, and residual variances were constrained to be equal (residual invariance). Achieving this latter level of invariance is a prerequisite to group-based comparisons based on aggregated manifest scores. When comparing the increasingly constrained models, relative change in fit indices was observed (Chen, 2007; Cheung & Rensvold, 2002; Marsh et al., 2009): $\Delta CFI \leq .010$; $\Delta TLI \leq .010$; $\Delta RMSEA \leq .015$.

To identify possible groups of pornography users whose activity could be considered problematic, latent profile analysis (LPA) was used. LPA is a person-centered mixture modeling technique that can classify subgroups of people who gave similar responses to the six dimensions (Collins & Lanza, 2010). The analysis was performed with two to four classes on the full sample. To determine the number of latent classes, several indices were used: the Akaike information criterion (AIC), the Bayesian information criterion (BIC), and the sample-size-adjusted Bayesian information criterion (SSABIC), where lower values indicate more parsimonious models. Entropy was also examined, indicating the accuracy of the classification process. Higher values indicate higher accuracy, with .40 being low, .60 being medium, and .80 being high entropy (Clark & Muthén, 2009). Finally, the Lo-Mendell-Rubin adjusted likelihood ratio test (L-M-R test) was also used, which compares the estimated model (e.g., three classes) with a model having one less class (e.g., two classes). A statistically significant p value ($p < .05$) suggests that the model with more classes fits the data better (Muthén & Muthén, 1998– 2012). These groups were then compared along several key variables with analysis of variance (ANOVA) and the Bonferroni post hoc test.

To determine the cutoff point for the PPCS, a sensitivity analysis was carried out based on membership in the at-risk group in the LPA. Considering the membership in this group as a gold standard, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy values for all PPCS cutoff points were calculated. Sensitivity was defined as the proportion of true positives belonging to the most problematic group based on the LPA, while specificity was defined as the proportion of the true negatives (Altman & Bland, 1994a; Glaros & Kline, 1988). Positive predictive value was defined as the proportion of the individuals with positive test results correctly diagnosed as problematic users, while negative predictive value was defined as the proportion of participants with negative test results correctly diagnosed as nonproblematic users (Altman & Bland, 1994b; Glaros & Kline, 1988).

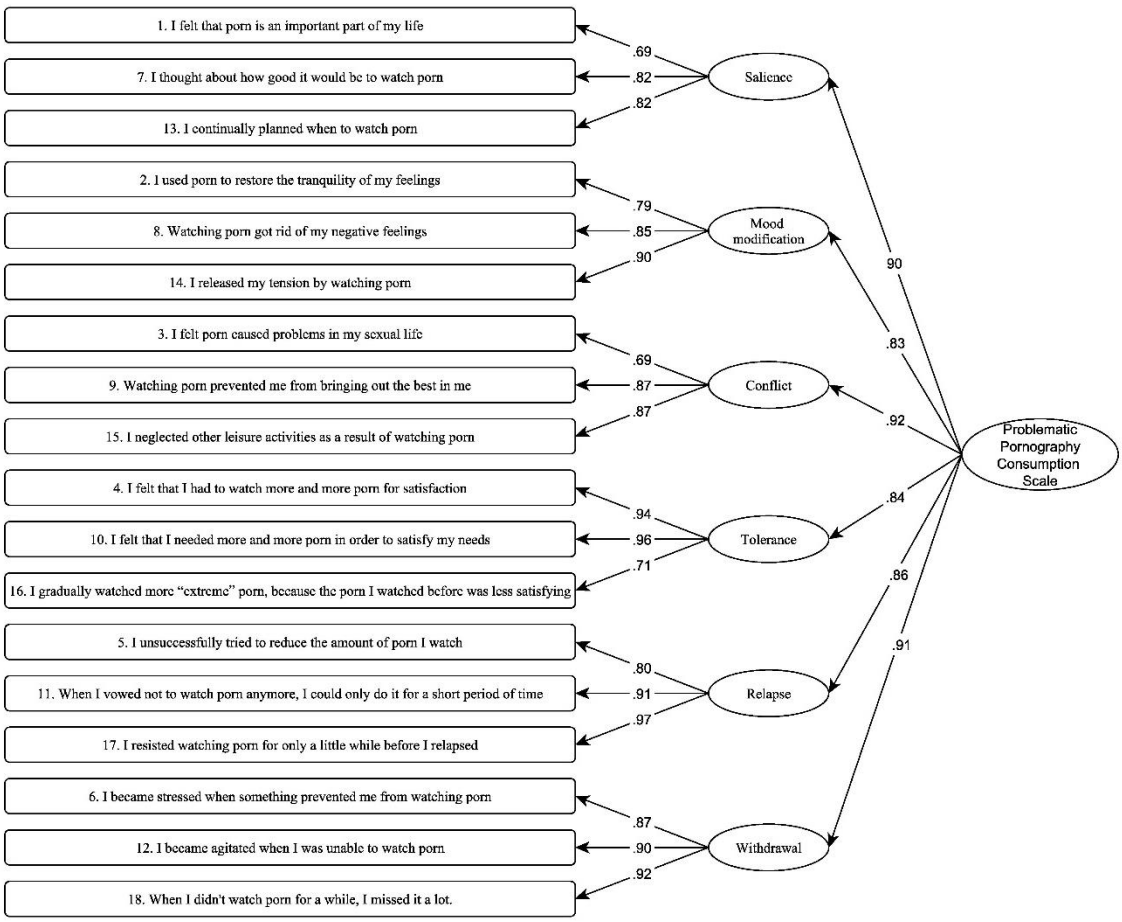
IV/3. RESULTS

IV/3.1. Dimensionality and Structural Validity

In the first part of the analysis, each of the initial 24 items were examined based on (a) their corrected item-total correlations, (b) normality in terms of skewness and kurtosis, and (c) content validity compared to the other items and pornography viewing

in general. Three items per factor were chosen in order to have a concise and non-repetitive item set. The final items were chosen as a result of high item-total correlation and relatively low kurtosis and skewness values. Furthermore, the aim was to keep the diversity of wording.

Next, CFA was performed on the selected items due to the well-established theoretical model. The CFA results showed that the theory-based hierarchical model with six factors and a superordinated problematic use dimension (CFI = .977, TLI = .973, RMSEA = .064 [90% CI .059 to .070]) had adequate fit. Factor loadings were high (ranging from .69 to .96), and the six components loaded strongly on the general factor (ranging from .83 to .92) (see Figure 1). This 18-item, six-factor model provides the opportunity to investigate the role of each factor in the development and maintenance of problematic use.



IV/Figure 1. The factor structure of the Problematic Pornography Consumption Scale (PPCS). *Note*. Standardized loadings are indicated on the arrows. All loadings are significant at $p < .001$.

IV/3.2. Measurement Invariance

To ensure that group-based comparisons are meaningful, measurement invariance was employed to examine the factor structure of the scale across two subgroups. The results of the invariance analysis are shown in IV/Table 1. In step zero, the baseline models were estimated for both males and females, showing good fit. Then, parameters were gradually constrained and changes in fit indices were observed. In the configural model (model 1), all parameters were freely estimated and the fit indices were within the range of acceptability (CFI = .975, TLI = .970, RMSEA = .065 [90% CI .059 to .071]). In the metric model (model 2), factor loadings were constrained to be equal, resulting in negligible differences in fit indices (ΔCFI = −.002; ΔTLI = .000; ΔRMSEA = .000). In the scalar invariance model (model 3), factor loadings and thresholds were set to be equal in both groups, again showing adequacy in terms of fit index changes (ΔCFI = .001; ΔTLI = .008; ΔRMSEA = −.009). In the last step, strict invariance model (model 4), residual variances were constrained to be equal, and there was no significant deterioration of fit indices compared to the preceding model (ΔCFI = .003; ΔTLI = .003; ΔRMSEA = −.005). Fit indices incorporating a control for parsimony (TLI and RMSEA) even resulted in improvements when equality constraints were added, supporting the comparability of the PPCS across gender groups.

IV/3.3. Gender Differences and Correlates

The descriptive statistics of the PPCS are shown in IV/Table 2. PPCS scores weakly correlated with the time spent viewing pornography per occasion (r (770)=.14, p < .01). PPCS correlated with the frequency of reading online pornographic stories (r(770)=.13, p < .01), online pornography picture viewing (r(770)=.27, p < .01), and online pornography video viewing (r(770)=.47, p < .01). The frequency of masturbation positively correlated with PPCS scores (r(770)=.38, p < .01), and the frequency of pornography consumption during masturbation also positively related with PPCS scores (r(770)=.27, p < .01). Satisfaction with sexual life was weakly and negatively correlated with PPCS scores (r(372)=-.22, p < .01). One-way ANOVA was used to assess differences in sexual orientation regarding the five larger groups (excluding asexual and unsure respondents as a result of low proportion N_{sum}=8). According to the results, no differences in PPCS scores were found regarding sexual orientation. However, gender differences were found, as women (M_{female}=1.66, SD_{female}=0.87) had lower scores [t(729.77) = 8.52, p < .01] than men (M_{male}=2.26, SD_{male}=1.07).

IV/Table 1. Tests of gender invariance on the Problematic Pornography Consumption Scale

Model	WLSMV χ^2	df	CFI	TLI	RMSEA	90% CI	Model comparison	ΔCFI	ΔTLI	ΔRMSEA
Baseline male	395.016*	129	.983	.979	.055					
Baseline female	286.645*	129	.981	.977	.057					
M1: configural	679.104*	258	.975	.970	.065	.059-.071				
M2: metric (weak)	718.544*	270	.973	.970	.065	.060-.071	M2-M1	-.002	.000	.000
M3: scalar (strong)	786.415*	354	.974	.978	.056	.051-.062	M3-M2	+.001	+.008	-.009
M4: residual (strict)	750.792*	372	.977	.981	.051	.046-.057	M4-M3	+.003	+.003	-.005

Note. WLSMV = WLSMV = weighted least squares mean- and variance-adjusted estimator; χ^2 = Chi-square; df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root-mean-square error of approximation; 90% CI = 90% confidence interval of the RMSEA; ΔCFI = change in CFI value compared to the preceding model; ΔTLI = change in the TLI value compared to the preceding model; ΔRMSEA = change in the RMSEA value compared to the preceding model; $p < .001$.

IV/Table 2. Descriptive statistics, reliability indices and inter-factor correlation between the dimensions of the Problematic Pornography Consumption Scale

Scales	α	Skewness (SD)	Kurtosis (SD)	Range	M	SD	1	2	3	4	5	6
1. PPCS total	.93	1.70 (0.09)	3.10 (0.18)	1-7	1.95	1.02	—					
2. Salience	.77	0.77 (0.09)	-0.12 (0.18)	1-7	2.71	1.47	.81*	—				
3. Mood modification	.84	1.32 (0.09)	1.11 (0.18)	1-7	2.26	1.48	.81*	.61*	—			
4. Conflict	.71	3.40 (0.09)	14.30 (0.18)	1-7	1.35	0.80	.73*	.45*	.53*	—		
5. Tolerance	.78	2.20 (0.09)	5.20 (0.18)	1-7	1.77	1.20	.78*	.53*	.51*	.56*	—	
6. Relapse	.86	2.16 (0.09)	4.10 (0.18)	1-7	1.70	1.28	.78*	.49*	-.50*	.63*	.60*	—
7. Withdrawal	.86	1.83 (0.09)	2.77 (0.18)	1-7	1.93	1.41	-.85*	-.69*	-.63*	-.51*	-.58*	-.59*

Note. PPCS = Problematic Pornography Consumption Scale; α = Cronbach's alpha; M = mean; SD = standard deviation. * $p < .001$.

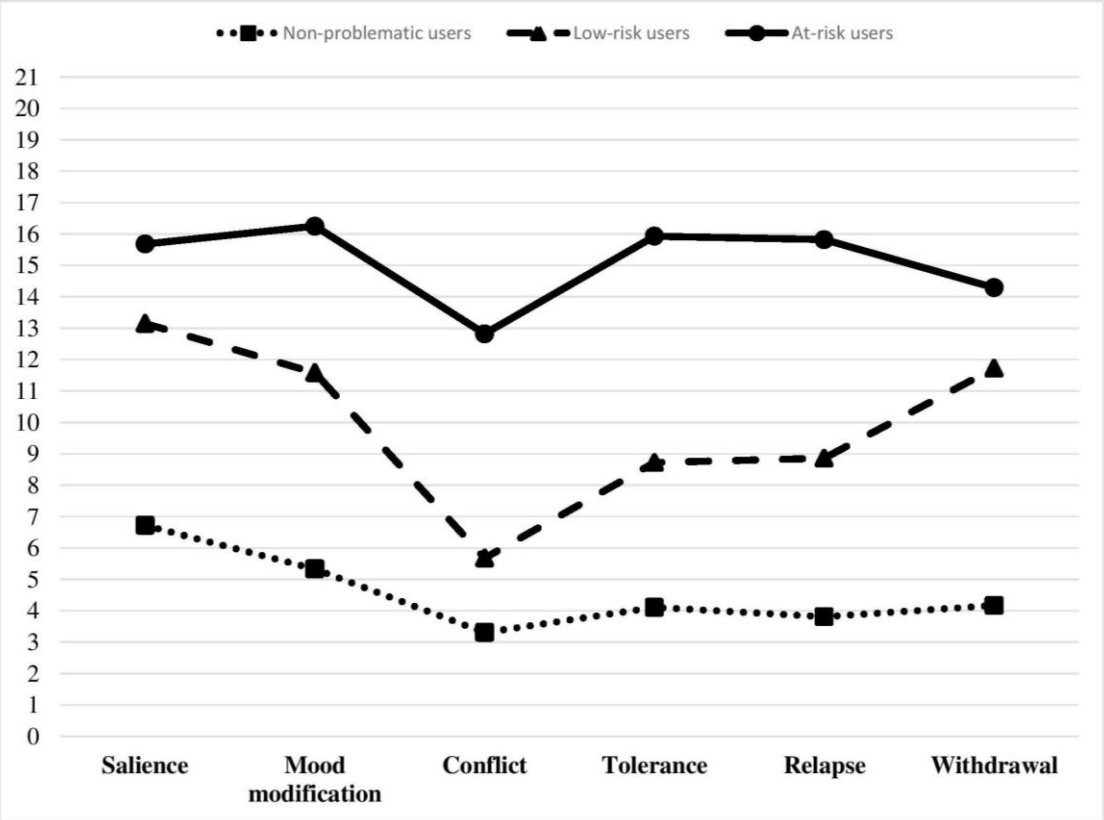
IV/3.4. Latent Profile Analysis

LPA was performed on the six PPCS factors. The AIC, BIC, and SSABIC values continuously decreased as more latent classes were added. Regarding entropy, all solutions had high levels of accuracy. The nonsignificant p value of the L-M-R test suggested that the four-class solution should be rejected in favor of the three-class solution (see IV/Table 3). Based on these criteria, the three-class solution was selected. The three latent classes with their respective relationship patterns are shown in Figure 2. The first class represented nonproblematic pornography users (614 individuals, 79.5%). The second class represented low-risk pornography users (130 individuals, 16.8%). The third class represented at-risk pornography users (28 individuals, 3.6%). The three latent classes and their characteristics can be seen in IV/Table 4.

IV/Table 3. Fit indices for the latent profile analysis on the Problematic Pornography Consumption Scale

Classes	AIC	BIC	SSABIC	Entropy	L-M-R Test	*p*
2	23343	23432	23371	.961	1999	< .001
3	**22720**	**22841**	**22758**	**.964**	**624**	**.006**
4	22364	22518	22413	.943	361	.104

Note. Classes = number of latent classes; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SSABIC = Sample-Size Adjusted Bayesian Information Criterion; L-M-R test = The Lo-Mendell-Rubin Adjusted Likelihood Ratio Test; *p* = *p* value associated with the L-M-R Test. Bold letters indicate that the three-class solution was selected as the final model.



IV/Figure 2. Latent classes based on the dimensions of the Problematic Pornography Consumption Scale.

IV/Table 4. Comparison of the three latent classes based on the Problematic Pornography Consumption Scale (PPCS)

	Range	(a) Non-problematic users (N = 614)	(b) Low-risk users (N = 130)	(c) At-risk users (N = 28)	ANOVA	
					F	*p*
PPCS	1-7	1.52 (0.43) $_{b\,c}$	3.32 (0.58) $_{a\,c}$	5.04 (0.83) $_{a\,b}$	1369.22	< .001
Time spent with pornography	1-6[đ]	2.82 (0.94) $_{b\,\dagger}$	3.10 (1.00) $_{a}$	3.21 (1.03) $_{\dagger}$	6.32	< .002
Frequency of pornography viewing	0-8[#]	4.47 (1.94) $_{b\,c}$	6.09 (1.46) $_{a}$	6.36 (1.66) $_{a}$	50.47	< .001
Loneliness	1-4	2.10 (0.71) $_{b\,c}$	2.38 (0.73) $_{a\,\dagger}$	2.70 (0.67) $_{a\,\dagger}$	16.64	< .001

Note. PPCS = Problematic Pornography Consumption Scale; subscript letters indicate mean differences between the classes; # = 0: never; 1: a few times a year; 2: every few months; 3: monthly; 4: half-monthly; 5: weekly; 6: more than once a week; 7: daily; 8: more than once a day; * = 1: less than 5 minutes; 2: 5 to 15 minutes; 3: 16 to 30 minutes; 4: 31 to 60 minutes; 5: 1 to 2 hours; 6: more than 2 hours; † = this difference was only a trend, $p < .10$.

IV/3.5. Determination of a Potential Cutoff Score to Be Classified as a Problematic Pornography User: Sensitivity and Specificity Analysis

Based on the membership in the third class (i.e., at-risk group) as a gold standard, the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the accuracy of the PPCS at all possible cutoff points was calculated (IV/Table 5). Based on this analysis, a cutoff score of 76 points was suggested as an optimal cutoff to be classified as problematic pornography user. In this case, sensitivity was 93%, while specificity was 99%. This means that practically 1% of the negative (i.e., nonproblematic) cases were considered problematic, while 7% of the true problematic cases were not recognized. At this value, PPV was 70% and NPV was 100%. This means that 30% of the individuals with a positive test result were identified mistakenly, while all individuals with negative test results were identified correctly. The accuracy of the PPCS was 98%. Increasing the cutoff score would lead to more false negative cases (i.e., problematic pornography users mistakenly diagnosed as nonproblematic users), while decreasing the cutoff score would have resulted in more false-positive cases (i.e., nonproblematic users mistakenly diagnosed as problematic pornography users).

IV/Table 5. Calculation of cut-off thresholds for PPCS

cut-off score	true positive	true negative	false positive	false negative	sensitivity (%)	specificity (%)	PPV (%)	NPV (%)	accuracy (%)
69	27	716	28	1	96.4	96.5	49.1	99.9	96.2
70	26	721	23	2	92.9	96.9	53.1	99.7	96.8
71	26	723	21	2	92.9	97.2	55.3	99.7	97.0
72	26	726	18	2	92.9	97.6	59.1	99.7	97.4
73	26	729	15	2	92.9	98.0	63.4	99.7	97.8
74	26	729	15	2	92.9	98.0	63.4	99.7	97.8
75	26	730	14	2	92.9	98.1	65.0	99.7	97.9
76	**26**	**733**	**11**	**2**	**92.9**	**98.5**	**70.3**	**99.7**	**98.3**
77	24	734	10	4	85.7	98.7	70.6	99.5	98.2
78	24	735	9	4	85.7	98.8	72.7	99.5	98.3
79	23	736	8	5	82.1	98.9	74.2	99.3	98.3
80	23	737	7	5	82.1	99.1	76.7	99.3	98.4
81	22	737	7	6	78.6	99.1	75.9	99.2	98.3
82	19	737	7	9	67.9	99.1	73.1	98.8	97.9

Note. The bolded row indicates the suggested cut-off threshold.

IV/4. DISCUSSION

The present study aimed to develop a problematic pornography consumption scale that is strongly based on theory alongside robust psychometric properties. Previous scales assessing problematic pornography use either did not have very strong psychometric properties or they had acceptable model fit, but the content of the factors raised theoretical questions (Grubbs et al., 2015; Kor et al., 2014). As seen from our results, based on theory (Griffiths, 2001, 2005), the PPCS had good factor structure and reliability. This six factor, second-order model provides the opportunity for future research to compare the role of each component in various theoretical frameworks such as obsessive versus harmonious passion toward pornography use (Vallerand, 2015), reward deficiency syndrome (Blum, Cull, Braverman, & Comings, 1996), or motivations regarding pornography use (Reid, Li, et al., 2011).

High levels of invariance (Meredith, 1993; Vandenberg, 2002; Vandenberg & Lance, 2000) were demonstrated across groups formed on the basis of gender (invariance of factor loadings, thresholds, and residual variances). The PPCS has strong psychometric properties in terms of factor structure, reliability, and model invariance. According to the latent class analysis, three groups could be reliably distinguished: a nonproblematic group, a low-risk group, and an at-risk group. No differences were found regarding sexual orientation. Similar to previous studies, males had higher scores on the PPCS than females (Haggstrom-Nordin et al., 2005; Svedin, Akerman, & Priebe, 2011; Traeen et al., 2006).

According to the descriptive statistics, the average participant in the present study viewed pornography-related videos weekly, and he or she spent 16 to 30 minutes viewing pornographic material on each occasion. PPCS scores were weakly related to the time spent viewing pornography but moderately related to the frequency of viewing pornographic videos. As both time and frequency were asked as categorical variables, it is difficult to calculate a composite score including both. However, the present results suggest that problematic pornography use is more related to the frequency of viewing pornographic videos than the time spent engaged on each occasion. Despite the fact that frequent use of pornography is an essential part of problematic pornography use, frequency alone cannot be considered a satisfactory definition of this phenomenon. It is possible that individuals visit online pornography websites on a regular basis, but they can stop this activity when it is necessary (Kor et al., 2014). Recent research has confirmed this notion, because the relationship between the frequency and duration of

use and problematic behavior itself is positive but only moderate (e.g., Brand et al., 2011; Grubbs et al., 2015; Twohig et al., 2009). Therefore, labeling people as problematic pornography users based only on the duration or the frequency of their pornography consumption is not appropriate.

Furthermore, regarding the form of the pornographic material, the frequency of pornographic video viewing was more strongly related to PPCS scores than viewing pornographic pictures or reading pornographic stories and thus in accordance with previous results (Brand et al., 2011). The frequency of masturbation was also moderately related to problematic pornography use. The strength of this relationship appeared to be even stronger than the association between PPCS scores and the frequency of viewing pornography during masturbation. In line with previous results (e.g., Reid, Li, et al., 2011; Reid et al., 2012; Womack et al., 2013), the present results also highlight the relevance of hypersexuality in problematic pornography consumption. More specifically, a high level of sexual behavior might be a precursor of problematic pornography use, and it is assumed that both problematic pornography use and frequent masturbation are both consequences of hypersexuality. Therefore, problematic pornography use can appear under the umbrella of hypersexuality similarly to frequent masturbation, going to strip clubs, and engaging in phone sex and various forms of cybersex (Kafka, 2010).

Based on LPA, three severity groups of users were identified. Almost 4% of the sample belonged to the at-risk group. These individuals had high scores on each PPCS component. However, it is important to note that all three groups had relatively lower scores on the conflict component. Arguably, problematic pornography use is not as visible as other forms of problematic behaviors or addictions (such as substance abuse or drinking alcohol). Therefore, the interpersonal conflicts are not as prevalent as in the case of other potentially addictive behaviors. Despite the fact that the at-risk group viewed pornography more frequently and spent more time engaging in it on each occasion, the differences between the low-risk and at-risk groups were only trends.

Finally, sensitivity and specificity analyses revealed an optimal cutoff of 76 points for diagnosing problematic pornography use with the PPCS. However, future studies should further validate this cutoff in a clinical sample to consolidate the present findings. Also, it is important to note that the use of scales is limited when employed as an early diagnostic indicator, because only clinically based interview studies are

appropriate to diagnose that a specific behavior is truly problematic or pathological for a given individual (Maraz et al., 2015).

The present study was not without limitations. This was a self-selected, self-report, questionnaire-based, cross-sectional study that is prone to bias. Furthermore, a longitudinal design would be most useful in examining how potential life events could affect an individual's problematic pornography use. Although the sample was diverse and the gender ratio was good, it was not representative, which limits the generalization of the results. Therefore, future studies— similarly to Hald (2006), Luder et al. (2011), and Traeen et al. (2004)—should use representative samples. Regarding the PPCS, the results were based on a correlational design that does not make it possible to infer causality. Further research is needed to examine its temporal stability, as well as convergent, divergent, and predictive validity in different cultures. In terms of clinical practice, prevalence and incidence should be investigated. It would also be useful to examine the relationship patterns between hypersexuality, compulsive behavior, and problematic pornography. Further research is also needed to explore whether problematic pornography use and other problematic online behaviors have the same roots. It is possible that these online behaviors have very similar negative consequences.

IV/5. CONCLUSIONS

The Problematic Pornography Consumption Scale is based on a solid theoretical framework of addictions, specifically Griffiths's six-component model (2005), and it has strong psychometric properties in terms of factor structure, reliability, and model invariance. Latent profile analysis identified almost 4% of the sample as at-risk pornography users. However, further clinical investigation and validation are needed to assess the extent of problems related to pornography use. Further cross-cultural research should focus on the characteristics of low- and at-risk groups and identifying potential pathways that lead to problematic pornography use to establish potential risk factors and protective factors that can be utilized in prevention and intervention programs.

V. REVISITING THE ROLE OF IMPULSIVITY AND COMPULSIVITY IN PROBLEMATIC SEXUAL BEHAVIORS (STUDY 4)[10]

ABSTRACT

Impulsivity and compulsivity are transdiagnostic features associated with clinically relevant aspects of psychiatric disorders, including addictions. However, little research has investigated how impulsivity and compulsivity relate to hypersexuality and problematic pornography use. Thus, the aims of the present study were to investigate (a) self-reported impulsivity and compulsivity with respect to hypersexuality and problematic pornography use and (b) the similarities and possible differences between hypersexuality and problematic pornography use in these domains. Utilizing structural equation modeling (SEM) in a large community sample (N = 13,778 participants; female = 4,151, 30.1%), results indicated that impulsivity (β = .28, β = .26) and compulsivity (β = .23, β = .14) were weakly related to problematic pornography use among men and women, respectively. Impulsivity had a stronger relationship (β = .41, β = .42) with hypersexuality than did compulsivity (β = .21, β = .16) among men and women, respectively. Consequently, impulsivity and compulsivity may not contribute as substantially to problematic pornography use as some scholars have proposed. On the other hand, impulsivity might have a more prominent role in hypersexuality than in problematic pornography use. Future research should examine further social and situational factors associated with problematic pornography use.

Keywords: behavioral addiction, compulsivity, hypersexuality, impulsivity, problematic pornography use

[10]Bőthe, B., Tóth-Király, I., Potenza, M. N., Griffiths, M. D., Orosz, G., & Demetrovics, Z. (2018). Revisiting the role of impulsivity and compulsivity in problematic sexual behaviors. *Journal of Sex Research*, 1-14. doi: 10.1080/00224499.2018.1480744

V/1. INTRODUCTION

Online pornography has become more anonymous, accessible, and affordable over time. One popular pornography Web site's statistics reported approximately 81 million visitors per day and approximately 28.5 billion visits in 2017 (Pornhub.com, 2018). In most cases, pornography viewing is not problematic. However, for some viewers, pornography use may become problematic (estimated at approximately 3.6% of pornography users; Bőthe, Tóth-Király, Zsila, et al., 2018) and negatively impact functioning by generating impairments in romantic relationships, meeting obligations, and/or achieving other goals (Kraus, Meshberg-Cohen, Martino, Quinones, & Potenza, 2015; Twohig, Crosby, & Cox, 2009). According to recent case studies (Bostwick & Bucci, 2008; Kraus, Meshberg-Cohen et al., 2015), difficulties in controlling urges to engage in pornography use, a feature which may involve impulsive and compulsive tendencies, may represent a strong obstacle for people to overcome when attempting to reduce problematic pornography use. Problematic pornography use may represent a prominent manifestation of hypersexuality (also referred to as *sexual compulsivity*, *sexual addiction*, or *excessive sexual behavior* in the literature; Kafka, 2010; Karila et al., 2014; Wéry & Billieux, 2017) because in several studies more than 80% of people with hypersexuality have reported excessive/problematic pornography use (Kafka, 2010; Reid et al., 2012). An improved understanding of the similarities and possible differences between problematic pornography use and hypersexuality may help with respect to developing improved interventions. Because both impulsivity and compulsivity have been highly associated with non-substance-related addictive behaviors such as gambling (American Psychiatric Association, 2013; el-Guebaly, Mudry, Zohar, Tavares, & Potenza, 2012; Leeman & Potenza, 2012; World Health Organization, 2017), questions have arisen regarding the extent to which these features may be associated with problematic pornography use and hypersexuality. The aim of the present study was, for the first time, to simultaneously examine the relationships between the two transdiagnostic measures of self-reported impulsivity and compulsivity and specific forms of problematic sexual behaviors (i.e., problematic pornography consumption and hypersexuality).

V/1.1. The Proposed Obsessive-Compulsive Spectrum Model as Related to Problematic Sexual Behaviors

Over two decades ago, an obsessive-compulsive spectrum model was proposed (Hollander, 1993; Hollander & Wong, 1995) with the conceptualization that different addictions could be juxtaposed on a continuum or spectrum. Disorders were proposed to lie along this spectrum with underestimation of harm being on the impulsive end and overestimation of harm being on the compulsive end (American Psychiatric Association, 2013; Hollander & Benzaquen, 1997). According to the metatheory of Hollander and Wong (1995), sexuality-related compulsions or addictions are closer to the impulsive end of the spectrum. Just over a decade later, Mick and Hollander (2006) proposed that problematic sexual behaviors had both impulsive and compulsive characteristics. However, these models were proposed largely in the absence of empirical data supporting this continuum of impulsivity and compulsivity lying along extreme ends of a continuous spectrum. When examining gambling and substance use disorders, both impulsive and compulsive features have been observed, and individuals with gambling disorders score high on measures of both impulsivity and compulsivity (Leeman & Potenza, 2012; Potenza, 2007). Consequently, questions exist regarding empirically derived relationships between problematic sexual behaviors and impulsivity and compulsivity.

According to Lochner et al.'s (2005) study, hypersexual disorder may belong to the reward-deficiency cluster rather than impulsive or somatic clusters on the basis of complex clinical interviews with patients with obsessive-compulsive spectrum disorders. However, the ICD-11 (beta version of the eleventh version of the *International Statistical Classification of Diseases and Related Health Problems*) Working Group on obsessive-compulsive and related disorders suggested that compulsive sexual behavior disorder (hypersexual disorder) should be included under the classification of impulse control disorders in the ICD-11 (Grant et al., 2014; Kraus et al., 2018; Stein et al., 2016; World Health Organization, 2017) due to its conceptualization and symptomatology (e.g., repeated failure to resist the impulse to engage in sexual behavior despite its long-term negative consequences). However, such a classification has been questioned because compulsive sexual behavior has similar neurobiological features to substance use disorders, indicating that compulsive sexual behavior could be considered an addictive disorder (Potenza, Gola et al., 2017). Thus, there is currently no consensus whether sexuality-related disorders or problems (such as

problematic pornography use or hypersexuality) relate to impulsive or compulsive features or whether they should be considered behavioral addictions (e.g., Griffiths, 2016; Kraus et al., 2016; Potenza et al., 2017), while noting that these possibilities are not mutually exclusive. Given that no prior studies have simultaneously examined impulsivity and compulsivity as related to hypersexuality and problematic pornography use, there is currently a knowledge gap in this area.

One study investigated compulsivity and impulsivity together as related to pornography use (Wetterneck et al., 2012). However, in this study, sexual compulsivity, as opposed to general compulsivity, was assessed. According to that study's results, impulsivity-related features (risk taking and sensation seeking) were positively and weakly correlated with self-reported positive and negative effects of pornography use and the frequency of pornography use. However, after dividing the sample into problematic and nonproblematic users, there were no significant differences between the groups regarding their level of impulsivity. With respect to sexual compulsivity, the positive and negative effects of pornography use and the frequency of pornography use were positively and moderately associated with sexual compulsivity, and there was a significant difference between the problematic and nonproblematic user groups, because individuals in the problematic groups reported 1.5-fold higher levels of sexual compulsivity than the nonproblematic group. This study is the only one that has assessed both impulsivity and (sexual) compulsivity in one model, with few studies having separately examined impulsivity or compulsivity as related to problematic sexual behaviors, such as hypersexuality and problematic pornography consumption, as discussed in the next section.

V/1.2. Impulsivity, Hypersexuality, and Pornography Consumption

Impulsivity has been related to multiple behaviors relevant to psychiatric problems and disorders (alcohol drinking, Anestis, Selby, & Joiner, 2007; Fischer, Anderson, & Smith, 2004; Fischer & Smith, 2008; compulsive buying, Billieux et al., 2008; eating disorders, Claes, Vandereycken, & Vertommen, 2005; Fischer et al., 2004; Fischer & Smith, 2008) and specific problematic online behaviors or online addictions (such as Internet addiction, Burnay, Billieux, Blairy, & Larøi, 2015; problematic online gaming, Billieux et al., 2011; Zsila et al., 2017; Facebook overuse and problematic series watching, Orosz et al., 2016). According to Whiteside and Lynam (2001), impulsivity is defined via four dimensions: *sensation seeking* (openness to experiences

that might be dangerous and enjoyment of exciting activities), *negative urgency* (the tendency to engage in impulsive behaviors in order to diminish negative emotions and affects, despite the potentially harmful long-term consequences), *lack of perseverance* (difficulties with staying focused on tasks that might be boring and with finishing projects or tasks if distracting stimuli are present), and *lack of premeditation* (acting before thinking about the possible consequences). This original four-dimensional impulsivity model was later complemented with a fifth dimension, namely, *positive urgency* (Billieux et al., 2012; Lynam, Smith, Whiteside, & Cyders, 2006). Positive urgency refers to the tendency to act rashly when experiencing intensive positive emotions. Most research examining the relationships between pornography use and impulsivity or hypersexuality and impulsivity have either applied a unidimensional impulsivity concept or emphasized the role of sensation seeking.

Within the field of hypersexuality, previous research on heterosexual, bisexual, and homosexual men and women has identified a positive but weak association between self-reported impulsive tendencies and hypersexuality. This suggests that people with higher impulsivity are more likely to engage in hypersexual behaviors (Walton, Cantor, & Lykins, 2017). However, in a study examining a combined sample of hypersexual males and healthy community controls, a moderate positive association was found between impulsivity and the level of hypersexuality, a relationship persisting when anxiety, depression, vulnerability, and mindfulness were taken into consideration (Reid, Bramen et al., 2014). In the case of highly sexually active gay and bisexual males, a similar positive, moderate association has been observed between self-reported impulsivity and levels of hypersexuality (Pachankis, Rendina, Ventuneac, Grov, & Parsons, 2014).

However, when hypersexual and nonhypersexual males were compared regarding their level of impulsivity, only a trend toward significance was found in relation to impulsivity (Mulhauser et al., 2014). In another study comparing impulsivity between hypersexual gay men and nonhypersexual gay men (Miner et al., 2016), only one significant difference was observed. Hypersexual gay men showed elevated levels of nonplanning impulsivity compared to non-hypersexual gay men. There were no significant differences between the two groups in their levels of attentional and motor impulsivity. The aforementioned findings suggest that hypersexuality is related to generalized impulsivity and that hypersexual males are not a homogenous group regarding impulsivity levels (Miner et al., 2016; Mulhauser et al., 2014). However, the

findings suggest that impulsivity importantly relates to hypersexuality (Pachankis et al., 2014; Reid et al., 2014; Walton, Cantor, Bhullar, et al., 2017).

Regarding pornography use, sensation seeking is arguably the most prevalently examined impulsivity-related characteristic studied to date. Sensation seeking has been found to be positively related to the frequency of pornography consumption (Beyens, Vandenbosch, & Eggermont, 2015; Peter & Valkenburg, 2010). For men, experience seeking has also been found to be positively related to online pornography use (Paul, 2009). According to Cooper et al.'s (2000) research, sexually compulsive people and individuals with cybersex addictions score higher on sexual and nonsexual sensation-seeking scales than do non–sexually compulsive and moderately sexually compulsive people. In sum, people with higher levels of sensation seeking may use pornography more intensively as manifested by either an increased amount of time spent with online pornography or the development of problematic online pornography use. Regarding the four other proposed dimensions of impulsivity (negative urgency, positive urgency, lack of perseverance, and lack of premeditation), no previous research has ever examined associations between these variables and online pornography use.

With respect to general impulsivity, the frequency of pornography use has been found to be negatively related to impulsivity among men (i.e., losing one's temper or easily getting irritated), but this was not the case for women (Carroll et al., 2008). In a separate study, low self-control (including impulsivity) explained only a small amount of the variance concerning the frequency of visiting pornography Web sites and downloading pornographic material after controlling for gender and age (Buzzell, Foss, & Middleton, 2006). Other research has found that motivations for using pornography positively and moderately relate to impulsivity across all motivational dimensions investigated (Reid, Li, Gilliland, Stein, & Fong, 2011). Consequently, these data suggest weak but complex relationships between pornography use and impulsivity that do not appear entirely consistent across studies.

In sum, the empirical evidence shows that impulsivity is weakly or moderately related to several aspects of pornography use, such as frequency of pornography use or motivation for pornography viewing (e.g., Beyens et al., 2015; Carroll et al., 2008; Peter & Valkenburg, 2010; Reid et al., 2011). However, little research has focused on the relationship between impulsivity and problematic pornography use. On the other hand, data suggest that impulsivity relates to hypersexuality, with other personality-related

measures also showing relationships (Miner et al., 2016; Mulhauser et al., 2014; Pachankis et al., 2014; Reid et al., 2014; Walton et al., 2017).

V/1.3. Compulsivity, Hypersexuality, and Pornography Consumption

Compulsivity is another personality-related characteristic that has been associated with psychiatric disorders and behaviors (e.g., substance use and gambling disorders, Leeman & Potenza, 2012; compulsive overeating, Davis & Carter, 2009; alcohol abuse and dependence, Modell, Glaser, Mountz, Schmaltz, & Cyr, 1992; bulimia nervosa, Engel et al., 2005). Compulsivity is characterized by the "performance of repetitive and functionally impairing overt or covert behavior without adaptive function, performed in a habitual or stereotyped fashion, either according to rigid rules or as a means of avoiding perceived negative consequences" (Fineberg et al., 2014, p. 70). Therefore, compulsivity may refer to the engagement in ritualistic, repetitive behaviors and actions to prevent or reduce distress or eliminate feared consequences of an individual's behaviors. However, this feeling of alleviation may be temporary, leading to a vicious cycle where the individual regularly engages in ritualistic actions (Deacon & Abramowitz, 2005).

Few studies have examined associations between compulsivity and hypersexuality. Among males with nonparaphilic hypersexual disorder, the lifetime prevalence of obsessive-compulsive disorder—a psychiatric disorder characterized by compulsivity—ranges from 0% to 14% (Kafka, 2015). Obsessiveness—which may be associated with compulsive behavior (Minnesota Multiphasic Personality Inventory 2 (MMPI-2); Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989)—in treatment-seeking men with hypersexuality has been found to be elevated relative to a comparison group, but the effect size of this difference was weak (Reid & Carpenter, 2009). When the association between the level of obsessive-compulsive behavior—assessed by a subscale of the Structured Clinical Interview for DSM-IV (SCID-II) (First, Gibbon, Spitzer, Williams, & Benjamin, 1997)—and the level of hypersexuality was examined among treatment-seeking males with hypersexual disorder, a trend toward a positive, weak association was found (Carpenter et al., 2013). On the basis of the aforementioned results, compulsivity appears to contribute in a relatively small manner to hypersexuality.

Sexual compulsivity (more so than general compulsivity) has been associated with pornography use. Among male students, pornography viewing has been found to

be positively and moderately associated with sexual compulsivity, with sexual compulsivity mediating the positive association between pornography viewing and problematic behavioral outcomes (Twohig et al., 2009). In line with the effects of thought suppression observed in obsessive-compulsive disorder (e.g., Abramowitz, Tolin, & Street, 2001; Tolin, Abramowitz, Przeworski, & Foa, 2002), these results suggest that the unwanted urges to use pornography may influence pornography use, leading to ego-dystonic viewing (i.e., pornography viewing in conflict with an individual's personality and beliefs), which in turn could lead to negative outcomes (i.e., problematic viewing). A moderate positive association between sexual compulsivity and problematic pornography use was reported in a separate convenience sample of males and females (Grubbs, Exline et al., 2015). Other research has found that craving for pornography was also positively and moderately related to sexual compulsivity (Kraus & Rosenberg, 2014). These results are consistent with the notion that hypersexuality includes elements of sexual compulsivity (e.g., Kafka, 2010).

In one study, general compulsivity was examined in relation to problematic pornography use among men, showing positive but weak associations (Egan & Parmar, 2013). When investigated in a more complex model, the relationship between general compulsivity and problematic pornography use was mediated by sexual addiction and Internet addiction, as well as an addiction more generally (Egan & Parmar, 2013). Taken together, the associations between compulsivity and hypersexuality and compulsivity and problematic use appear relatively weak (Carpenter et al., 2013; Egan & Parmar, 2013).

V/1.4. Examining Impulsivity and Compulsivity With Respect to Hypersexuality and Problematic Pornography Consumption

Building on prior work (Wetterneck et al., 2012), a subsequent step is the simultaneous examination of general compulsivity and impulsivity and how each of the constructs may relate to problematic pornography use and hypersexuality in the case of men and women. The aims of the present study were to examine impulsivity and compulsivity relative to hypersexuality and problematic pornography use to identify possible similarities and differences in relationships with hypersexuality and problematic pornography use in a large, nonclinical sample and using validated and well-established measures. It was hypothesized that impulsivity and compulsivity would

each positively correlate with problematic pornography use and hypersexuality, and that these relationships would be relatively weak but stronger for hypersexuality.

V/2. METHOD

V/2.1. Participants and Procedure

The present study was conducted in accordance with the approval of the institutional review board (IRB) of the related university and following the Declaration of Helsinki. Informed consent was obtained from all participants. Data collection was conducted in January 2017 via an online questionnaire that was advertised on one of the largest Hungarian news portals as a research study examining sexual activities. Only individuals aged 18 years old or older were invited to participate in the present study. Participants received detailed information about the aims of the study (i.e., investigation of sexual habits and behaviors of people), and they were assured of anonymity and confidentiality. Subsequently, the participants read and provided informed consent. Completing the questionnaire took approximately 30 minutes.

Overall, 24,372 individuals agreed to participate. However, 7,282 participants quit before completing the scales used in these analyses. Four requirements were established for being included in the present analysis: (1) having watched pornography at least once in the past year, (2) completing the hypersexuality-related scale, (3) completing the compulsivity-related scale, and (4) completing the impulsivity-related scale. Out of 17,090 participants, 1,602 had not watched pornography at least once in the past year; 469 did not complete the hypersexuality-related scale; 899 did not complete the compulsivity-related scale, and 342 did not complete the impulsivity-related scale. Therefore, 13,778 participants met the aforementioned criteria (female = 4,151, 30.1%; did not indicate gender = 72, 0.5%) and were aged between 18 and 76 years (M_{age} = 33.52, SD_{age} = 10.93). Regarding residency, 7,505 (54.5%) lived in the capital city, 2,133 (15.5%) in county towns, 2,881 (20.9%) in towns, and 1,259 (9.1%) in villages. Regarding level of education, 350 (2.5%) had primary school degrees or less, 541 (3.9%) had vocational degrees, 4,383 (31.8%) had high school degrees, and 8,504 (61.7%) had higher education degrees (bachelor’s, master’s, or doctoral). Regarding relationship status, 3,198 were single (23.2%), 5,932 were in a relationship (43.1%), 556 were engaged (4.0%), 3,430 were married (24.9%), 384 were divorced (2.8%), 67 were widows/widowers (0.5%), and 211 indicated the “other” option (1.5%). A previously established question was asked to assess the sexual orientation of the

participants (Træen, Nilsen, & Stigum, 2006). Based on responses to this question, 11,388 were heterosexual (82.7%), 1,401 were heterosexual with same-sex orientation to some extent (10.2%), 380 were bisexual (2.8%), 99 were homosexual with heterosexuality to some extent (0.7%), 384 were same-sex orientation (2.8%), 16 were asexual (0.1%), 73 were unsure about their sexual orientation (0.5%), and 37 indicated the "other" option (0.3%). Regarding past-year pornography use, participants watched online pornography weekly, and reported spending 26.4 minutes per session (*SD* = 20.5).

V/2.2. Measures

UPPS-P Impulsive Behavior Scale (UPPS-P). The Short UPPS-P Impulsive Behavior Scale (Zsila, Bőthe et al., 2017) was developed by Billieux et al. (2012) from the original 59-item UPPS-P (Lynam et al., 2006). The Short UPPS-P is a 20-item scale comprising five different impulsivity aspects with four items per dimension: negative urgency (e.g., "When I am upset I often act without thinking"), positive urgency (e.g., "When I am really excited, I tend not to think about the consequences of my actions"), sensation seeking (e.g., "I sometimes like doing things that are a bit frightening"), lack of premeditation (e.g., "I usually think carefully before doing anything"), and lack of perseverance (e.g., "I generally like to see things through to the end"). All items were scored on a four-point Likert scale (from 1 = *I agree strongly* to 4 = *I disagree strongly*). The facets negative urgency, positive urgency, and sensation seeking include reversed items. Descriptive statistics and the internal consistencies of the scale are shown in V/Table 1.

Structured Clinical Interview for DSM Disorders. The SCID-II (First et al., 1997; Szádóczky, Unoka, & Rózsa, 2004) comprises 140 items covering 10 personality disorders included in *The Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (DSM-IV), Axis II and two personality disorders listed in the appendix for diagnoses requiring further studies. In the present research, only the compulsivity subscale was used, which assesses compulsive behavior, utilizing nine true (1) or false (0) items (e.g., "Do you have trouble throwing things out because they might come in handy someday?"). Descriptive statistics and the internal consistency of the scale are shown in V/Table 1.

Hypersexual Behavior Inventory (HBI). The HBI (Bőthe, Bartók et al., 2018; Reid et al., 2011) comprises 19 items assessing the level of hypersexual behavior across

three dimensions. The *control* factor (eight items; e.g., “I engage in sexual activities that I know I will later regret”) assesses the lack of self-control in sexuality-related behaviors, such as an individual’s failed attempts to change his or her sexual behavior. The *coping* factor (seven items; e.g., “Doing something sexual helps me cope with stress”) refers to sexual behaviors as a response to emotional distress, such as frustration, sadness, or daily life worries. The *consequences* factor (four items; e.g., “My sexual thoughts and fantasies distract me from accomplishing important tasks”) refers to perceived consequences of sexual urges, thoughts, and behaviors, such as sexual activities interfering with important tasks, studies, or work. This scale was translated on the basis of the protocol outlined by Beaton et al. (2000). All items are scored on a five-point Likert scale (from 1 = *Never* to 5 = *Very often*). Descriptive statistics and the internal consistency of the scale are shown in V/Table 1.

Problematic Pornography Consumption Scale (PPCS). The PPCS (Bőthe, Tóth-Király et al., 2018) is based on a proposed six-component addictions model (Griffiths, 2005). The PPCS is an 18-item scale that assesses problematic pornography consumption using six factors, with three items relating to each factor. *Tolerance* captures when increasing amounts of the activity are required to achieve the same mood-modifying effects (e.g., “I felt that I had to watch more and more porn for satisfaction”). *Salience* refers to the relevance of pornography in an individual’s life (e.g., “I felt that porn is an important part of my life”). *Mood modification* is an either arousing or relaxing subjective experience that users report as a consequence of viewing pornography (e.g., “I released my tension by watching porn”). *Conflict* includes interpersonal conflicts between problematic users and their significant others, intrapsychic conflicts (e.g., knowing the activity is generating problems but finding difficulties consuming less or quitting), and occupational or educational concerns (e.g., “I felt porn caused problems in my sexual life”). *Relapse* is the tendency for returning to pornography quickly after abstinence or control (e.g., “I unsuccessfully tried to reduce the amount of porn I watch”). Last, *withdrawal* refers to the unpleasant feelings and emotional states that occur when the particular activity is decreased or ceased (e.g., “I became stressed when something prevented me from watching porn”). All items are scored on a 7-point Likert scale (from 1 = *Never* to 7 = *Very often*). Descriptive statistics and the internal consistency of the scale are shown in V/Table 1.

V/2.3. Statistical Analyses

For the statistical analysis, SPSS 21 and Mplus 7.3 (Muthén & Muthén, 1998–2015) were used. Normality was assessed by the investigation of skewness and kurtosis. Reliability was assessed using Cronbach's alpha (Nunnally, 1978) in the case of continuous scales. For the one dichotomous scale used (i.e., compulsivity subscale of SCID-II), internal consistency was examined with Kuder–Richardson formula 20 (KR-20, Kuder & Richardson, 1937). Structural equation modeling (SEM) was used to explore the associations between impulsivity, compulsivity, hypersexuality, and problematic pornography use. Items were treated as categorical indicators, because they had significant floor effects (on the basis of kurtosis and skewness). Consequently, the mean- and variance-adjusted weighted least squares estimator (WLSMV) was applied (Finney & DiStefano, 2006). Commonly used goodness-of-fit indices (Brown, 2015; Kline, 2011) were observed (Bentler, 1990; Brown, 2015; Browne & Cudeck, 1993; Hu & Bentler, 1999; Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2001) to assess the acceptability of the proposed model. The analyses examined the comparative fit index (CFI; ≥ .95 for good, ≥ .90 for acceptable), the Tucker–Lewis index (TLI; ≥ .95 for good, ≥ .90 for acceptable), and the root mean square error of approximation (RMSEA; ≤ .06 for good, ≤. 08 for acceptable) with a 90% confidence interval (CI).

In the case of the SCID-II compulsivity subscale and the HBI items, a parceling approach was conducted due to the fact that these latent variables were assessed using many items. Parcels are aggregated items that were used in the present model as assessed variables. This approach is acceptable in the case of theoretically unidimensional scales (e.g., Bandalos & Finney, 2001; Little, Cunningham, Shahar, & Widaman, 2002; Orosz et al., 2016), and it can minimize the issues related to non–normally distributed data (Bandalos, 2002; Matsunaga, 2008). In the case of the SCID-II compulsivity subscale, Rogers and Schmitt's (2004) exploratory factor analysis–based algorithm was applied in the parcel construction. For the HBI, a facet-representative approach was employed (Little, Rhemtulla, Gibson, & Schoemann, 2013) and each subscale (namely, coping, control, and consequences) was averaged. Consequently, three indicators were constructed.

V/Table 1. Descriptive statistics, reliability indices and correlations between the aspects of impulsivity, compulsivity, hypersexuality and problematic pornography use

Scales	Skewness (SE)	Kurtosis (SE)	Range	M (SD)	α	1	2	3	4	5	6	7	8
1. PPCS total	1.61 (0.02)	2.61 (0.04)	1-7	1.92 (1.00)	.94	—							
2. HBI total	1.24 (0.02)	1.85 (0.04)	1-5	1.76 (0.57)	.89	.57*	—						
3. UPPS-P total	0.06 (0.02)	-0.10 (0.04)	1-4	2.28 (0.41)	.85	.15*	.31*	—					
4. UPPS-P negative urgency	0.17 (0.02)	-0.57 (0.04)	1-4	2.38 (0.73)	.83	.13*	.24*	.76*	—				
5. UPPS-P positive urgency	-0.05 (0.02)	-0.25 (0.04)	1-4	2.61 (0.63)	.73	.13*	.29*	.80*	.64*	—			
6. UPPS-P sensation seeking	-0.10 (0.02)	-0.24 (0.04)	1-4	2.58 (0.63)	.77	.04*	.15*	.47*	.17*	.39*	—		
7. UPPS-P lack of premeditation	0.38 (0.02)	-0.03 (0.04)	1-4	1.90 (0.58)	.82	.04*	.14*	.67*	.36*	.35*	.04*	—	
8. UPPS-P lack of perseverance	0.41 (0.02)	-0.05 (0.04)	1-4	1.91 (0.59)	.83	.14*	.18*	.52*	.18*	.16*	-.09*	.49*	—
9. SCID-II compulsivity	-0.15 (0.02)	-0.41 (0.04)	0-1	0.54 (0.21)	.49[a]	.13*	.14*	.02*	.17*	.11*	.04*	-.19*	-.11*

Note. PPCS = Problematic Pornography Consumption Scale; HBI = Hypersexual Behavior Inventory; UPPS-P = UPPS-P Impulsive Behavior Scale; SCID-II = Structured Clinical Interview for DSM Disorders; α = Cronbach's alpha; M = mean; SD = standard deviation; SE = standard error; [a] = Internal consistency was examined by assessment of the Kuder-Richardson Formula 20 (KR-20) for this dichotomous scale. *$p < .001$

V/3. RESULTS

Descriptive data, reliability indices, and correlations between the aspects of impulsivity, compulsivity, hypersexuality, and problematic pornography use are shown in V/Table 1. According to the correlations, there were only small differences between the correlations of problematic pornography use, hypersexuality, and the specific aspects of impulsivity. Therefore, for the sake of simplicity, the total score of impulsivity was used in further analyses.

By using SEM, the associations between impulsivity, compulsivity, hypersexuality, and problematic pornography use were investigated in the total sample and in the case of men and women in separate models as well. The models with standardized estimates are shown in Figure 1.

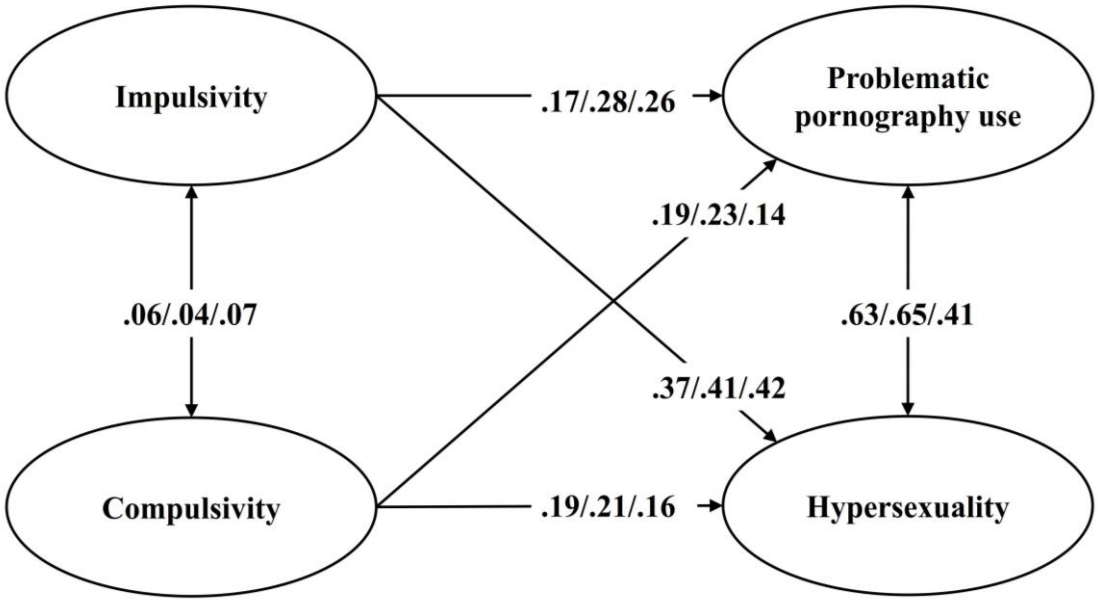
In the total sample model, the fit indices were acceptable (CFI = .941, TLI = .937, RMSEA = .055 [90% CI = .054–.055]). Both impulsivity and compulsivity were related positively but weakly to problematic pornography use (β = .17, p < .01, and β = .19, p < .01, respectively). The proportion of explained variance of problematic pornography use was 6.6%. In the case of hypersexuality, compulsivity was also positively but weakly related to hypersexuality (β = .19, p < .01). However, impulsivity was positively but moderately related to hypersexuality (β = .37, p < .01). The proportion of explained variance of hypersexuality was 18.1%.

In the male sample model, the fit indices were acceptable (CFI = .929, TLI = .924, RMSEA = .059 [90% CI = .058–.059]). Both impulsivity and compulsivity were related positively but weakly to problematic pornography use (β = .28, p < .01, and β = .23, p < .01, respectively). The proportion of explained variance of problematic pornography use was 13.2%. In the case of hypersexuality, compulsivity was also positively but weakly related to hypersexuality (β = .21, p < .01). However, impulsivity was positively but moderately related to hypersexuality (β = .41, p < .01). The proportion of explained variance of hypersexuality was 21.7%.

In the female sample model, the fit indices were acceptable (CFI = .914, TLI = .908, RMSEA = .055 [90% CI = .054–.056]). Both impulsivity and compulsivity were related positively but weakly to problematic pornography use (β = .26, p < .01, and β = .14, p < .01, respectively). The proportion of explained variance of problematic pornography use was 9.1%. In the case of hypersexuality, compulsivity was also positively but weakly related to hypersexuality (β = .16, p < .01). However, impulsivity

was positively but moderately related to hypersexuality (β = .42, p < .01). The proportion of explained variance of hypersexuality was 21.0%.

In sum, the associations between problematic pornography use and impulsivity and compulsivity, respectively, were weak, and the explained variance of problematic pornography use by impulsivity and compulsivity was relatively low (6.6% to 13.2%) in the total sample, as well as among men and women. In the case of hypersexuality, impulsivity had a stronger effect on hypersexual behavior than compulsivity, with hypersexuality having an explained variance of approximately 20% by impulsivity and compulsivity in the total sample, as well as among men and women.



V/Figure 1. The impulsivity and compulsivity background of hypersexuality and problematic pornography use (N_{total} = 13,778; N_{males} = 9,555; $N_{females}$ = 4,151). *Note.* All variables presented in ellipses are latent variables. For the sake of clarity, indicator variables related to them are not depicted in this figure. One-headed arrows represent standardized regression weights and two-headed arrows represent correlations. The first numbers on the arrows indicate the path coefficients of the total sample, the second numbers indicate the path coefficients of the male sample, and the third numbers indicate the path coefficients of the female sample. All pathways were significant at level p < .01.

V/4. DISCUSSION

There is a current debate regarding how best to consider problematic sexual behaviors (such as hypersexuality and problematic pornography use), with competing models proposing classifications as impulse-control disorders, obsessive-compulsive spectrum disorders, or behavioral addictions (e.g., Griffiths, 2016; Kraus et al., 2016; Potenza et al., 2017). Relationships between transdiagnostic features of impulsivity and compulsivity and problematic sexual behaviors should inform such considerations, although both impulsivity and compulsivity have been implicated in addictions (Fineberg et al., 2014; Leeman & Potenza, 2012). The present study contributes to the ongoing debate by examining and identifying differences in the relationships between measures of self-reported impulsivity, compulsivity, hypersexuality, and problematic pornography consumption.

The findings of the present study showed that impulsivity was moderately and positively related to hypersexual behavior, while compulsivity was only weakly related, suggesting that impulsivity contributes more strongly to hypersexuality than compulsivity in both men and women. However, impulsivity and compulsivity related only weakly to problematic pornography use among both genders. From a statistical perspective, impulsivity and compulsivity both positively predicted problematic pornography use, but the effect sizes were small in both cases and the proportion of explained variance of problematic pornography use did not reach 15%, suggesting that more emphasis should be put on other factors (e.g., social and society related) in research and clinical interventions in the case of problematic pornography use. On the other hand, the finding that impulsivity related moderately to hypersexuality provides support both for the classification of compulsive sexual behavior disorder (as proposed for ICD-11; World Health Organization, 2017) as an impulse-control disorder or as a behavioral addiction. In considering the other disorders currently being proposed as impulse-control disorders (e.g., intermittent explosive disorder, pyromania, and kleptomania) and the central elements of compulsive sexual behavior disorder and proposed disorders due to addictive behaviors (e.g., gambling and gaming disorders), the classification of compulsive sexual behavior disorder in the latter category appears better supported.

The findings of the present study suggest that problematic pornography use may differ from hypersexuality more generally. As such, considering specific forms of excessive or problematic sexual behaviors will be important because different

individuals with different temperamental features may be vulnerable to, and experience problems with, different types of sexual behavior.

V/4.1. The Role of the Impulsivity and Compulsivity in Hypersexuality and Problematic Pornography Consumption

Impulsivity and compulsivity are among the most frequently examined personality-related factors in the case of problematic behaviors with addictive potential (e.g., Billieux et al., 2008; Davis & Carter, 2009; Deckman & DeWall, 2011; Engel et al., 2005; Leeman & Potenza, 2012; Mottram & Fleming, 2009). However, little research has examined the associations of impulsivity, compulsivity, and problematic sexual behaviors (such as hypersexuality and problematic pornography use). This small body of work reports relatively small effect sizes and inconsistent results. However, no prior study to this one has ever simultaneously investigated the relationships of impulsivity and compulsivity with hypersexuality and problematic pornography use.

Regarding pornography use motivations (Reid et al., 2011), impulsivity was positively and moderately related to almost all motivational factors, whereas, in the case of frequency of pornography use, a less consistent pattern was observed, from positive associations to no association (e.g., Beyens et al., 2015; Carroll et al., 2008; Peter & Valkenburg, 2011). Only one study (i.e., Wetterneck et al., 2012) has investigated the associations between impulsivity, compulsivity, and problematic pornography use simultaneously. Similar to the results of the present study, positive but weak associations between the variables were observed, and after dividing the sample into problematic and nonproblematic users, no significant differences were found between the groups regarding levels of impulsivity. Therefore, impulsivity may not be as relevant to problematic pornography use as previously proposed (e.g., Hollander & Wong, 1995; Mick & Hollander, 2006).

In the case of hypersexuality, research has shown that impulsivity is weakly or moderately associated with hypersexual behaviors, fantasies, and urges (Pachankis et al., 2014; Reid et al., 2014; Walton, Cantor, Bhullar, et al., 2017). However, comparisons of hypersexual and nonhypersexual individuals have not shown consistent results (Miner et al., 2016; Mulhauser et al., 2014). The results of the present study corroborate the findings of Pachankis et al. (2014) and Reid et al. (2014) because the associations between impulsivity and hypersexuality are positive and moderate,

suggesting that impulsivity may contribute importantly to the development and maintenance of hypersexuality.

Regarding compulsivity, associations between pornography use and sexual compulsivity have been more widely investigated than those between pornography use and general compulsivity. Not surprisingly, when sexual compulsivity was assessed in relation to pornography viewing (e.g., Grubbs, Exline et al., 2015; Twohig et al., 2009; Wetterneck et al., 2012), the association was moderate and positive. Several possible reasons for this relationship have been proposed. First, context-specific compulsivity may be expected to be more strongly related to problematic pornography use than context-free (i.e., general) compulsivity. Second, hypersexuality by definition may include sexual compulsivity (e.g., Kafka, 2010). However, when general compulsivity has been assessed as an antecedent of problematic pornography use, similar to the results of the present study, positive but weak associations were observed (Egan & Parmar, 2013). Previously, general compulsivity or obsessiveness was only weakly related or unrelated to hypersexuality (e.g., Carpenter et al., 2013; Reid & Carpenter, 2009). In the present study, similar relationships were observed because general compulsivity (from a statistical perspective) significantly predicted hypersexuality, but the effect size was low.

In the present study, the five-facet model of impulsivity (Billieux et al., 2012; Lynam et al., 2006) was examined in relation to problematic pornography use and hypersexuality. The five facets—namely, negative urgency, positive urgency, lack of premeditation, lack of perseverance, and sensation seeking—were generally positively but weakly related to problematic pornography use and positively and moderately to hypersexuality, demonstrating a consistent relationship pattern between the aspects of impulsivity and problematic pornography use and hypersexuality. Therefore, the total score of impulsivity was used as a statistical predictor of problematic pornography use and hypersexuality. As expected, impulsivity was positively associated with problematic pornography use and hypersexuality. However, the extent of the association between impulsivity and problematic pornography use was rather small.

V/4.2. Possible Explanations for the Weak Associations between Impulsivity, Compulsivity, and Problematic Pornography Use

Several factors may explain why impulsivity and compulsivity only weakly statistically predicted the level of problematic pornography use while hypersexuality

was moderately statistically predicted by impulsivity. It is possible that impulsivity and compulsivity do not have a strong direct impact on problematic pornography use but have stronger effects via mediating variables. In the case of impulsivity, Reid et al. (2011) found that impulsivity had positive moderate associations with all four motivations of pornography use. From their four motivational factors, emotional avoidance had the strongest relationship with impulsivity, with excitement seeking being the second strongest and sexual pleasure being the third strongest, whereas sexual curiosity had the weakest relationship with impulsivity. Based on these results, emotional avoidance motivation may represent a mediator between impulsivity and problematic pornography use, although direct investigation of this possibility is needed to confirm the hypothesis.

Moreover, the frequency of pornography use may also serve as a potential mediator between impulsivity and problematic pornography use. For men, impulsivity has been found to be positively related to the frequency of pornography viewing; for females, it was not related (Carroll et al., 2008). As men tend to have higher levels of impulsivity (e.g., Chapple & Johnson, 2007; Cross et al., 2011; Waldeck & Miller, 1997), it could be hypothesized that this elevated level of impulsivity may lead to an increased frequency of pornography use, which in turn may lead to problematic pornography use (e.g., Brand et al., 2011; Grubbs, Exline et al., 2015; Grubbs, Volk et al., 2015; Twohig et al., 2009). For women, impulsivity was not related to the frequency of pornography use (Carroll et al., 2008); therefore, it could be assumed that their impulsivity may not reflect in the frequency of pornography leading to problematic pornography use, but problematic pornography use could develop via different pathways (e.g., Lewczuk et al., 2017). In Egan and Parmar's (2013) study, the association between compulsivity and problematic pornography use was mediated by sexual addiction, Internet addiction, and addiction more generally. Therefore, a similar mediational pattern could be hypothesized regarding the association between compulsivity and hypersexuality.

Likewise, self-efficacy may also mediate possible relationships between impulsivity, compulsivity, and problematic pornography use. In previous studies (e.g., Kraus, Rosenberg, Martino, Nich, & Potenza, 2017; Kraus, Rosenberg, & Tompsett, 2015), self-efficacy in reducing pornography use and self-efficacy in avoiding possibly tempting situations were identified as important factors in reducing problematic pornography use. Therefore, one might hypothesize that people with high levels of

impulsivity or compulsivity may control their urges because of their high level of self-efficacy to avoid tempting situations, which in turn may result in lower levels of problematic pornography use.

Nevertheless, it is possible that levels of impulsivity and compulsivity in relationships with problematic sexual behaviors (such as problematic pornography use and hypersexuality) have been overestimated. According to a number of scholars (e.g., Conway, Kane, Ball, Poling, & Rounsaville, 2003; Griffiths, 2017; Kerr, 1996; Szalavitz, 2016), no single personality trait or set of traits may lead to problematic behaviors or addictions. The three cornerstones of online pornography use (anonymity, affordability, and accessibility; Cooper, 1998) may create situations that facilitate the increased use of pornography, and these may also contribute to the development of problematic pornography use. The careful, experimental examination of these cornerstones may significantly contribute to the understanding of problematic pornography use. Furthermore, situation-related factors that may affect individuals in a given life stage, such as loneliness (e.g., Bozoglan, Demirer, & Sahin, 2013; Ceyhan & Ceyhan, 2008) or perceived stress (e.g., Grubbs, Volk, et al., 2015; Levin, Lillis, & Hayes, 2012; Paul & Shim, 2008; Reid et al., 2011), may also influence the level of addictive online behaviors such as problematic pornography use. Finally, it should also be noted that societal factors such as regulations and policies that influence the accessibility, affordability, and anonymity of pornography may in turn promote or hinder the emergence of those specific situations in which (problematic or nonproblematic) pornography use may have significant psychosocial impacts.

V/4.3. Future Studies and Limitations

Further measures are needed in future studies that may directly assess respondents' behaviors while respecting individuals' privacy. The extent of problematic pornography consumption and the level of hypersexuality may be temporally stable or it may change over time. It is possible that an individual may temporarily use pornography more intensively or in a more problematic manner, but this behavior may change. Therefore, longitudinal studies are needed to answer the question of stability. Future experimental studies with well-established designs are needed to determine a potentially causal role of individual differences and situational factors in the development and maintenance of hypersexuality and problematic pornography use, such as sex mind-set beliefs (Bőthe, Tóth-Király, Demetrovics, & Orosz, 2017), reward

deficiency syndrome (Comings & Blum, 2000; Lochner et al., 2005), perceived stress (Grubbs, Volk et al., 2015), or basic psychological needs (Tóth-Király, Morin, Bőthe, Orosz, & Rigó, 2018). Finally, it should be kept in mind that the outcomes studied in the present study pertain only to specific problematic aspects of sexuality (i.e., problematic online pornography use and hypersexuality). Developing measures that can assess nonproblematic aspects of pornography use may be useful in further research. Stronger cooperation between pornography Web sites—which may provide behavioral data—and the scientific community may be beneficial in providing predictive validity of related measures. Future studies should focus on preventions and interventions that emphasize not only self-reported individual differences but also social and situational factors related to the development and maintenance of problematic sexual behaviors.

Some limitations of the present study should be noted. The use of self-report cross-sectional methods have possible biases that need be considered when interpreting the findings. Moreover, causality cannot be inferred from the present cross-sectional findings. The internal consistency of the compulsivity subscale of the SCID-II was not adequate; therefore, it is possible that the low level of internal consistency may have distorted the findings. In addition, self-reported compulsivity was assessed via SCID-II methods. Other assessments of compulsivity (e.g., via the Padua Inventory or other assessments; Andrews et al., 2011; Scherrer, Xian, Slutske, Eisen, & Potenza, 2015) may have yielded different results. Similar concerns exist regarding the UPPS-P and other self-report measures of impulsivity. In addition, because self-report measures differ with behavioral measures of constructs (e.g., Krishnan-Sarin et al., 2007), it is important for future studies to investigate both behavioral and self-report measures related to hypothesized predictors of the given behavior (e.g., using the cued go/no-go task [Fillmore, 2003] or the stop signal task [Logan, 1994] with a self-reported measure in the case of impulsivity [Ding et al., 2014]). It will also be important to concurrently assess the behavior itself (e.g., actual amount of pornography use employing tracking-data approaches in collaboration with pornography Web site operators as has been done in other fields such as gambling; Griffiths, 2014).

V/5. CONCLUSIONS AND IMPLICATIONS

In sum, impulsivity and compulsivity did not contribute as importantly and directly to problematic pornography use as previously proposed in the literature, and impulsivity may have a more prominent role in hypersexuality. Furthermore, these

results have several conceptual and research implications. First, several issues arise regarding the categorization of problematic pornography use. One issue is whether problematic pornography use may be considered a subcategory of hypersexuality if relationships with impulsivity and compulsivity are not as strong as previously hypothesized. A second issue —which may be related to the categorization of problematic pornography use under the umbrella of hypersexuality—is how problematic pornography use (and especially problematic online pornography use) may best be categorized (Griffiths, 2016; Kraus et al., 2016; Potenza et al., 2017).

From a research perspective, self-reported tendencies may have a stronger impact on problematic sexual behaviors via mediating variables such as motivations, frequency and time spent with the activity, frustration relating to psychological needs, beliefs about the malleability of the given activities, topic-relevant self-efficacy beliefs, and/or other factors. All of these possibilities warrant direct examination. Moreover, it is important to consider the complex etiologies of addictions. More specifically, it is likely that a complex set of personality factors, other individual difference factors, and social and situational factors lead to the development and maintenance of problematic sexual behaviors and that these may vary according to the type of problematic sexual behavior. Additional research is needed to understand factors related to specific problematic sexual behaviors and translate the factors into improved prevention, treatment, and policy initiatives.

VI. INVESTIGATING THE ASSOCIATIONS OF ADULT ADHD SYMPTOMS, HYPERSEXUALITY AND PROBLEMATIC PORNOGRAPHY USE AMONG MEN AND WOMEN ON A LARGESACLE, NON-CLINICAL SAMPLE (STUDY 5)[11]

ABSTRACT

Background: Attention deficit hyperactivity disorder (ADHD) is one of the most prevalent comorbid disorders in hypersexuality; however, previous studies only examined the associations of ADHD and hypersexuality among treatment-seeking men. Despite problematic pornography use (PPU) might considered the most frequent manifestation of hypersexuality, no previous research examined its association with ADHD symptoms.

Aim: The aims of the present study were to (a) examine ADHD symptoms in relation to hypersexuality and PPU and to (b) identify possible similarities and differences in relationship with hypersexuality and PPU in a large, non-clinical sample among both genders.

Methods: Multi-group structural equation modeling was conducted to investigate the hypothesized associations between adult ADHD symptoms, hypersexuality and PPU among men and women (N = 14,043 participants; females = 4,237; M_{age} = 33.5 years, SD_{age} = 10.9).

Outcomes: Adult ADHD symptoms was assessed in relation to hypersexuality and PPU via self-reported measures.

Results: Results indicated that hypersexuality had positive and moderate association with problematic pornography use among women ($r(14041) = .50$, $p < .01$) and positive and strong association among men ($r(14041) = .70$, $p < .01$). ADHD symptoms had positive and moderate associations with hypersexuality among both men and women ($\beta = .50$, $p < .01$; $\beta = .43$, $p < .01$; respectively). Regarding men, ADHD symptoms had a positive, moderate association with PPU ($\beta = .45$, $p < .01$), while ADHD symptoms had a positive, but weak association with PPU in the case of women ($\beta = .26$, $p < .01$).

[11]Bőthe, B., Koós, M., Tóth-Király, I., Orosz, G., & Demetrovics, Z. (in press). Investigating the associations of adult ADHD symptoms, hypersexuality, and problematic pornography use among men and women on a largescale, non-clinical sample. *Journal of Sexual Medicine.*

Clinical Translation: When men having high levels of hypersexuality or PPU, ADHD should be assessed as a potential comorbid disorder. Regarding women, ADHD should be assessed as a potential comorbid disorder only in the case of hypersexuality.
Strengths & Limitations: Applying self-report methods have possible biases that should be taken into account when interpreting the present findings. However, the present study was conducted on a large, community sample and examined the differentiated role of ADHD symptoms in hypersexuality and PPU not only among men but women as well that has never been addressed in the literature.
Conclusion: ADHD symptoms might play an important role in the severity of hypersexuality among both genders, while ADHD symptoms might only play a stronger role in PPU among men, but not among women. The findings corroborate previous results that PPU may not be unambiguously considered as a subcategory of hypersexuality. Also, potential background mechanisms behind problematic pornography use should be examined separately among men and women.

Keywords: ADHD symptoms, attention deficit hyperactivity disorder, gender differences, hypersexuality, problematic pornography use

VI/1. INTRODUCTION

Previously, Hypersexual Disorder (HD) was considered for inclusion in the *Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders* (DSM-V) (American Psychiatric Association, 2013), but it was ultimately rejected due to theoretical and practical issues (Kafka, 2014; Reid & Kafka, 2014; Walton, Cantor, Bhullar, & Lykins, 2017). As a result of thorough empirical examination and theoretical considerations in the past decade (Bőthe, Tóth-Király, Potenza, et al., 2018; Kraus et al., 2016; Montgomery-Graham, 2017; Reid, Bramen et al., 2014; Reid, Carpenter, Gilliland, & Karim, 2011), hypersexuality is now included in the eleventh version of *International Statistical Classification of Diseases and Related Health Problems* (ICD-11) as Compulsive Sexual Behavior Disorder (CSBD) (World Health Organization, 2018). The main domains of the proposed diagnosis for HD (Kafka, 2010) and the diagnosis of CSBD (World Health Organization, 2018) highly overlap (i.e., failure to control sexual behavior; interference with goals, activities and obligations; unsuccessful efforts to control or reduce it; causing clinically significant distress or impairment), but some differences need to be noted. The proposed diagnosis of HD included criteria related to motivations (i.e., engaging in sexual activities to reduce stress or negative feelings), while these motivational domains were excluded from the CSBD diagnosis. Also, some additional criteria were added to the CSBD diagnosis (e.g., distress related to sexual activities deriving from moral judgement and disapproval is not sufficient to be diagnosed with CSBD) that were not considered in the proposed HD diagnosis. Despite the aforementioned dissimilarities between hypersexuality and CSBD, these two conceptualizations can be considered highly similar (Reid, Garos, & Fong, 2012; Reid, Li et al., 2011). In the present study, the term "hypersexuality" is preferred as the study was conducted before the official CSBD diagnosis and it employed the Hypersexual Behavior Inventory (Reid, Li, et al., 2011) that was developed on the basis of the proposed HD diagnostic criteria (Kafka, 2010).

Hypersexuality can appear in several forms with previous findings indicating that problematic pornography use can be considered as one of the most prominent manifestations, followed by masturbation, and sex with consenting adults (Kafka, 2010; Reid, Carpenter, et al., 2012; Wéry & Billieux, 2016; Wordecha et al., 2018). However, according to recent results (e.g., Werner, Štulhofer, Waldorp, & Jurin, 2018; Wéry et al., 2016), it is not unambiguous whether problematic pornography use should be taken into account as a core element of hypersexuality or whether hypersexuality and

problematic pornography use have similar antecedents (Bőthe, Tóth-Király, Potenza, et al., 2018), suggesting that further research is needed to decide whether problematic pornography use is indeed a subcategory of hypersexuality or not. Therefore, the aim of the present study was to examine the associations of hypersexuality, problematic pornography use and self-report adult ADHD symptoms among men and women focusing on the potential similarities and dissimilarities.

VI/1.1. The Associations of ADHD Symptoms, Hypersexuality, and Problematic Pornography Use

Besides mood disorders and anxiety disorders (Blankenship & Laaser, 2004; Kraus et al., 2016; Reid, 2007; Reid, Carpenter, et al., 2011; Reid, Davtian, Lenartowicz, Torrevillas, & Fong, 2013; Wéry et al., 2016), attention deficit hyperactivity disorder (ADHD) is a highly comorbid disorder with hypersexuality: 17%-67% of individuals with hypersexuality reported some patterns of ADHD (Reid et al., 2013). Fewer studies examined the associations of problematic pornography use and psychiatric disorders (Grubbs, Volk et al., 2015; Kraus, Potenza, Martino, & Grant, 2015; Willoughby, Busby, & Young-Petersen, 2018), but similar relationship patterns can be observed as mood disorders and anxiety disorders showed highly comorbidity with problematic pornography use (Kraus et al., 2015). However, ADHD was present only in 3% of men seeking treatment for problematic pornography use (Kraus et al., 2015). Consequently, from the perspective of the examination of dissimilarities between hypersexuality and problematic pornography use, the level of ADHD symptoms may arguably be considered as a potential difference between hypersexuality and problematic pornography use.

In DSM-5, ADHD is defined as repeated patterns of hyperactivity and/or inattention causing problems in functioning or development with being present in two or more settings for at least six months (American Psychiatric Association, 2013). The diagnostic criterion of ADHD is arranged in two categories, namely, inattention and hyperactivity-impulsivity related symptoms. The inattention related symptoms include such manifestations as reluctance to engage in tasks that require sustained attention or mental effort, easy distraction by external stimuli, losing things or forgetfulness. The hyperactivity and impulsivity related symptoms includes such manifestations as excessive talking, interruption or intrusion of others, difficulties in waiting for own turns, or restlessness (American Psychiatric Association, 2013).

Although high comorbidity can be observed between hypersexuality and adult ADHD symptoms, a relatively low number of studies examined their associations and even fewer aimed to identify why individuals with ADHD may be more vulnerable to develop hypersexuality than general populations (Reid et al., 2013). Formerly, it was hypothesized that the hyperactive-impulsive aspect of ADHD may be a key as to why hypersexuality showed high comorbidity with ADHD as studies shows moderate, positive associations between impulsivity and hypersexuality (Bőthe, Tóth-Király, Potenza, et al., 2018; Miner et al., 2016; Mulhauser et al., 2014; Reid et al., 2014; Reid, Carpenter, et al., 2011; Walton, Cantor, & Lykins, 2017). However, investigations including men with hypersexuality did not support this assumption as problems with self-concept, emotional lability, memory problems, and inattentive symptoms of ADHD showed stronger associations with the severity of hypersexuality than restlessness and hyperactive-impulsive symptoms (Reid, Carpenter, et al., 2011).

Thus, the most frequently reported ADHD symptoms among individuals with ADHD were related to inattention, suggesting that inattentive symptoms may be more relevant in the case of hypersexual individuals than impulsivity related symptoms (Blankenship & Laaser, 2004; Kafka & Hennen, 1999; Reid, 2007; Reid et al., 2013). Children with ADHD can experience problems with social relationships, academic difficulties, failures in task completion that may not disappear in their adulthood potentially leading to relationship difficulties, loneliness and diminished work performance in the long run (de Boo & Prins, 2007; Paulson, Buermeyer, & Nelson-Gray, 2005; Reid et al., 2013; Solanto, Marks, Mitchell, Wasserstein, & Kofman, 2008). Supposedly, these negative experiences are accompanied by negative feelings and emotions, leading to the point when the given individual looks for activities that can reduce or alleviate these negative feeling and emotions. In these cases, sexual activities may serve as mood modifying “self-medication” methods such as drugs that were previously reported as “self-medication” methods among individuals with ADHD (Gudjonsson, Sigurdsson, Sigfusdottir, & Young, 2012; Reid, Carpenter, et al., 2011; Reid et al., 2013; Wilens et al., 2007). It is also possible that the aforementioned ADHD related negative experiences (e.g., academic or work difficulties) may lead to higher levels of stress, which in turn, may result in engagement of sexual activities as means of stress reduction strategies (Reid, Carpenter, et al., 2011). Hypothetically, it is also possible that stimulants used as ADHD medication may enhance sexual drive and

sexual desire, which in turn, may have negative consequences on individuals with hypersexuality enhancing the symptoms of hypersexuality (Reid et al., 2013).

When turning to the topic of problematic pornography use, to the best of the authors' knowledge, only one study reported on their comorbidity (Kraus et al., 2015). However, on the basis of previous findings on the associations of impulsivity and pornography use frequency/problematic pornography use (weak, positive or no associations at were reported) (Bőthe, Tóth-Király, Potenza, et al., 2018; Wetterneck et al., 2012), it may be hypothesized that the hyperactivity and impulsivity related symptoms of ADHD may not have a role in problematic pornography use. However, inattention symptoms might have a more important role in the severity of problematic pornography use.

Regarding problematic pornography use, boredom proneness or boredom reduction as a motivation (presumably deriving from difficulties in sustaining attention (Malkovsky, Merrifield, Goldberg, & Danckert, 2012) to use pornography was reported as potential risk factors to engage in pornography use in a problematic manner (Chen, Leung, Chen, & Yang, 2013; Grubbs, Braden, Kraus, Wilt, & Wright, 2017; Paul & Shim, 2008; Rothman, Kaczmarsky, Burke, Jansen, & Baughman, 2014). As individuals can have problems with sustaining attention during tasks and can be easily distracted by external stimuli (Association, 2013), pornography may be considered as a potentially risky activity as it is easily accessible, convenient, affordable, anonym, using it has become more and more acceptable, and it can provide (almost) infinite novelty and excitement (Carroll et al., 2008; Cooper, 1998; D'Orlando, 2011; King, 1999; Young et al., 2000).

In the literature, little attention has been paid to hypersexuality and problematic pornography use among women (Dhuffar & Griffiths, 2016; Klein, Rettenberg et al., 2014; Lewczuk et al., 2017), but the results suggest that fundamental differences may be observed between men and women (e.g., engaging in religious practices may play a direct role in treatment seeking for pornography use among women, but not among men (Gola et al., 2016; Lewczuk et al., 2017). Thus, it can be considered as an important limitation in the aforementioned studies that they were conducted on relatively small samples of men seeking treatment for hypersexuality (Blankenship & Laaser, 2004; Kafka & Hennen, 2002; Reid, 2007; Reid, Carpenter, et al., 2011) or among men seeking treatment for problematic pornography use (Kraus et al., 2015). In sum, no empirical data is available on the associations of hypersexuality, problematic

pornography use and ADHD symptoms among treatment-seeking women and non-treatment seeking populations.

To conclude, the prevalence of ADHD among individuals with hypersexuality showed high comorbidity and/or moderate, positive associations in previous studies (Blankenship & Laaser, 2004; Reid, 2007; Reid, Carpenter, et al., 2011; Reid et al., 2013), while in the case of problematic pornography users, only a low number of participants reported ADHD (Kraus et al., 2015). Based on these results, it can be assumed that ADHD symptoms are more strongly associated with the severity of hypersexuality than with the severity of problematic pornography use.

VI/1.2. Aims of the present study

Given that the previous studies were carried out in small samples of treatment-seeking men, there is currently a lack of empirical evidence in this area regarding the associations of adult ADHD symptoms and the severity of hypersexuality in non-treatment seeking men and women; and treatment-seeking women. Moreover, to the best of the authors' knowledge, no previous research examined the associations between adult ADHD symptoms and the severity of problematic pornography use. Following recent studies (Bőthe, Tóth-Király, Potenza, et al., 2018; Reid et al., 2013; Werner et al., 2018; Wéry et al., 2016), a subsequent step in the field is the examination of how self-reported adult ADHD symptoms may relate to the severity of hypersexuality and problematic pornography use among both males and females. Therefore, the aims of the present study were to (a) examine adult ADHD symptoms relative to hypersexuality and problematic pornography use, and to (b) identify possible similarities and differences in relationship with hypersexuality and problematic pornography use in a large, non-clinical sample with taking into consideration gender. Based on previous results (Blankenship & Laaser, 2004; Kafka & Hennen, 2002; Reid, Carpenter, et al., 2011; Reid et al., 2013), it might be hypothesized that the level of ADHD symptoms would have a positive, moderate association with the severity of hypersexuality. However, regarding the associations of problematic pornography use and ADHD symptoms, a weaker, but still positive association was expected as previous studies reported lower levels of comorbidity between these variables (Kraus et al., 2015). It has to be noted that the studies serving as basis for these hypotheses were carried out among men, thus, specific hypotheses for women or regarding potential gender differences could not be formulated.

VI/2. METHOD

VI/2.1. Participants and Procedure

The present study was conducted in accordance with the Helsinki Declaration and was approved by the Institutional Ethical Review Board of the related university. Data collection occurred in January 2017 via an online questionnaire set among adults. The survey was advertised on a popular Hungarian news portal describing the study as a sexuality related investigation. Informed consent was obtained from all participants. Overall, 24,372 Hungarian individuals accepted to participate in the study. Four requirements were established to be included in the present study: (a) completing the Hypersexual Behavior Inventory (6262 individuals did not complete it), (b) completing the Problematic Pornography Consumption Scale (3317 individuals did not complete it), (c) completing the ADHD Self-Report Scale (564 individuals did not complete it), and (d) identifying oneself as man or woman (186 individuals indicated their gender as other than man or woman) as gender-based comparisons were conducted. Thus, 10,329 participants were excluded from the present analyses.

A total number of 14,043 participants met the aforementioned criteria (female = 4,237, 30.2%) who were aged between 18 and 76 years (M_{age} = 33.53 years, SD_{age} = 10.94). The detailed description of the demographic and socio-economic characteristics of the sample can be seen in VI/Table 1. Respondents had 7 sex partners in their lifetime on average. Regarding the past year, those who were in a relationship had sexual intercourse with their partners weekly on average. Regarding the past year, on average, participants viewed online pornographic materials weekly and they masturbated two or three times a week.

VI/Table 1. Detailed demographic and socio-economic characteristics of the sample

Demographic and socio-economic characteristics	N = 14,043
Gender (females)	4,237 (30.2%)
Mean age in years (SD)	33.53 (10.9)
Residence	
Capital city	7,626 (54.3%)
County towns	2,181 (15.5%)
Towns	2,950 (21.0%)
Villages	1,286 (9.2%)
Highest level of education	
Primary school degrees or less	361 (2.6%)
Vocational degree	559 (4.0%)
High school degree	4,470 (31.8%)
Degree of higher education (e.g., bachelors, masters or doctorate degree)	8,653 (61.6%)
Current education	
Studied in high school	410 (2.9%)
Studied in higher education	3,687 (26.3%)
Studied in other educational institute	934 (6.7%)
Did not study in any form of education	9,012 (64.2%)
Work status	
Full-time job	9,217 (65.6%)
Part-time job	1,413 (10.1%)
Casual job	1,175 (8.4%)
Did not have a job	2,238 (15.9%)
Marital status	
Single	3,259 (23.2%)
In a relationship	6,049 (43.1%)
Engaged	569 (4.1%)
Married	3,496 (24.9%)
Divorced	392 (2.8%)
Widow/widower	67 (0.5%)
Other	211 (1.5%)
Children	
No child	9,564 (68.1%)
One child	1,431 (10.2%)
Two children	2,074 (14.8%)
Three children	728 (5.2%)
Four children	183 (1.3%)
Five children	37 (0.3%)
Six or more children	26 (0.1%)
Sexual orientation	
Heterosexual	11,626 (82.8%)
Heterosexual with homosexuality to some extent	1,419 (10.1%)
Bisexual	388 (2.8%)
Homosexual with heterosexuality to some extent	100 (0.7%)
Homosexual	389 (2.8%)
Asexual	16 (0.1%)
Unsure	70 (0.5%)
"Other"	35 (0.2%)

Note. SD = standard deviation.

VI/2.2. Measures

ADHD Self-Report Scale (ASRS) (Adler et al., 2006; Bitter, Simon, Bálint, Mészáros, & Czobor, 2010). The six-item screener version of the ASRS were used to assess adult ADHD symptoms (e.g., "How often do you feel overly active and compelled to do things, like you were driven by a motor?"). Participants indicated their answers on a seven-point Likert scale (0 = never; 4= very often) regarding the last six months. The internal consistency of the scale was rather low in the present study (α = .66), but it demonstrated excellent reliability in terms of specificity, sensitivity and accuracy in previous examinations (Kessler et al., 2005). Reliability may vary as a result of the number of items (i.e., having a small number of items may result in lower reliability; (Cortina, 1993), particularly when the items cover broad constructs which is the case for the ASRS. Therefore, composite reliability (CR) was calculated because it better represents the construct as it takes into account the factor loadings with their respective measurement errors (Dunn, Baguley, & Brunsden, 2014; McNeish, 2018) and it showed acceptable reliability (CR = .68).

Problematic Pornography Consumption Scale (PPCS) (Bőthe, Tóth-Király, Zsila, et al., 2018). PPCS assesses problematic pornography use via six factors based on the six-component addiction model (Griffiths, 2005). It includes three items relating to each factor: salience (e.g., "I felt that porn is an important part of my life."; α = .81), tolerance (e.g., "I felt that I had to watch more and more porn for satisfaction."; α = .77), mood modification (e.g., "I used porn to restore the tranquility of my feelings."; α = .85), relapse (e.g., "I unsuccessfully tried to reduce the amount of porn I watch."; α = .92), withdrawal (e.g., "I became agitated when I was unable to watch porn."; α = .84), and conflict (e.g., "Watching porn prevented me from bringing out the best in me."; α = .78). Participants indicated their answers on a seven-point Likert scale (1 = never; 7 = very often) regarding the last six months. A total of 76 points or more indicate possible problematic pornography use.

Hypersexual Behavior Inventory (HBI) (Bőthe, Kovács et al., 2018; Reid, Li, et al., 2011). HBI assesses hypersexual urges, fantasies and behaviors with 19 items via three factors based on the proposed criteria of Hypersexual Disorder (Kafka, 2010): coping (e.g., "Doing something sexual helps me feel less lonely."; seven items, α = .87), control (e.g., "Even though my sexual behavior is irresponsible or reckless, I find it difficult to stop."; eight items, α = .82), and consequences (e.g., "My sexual thoughts and fantasies distract me from accomplishing important tasks."; four items, α = .75).

Participants indicated their answers on a five-point Likert scale (1 = never; 5 = very often). Although a total of 53 points was suggested as a cutoff score based on preliminary results (Reid & Garos, 2007), a reliably cutoff score could not be established in a recent large-scale psychometric study (Bőthe, Kovács et al., 2018).

Sexuality and pornography related questions (Bőthe, Bartók et al., 2018). Besides the aforementioned scales and standard demographic questions (e.g., gender, age, place of residence), additional questions were applied to assess the participants' number of sexual partners in their lifetime, the frequency of having sex with their partner (if they had a partner), the frequency of masturbation and the frequency of pornography use. Participants indicated the frequency of having sex with their partner, their frequency of masturbation and their frequency of pornography consumption over the past year on a 10-point scale (1 = "never", 10 = "6 or 7 times a week"). Participants indicated their number of lifetime sexual partners on 16-point scale (1 = "0 partners", 16 = "more than 50 partners").

VI/2.3. Statistical Analyses

SPSS 21 and Mplus 7.3 were employed to conduct statistical analysis (Muthén, L. & Muthén, 2012). Normality was assessed by the examination of skewness and kurtosis values. Reliability was calculated using Cronbach's alpha (Nunnally, 1978). However, due to its potentially decreased appropriateness (Sijtsma, 2009), one additional index was calculated when the Cronbach alpha coefficient was not acceptable (i.e., composite reliability - CR). The CR was applied because it may better represent the construct as it takes into account the factor loadings with their respective measurement errors, which was computed based on the formula of Raykov (Raykov, 1997) (> .60 acceptable, > .70 good; (Bagozzi & Yi, 1988)). Structural equation modeling (SEM) was performed to investigate the associations between self-reported ADHD symptoms, hypersexuality and problematic pornography use. Items were treated as categorical indicators, because they had significant floor effects (based on kurtosis and skewness). Consequently, the mean- and variance-adjusted weighted least-squares estimator (WLSMV) was applied (Finney & DiStefano, 2006). Commonly used goodness-of-fit indices [9] were to assess the acceptability of the examined models: Comparative Fit Index (CFI; ≥ .90 for acceptable), Tucker–Lewis index (TLI; ≥ .90 for acceptable), and Root-Mean-Square Error of Approximation (RMSEA; ≤. 08 for acceptable) with a 90% confidence interval (Bentler, 1990; Brown, 2015; Browne &

Cudeck, 1993; Hu & Bentler, 1999; Kline, 2011; Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2001).

VI/3. RESULTS

Descriptive statistics and correlations between self-reported ADHD symptoms, hypersexuality, problematic pornography use, and sexuality and pornography related questions can be seen in VI/Table 2. According to the examined correlations, number of sexual partners, frequency of having sex with one's partner, frequency of masturbation and frequency of pornography viewing had negligible associations with ADHD symptoms (rs < |.15|), thus, these variables were not included in the models for the sake of simplicity.

With the utilization of structural equation modeling, the associations between ADHD symptoms, hypersexuality and problematic pornography use were investigated on the total sample and separate male and female models. The models with standardized estimates are shown in Figure 1.

The fit indices were acceptable in all models and all pathways were significant at $p < .01$. In the *total sample model* (CFI = .928, TLI = .923, RMSEA = .058 [90% CI .058-.059]), the level of ADHD symptoms was related positively and moderately to both hypersexuality and problematic pornography use (β = .47 [95% CI .447-.487] and β = .36 [95% CI .338-.378], respectively). The proportion of explained variance was 22% for hypersexuality and 13% for problematic pornography use.

In the *male sample model* (CFI = .913, TLI = .908, RMSEA = .064 [90% CI .064-.065]), the level of ADHD symptoms was related positively and moderately to both hypersexuality and problematic pornography use (β = .50 [95% CI .475-.520] and β = .45 [95% CI .428-.472], respectively). The proportion of explained variance was 25% for hypersexuality and 20% for problematic pornography use.

In the *female sample model* (CFI = .928, TLI = .923, RMSEA = .045 [90% CI = .044-.046]), the level of ADHD symptoms was related positively and moderately to hypersexuality (β = .43 [95% CI .388-.466]) and positively but weakly to problematic pornography use (β = .26 [95% CI .216-.298]). The proportion of explained variance was 18% for hypersexuality and 7% for problematic pornography use.

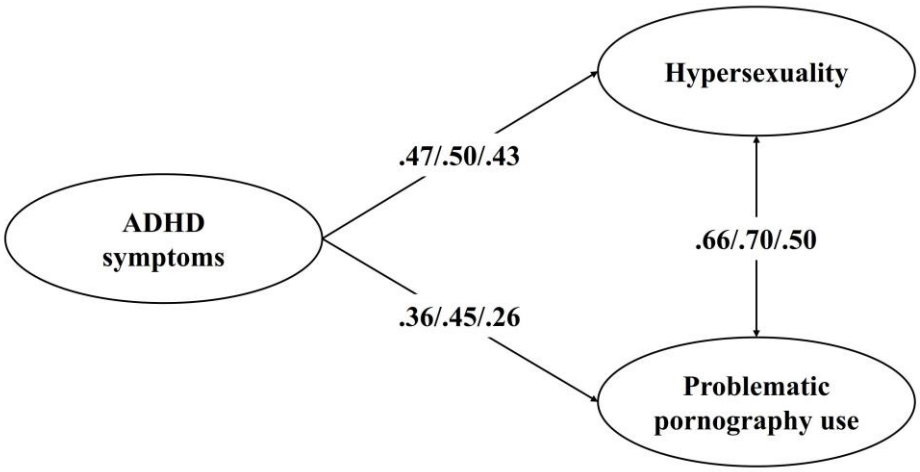
When comparing the associations of ADHD symptoms and hypersexuality and the associations of ADHD symptoms and problematic pornography use from a statistical perspective, all standardized regression coefficients were significantly

different in all models. However, when we took into consideration the effect sizes and the explained variances, notable differences could be identified between genders. In the case of men, both hypersexuality and problematic pornography use had a positive, moderate association with ADHD symptoms explaining approximately 20-25% of the variance in each case. However, in the case of women, hypersexuality also had a positive, moderate association with ADHD symptoms explaining 18% of the variance, while problematic pornography use had a positive, but weak association with ADHD symptoms explaining only 7% of the variance. Thus, similar associations could be observed between ADHD symptoms, hypersexuality and problematic pornography use among men, while marked differences were identified among women.

VI/Table 2. Descriptive statistics and correlations between the self-reported ADHD symptoms, hypersexuality, problematic pornography use and sexuality-related questions

Scales	Skewness (SE)	Kurtosis (SE)	Range	M (SD)	1	2	3	4	5	6
1. ADHD Self-Report Scale total	0.14 (0.02)	-0.16 (0.04)	0-4	1.65 (0.69)	—					
2. Hypersexual Behavior Inventory total	1.25 (0.02)	1.90 (0.04)	1-5	1.77 (0.57)	.33**	—				
3. Problematic Pornography Consumption Scale total	1.61 (0.02)	2.57 (0.04)	1-7	1.93 (1.01)	.26**	.58**	—			
4. Number of sexual partners	0.02 (0.02)	-1.31 (0.04)	1-16[a]	8.40 (4.32)	-.05**	.11**	-.02*	—		
5. Frequency of having sex with one's partner	-1.06 (0.02)	1.28 (0.04)	1-10[b]	7.04 (1.80)	.02*	-.06**	-.10**	.02	—	
6. Frequency of masturbation	-0.78 (0.02)	0.22 (0.04)	1-10[b]	7.14 (2.12)	.13**	.29**	.41**	.04**	-.11**	—
7. Frequency of online pornography viewing	-0.51 (0.02)	-0.69 (0.04)	1-10[b]	6.55 (2.47)	.09**	.26**	.51**	.05**	-.07**	.64**

Note. M = mean; SD = standard deviation; SE = standard error; [a] 1 = 0 partner; 2 = 1 partner; 3 = 2 partners; 4 = 3 partners; 5 = 4 partners; 6 = 5 partners; 7 = 6 partners; 8 = 7 partners; 9 = 8 partners; 10 = 9 partners; 11 = 10 partners; 12 = 11–20 partners, 13 = 21–30 partners; 14 = 31–40 partners; 15 = 41–50 partners; 16 = more than 50 partners; [b] 1 = never; 2 = once in the last year; 3 = 1–6 times in the last year; 4 = 7–11 times in the last year; 5 = monthly; 6 = two or three times a month; 7 = weekly; 8 = two or three times a week; 9 = four or five times a week; 10 = six or seven times a week; *$p < .05$; **$p < .001$



VI/Figure 1. The associations of ADHD symptoms with hypersexuality and problematic pornography use. *Note*. All variables presented in ellipses are latent variables. For the sake of clarity, indicator variables related to them are not depicted in this figure. One-headed arrows represent standardized regression weights and two-headed arrows represent correlations. Numbers on the arrows indicate the path coefficients (total, male and female sample, respectively). All pathways were significant at level $p < .01$.

VI/4. DISCUSSION

Problematic pornography use is often considered as one of the most prevalent manifestations of hypersexuality (Kafka, 2010; Reid, Carpenter, et al., 2012; Wéry & Billieux, 2016; Wordecha et al., 2018), but recent findings suggest that pornography use may not be a core element of hypersexuality and essential differences may be observed in their psychological background as well (Bőthe, Tóth-Király, Potenza, et al., 2018; Reid, Carpenter, et al., 2012; Werner et al., 2018; Wéry et al., 2016). Besides mood disorders and anxiety disorders, ADHD showed the highest psychiatric comorbidity with hypersexuality among treatment seeking men (Kraus et al., 2016; Reid et al., 2013); but in the case of problematic pornography use, the comorbidity rate of ADHD among treatment seeking men was 3% (Kraus et al., 2015). These results suggest that ADHD symptoms may potentially show differences in association with hypersexuality and problematic pornography use. Therefore, the aims of the present study were to, for the first time, simultaneously examine the severity of self-reported ADHD symptoms in

relation to hypersexuality and problematic pornography use focusing on the potential dissimilarities among both genders.

Using a large-scale, non-clinical sample, the associations between ADHD symptoms and hypersexuality and problematic pornography use were positive and moderate. When taking into consideration gender, the association between ADHD symptoms and hypersexuality remained the same effect size regardless gender. At the same time, the association between ADHD symptoms and problematic pornography use was stronger in the case of men, while it was weaker in the case of women. In sum, ADHD symptom severity may play similar roles in hypersexuality and problematic pornography use in the case of men, while in the case of women, it is more likely that ADHD symptoms would rather contribute to hypersexuality than to problematic pornography use. Moreover, the present findings further corroborated previous results (Werner et al., 2018; Wéry et al., 2016) that problematic pornography use may not be unequivocally considered as a manifestation of hypersexuality as different mechanisms may lead to the appearance of hypersexuality and problematic pornography use (Bőthe, Tóth-Király, Potenza, et al., 2018).

These results are in line with previous studies where the antecedents and consequences of problematic pornography use were investigated across gender (Gola et al., 2016; Lewczuk et al., 2017). For example, in the case of men, treatment seeking was directly associated with the amount of pornography use and indirectly via subjective religiosity and negative symptoms (Gola et al., 2016). While in the case of women, treatment seeking was not directly associated with the amount of pornography use, it only had indirect associations with treatment seeking via religious practices and negatives symptoms (Lewczuk et al., 2017). But it has to be mentioned that other studies did not find gender differences in the associations of impulsivity and compulsivity with respect to hypersexuality and problematic pornography use (Bőthe, Tóth-Király, Potenza, et al., 2018). In line with previous studies (Gola et al., 2016; Lewczuk et al., 2017) and based on the results of the present study, different mechanisms could lead to problematic pornography use in the case of men and women, suggesting that the examination of problematic pornography use among both gender and the investigation of the possible differences between different excessive sexual behaviors might be fruitful.

VI/4.1. Potential explanations of the differentiated relationship patterns of ADHD symptoms, hypersexuality, and problematic pornography use

Previous studies that examined the associations of ADHD symptoms and hypersexuality were carried out among men seeking treatment for hypersexuality (Blankenship & Laaser, 2004; Kafka & Hennen, 2002; Reid, 2007; Reid, Carpenter, et al., 2011) supposedly because ADHD is twice as prevalent among men than women (Association, 2013) and the estimated prevalence of hypersexuality is higher among men than women (Montgomery-Graham, 2017; Stewart & Fedoroff, 2014; Walton, Cantor, Bhullar, et al., 2017). Thus, previous studies searching for the possible explanations of the associations of ADHD symptoms and hypersexuality did not take into consideration possible gender differences.

With respect to hypersexuality, negligible differences could be observed between men and women when in relation to the associations of ADHD symptoms and hypersexuality. In both cases, the severity of self-reported ADHD symptoms had a positive, moderate association with the level of hypersexuality. These results are in line with previous findings in which positive, weak-to-moderate associations were identified between hypersexuality severity and ADHD symptoms among treatment seeking men (Reid, Carpenter, et al., 2011). Individuals with high levels of ADHD symptoms may experience prolonged social rejection, loneliness and difficulties in completing tasks or obligations (e.g., education or work), which in turn may lead to higher levels of stress and negative emotions (de Boo & Prins, 2007; Paulson et al., 2005; Reid et al., 2013; Solanto et al., 2008). In these cases, hypersexuality may appear as an answer to these negative experiences because hypersexuality can be considered as a maladaptive coping strategy when individuals experience stress or negative emotions (Kafka, 2010; Paul & Shim, 2008; Reid, Li, et al., 2011). Along with previous studies, the present findings support the “self-medication” theory as individuals experiencing ADHD symptoms may turn to drugs or sexual behaviors to reduce or eliminate stress and negative feelings (Gudjonsson et al., 2012; Reid, Carpenter, et al., 2011; Reid et al., 2013; Wilens et al., 2007). Based on the present results, this self-medication hypothesis may be true in the case of men and women as well.

As for problematic pornography use, a more differentiated pattern can be observed regarding the associations of self-reported ADHD symptom severity and the level of problematic pornography use. Among men, ADHD symptoms and problematic pornography use had a positive, moderate association with the strength being highly

similar to the strength of the association of ADHD symptoms and hypersexuality. These results suggest that men may also engage in pornography use (in a problematic manner) to alleviate the symptoms of ADHD and the related stress and negative emotions (Gudjonsson et al., 2012; Paulson et al., 2005; Reid, Carpenter, et al., 2011; Reid et al., 2013). However, in the case of women, other explanation may be taken into account why the association between ADHD symptoms and problematic pornography use was weak. It is possible that women may not choose pornography as a way to reduce their stress and negative feelings deriving from ADHD symptoms, but engage in other types of sexual behaviors (e.g., sex with romantic partner or casual partners). This explanation may be plausible as pornography use is more normative among men than women (Grubbs, Kraus et al., 2018; Hald, 2006; Rissel et al., 2017). However, this hypothesis needs to be tested as no previous studies have investigated the prevalence of different excessive sexual behaviors among women.

It is also likely that the feeling of problematic pornography use may have different antecedents among men and women. As it was mentioned previously, among women, treatment seeking for problematic pornography use was directly related to religious practices, while in the case of men, it was not related when complex models were tested (Gola et al., 2016; Lewczuk et al., 2017). To summarize, notable differences may be identified regarding problematic pornography use among men and women not only in the case of frequency of use or prevalence of problematic use (Grubbs et al., 2018; Hald, 2006; Rissel et al., 2017), but with respect to the psychological mechanisms that can lead to problematic pornography use (Gola et al., 2016; Lewczuk et al., 2017).

VI/4.2. Clinical implications of the present findings

From the perspective of ADHD and its diagnosis, it is possible that if only ADHD symptoms are assessed, individuals with hypersexuality may report higher levels of ADHD-like symptoms. For example, they are often preoccupied with sexuality-related thoughts that may distract their attention from their tasks and obligations, thus, they report high levels of inattention or they report inattentiveness not as a result of sustained attention difficulties, but because of sleep deprivation (Reid et al., 2013). Therefore, on the basis of previous findings (Blankenship & Laaser, 2004; Kafka & Hennen, 2002; Reid, Carpenter, et al., 2011) and the present results, in clinical practice and in future research, not only the level of ADHD symptoms should be assessed, but clinical interviews and/or assessments are needed to uncover whether the

symptoms are only related to hypersexuality (i.e., symptoms are not generalized to other aspects of functioning) or whether they were present before the onset of hypersexuality (Reid et al., 2013).

From the perspective of hypersexuality, among individuals seeking treatment for hypersexuality, not only mood and anxiety disorders showed high comorbidity, but substance use was also highly comorbid (Kraus et al., 2016). Thus, ADHD may be considered as a mutual background for these problematic behaviors considering the "self-medication" hypothesis (Gudjonsson et al., 2012; Paulson et al., 2005; Reid, Carpenter, et al., 2011; Reid et al., 2013). Thus, in clinical practice, when individuals seek treatment for hypersexuality with comorbid substance use, clinicians and therapists should also assess ADHD symptoms as hypersexuality and substance use may be only the symptoms of the "real" problem, ADHD. To summarize, in the case of individuals seeking treatment for hypersexuality (or men seeking treatment for problematic pornography use), it would be beneficial to examine not only the potentially comorbid mood disorders, anxiety disorders and substance use, but ADHD as well because these disorders may derive from ADHD.

VI/4.3. Limitations and future studies

Some limitations of the present investigation have to be discussed. The present study applied self-report scales and cross-sectional methods that may lead to possible biases distorting the results. Despite it is suggested that ADHD symptoms develop in childhood and can maintain during adulthood, causality could not be inferred from the present findings. As self-report scales were applied without clinical diagnosis, only the associations of ADHD symptoms, hypersexuality and problematic pornography use could be examined without establishing comorbidity rates. The ASRS demonstrated slightly lower internal consistency than the suggested threshold in the present study presumably as a result of administering a wide range of symptoms with relatively low number of items (Cortina, 1993). However, along with previous clinical results (Kessler et al., 2005), other indices of reliability and structural validity (i.e., composite reliability and confirmatory factor analysis) demonstrated that the ASRS can be considered as a reliable measure of ADHD symptoms in the present study. Therefore, the six-item ASRS may be used in future large-scale studies to assess the self-reported severity of ADHD symptoms. The dropout rate was high that may also affect the findings (e.g., religious individuals may quit the survey before answering to sexuality-related

questions; however, religiosity-related questions were not included in the present study, thus, this assumption could not be tested). Although the sample covered a wide range of respondents, it was not representative in nature and only examined those who used the Internet. Also, the survey covered a wide range of topics leading to long response time which may contribute to the rather high dropout rate. Moreover, participating in the research was voluntary, thus, those individuals who were not interested in the topic of the survey might have declined participation. Future studies may apply various research methods to assess not only self-reported severity of ADHD symptoms, but clinical diagnosis as well.

As several hypotheses are suggested how ADHD symptoms may result in hypersexuality and/or in problematic pornography use (Reid, Carpenter, et al., 2011; Reid et al., 2013), the examination of complex models are necessary to test these assumptions. Moreover, the potential common biological background of ADHD and hypersexuality deserves more scientific attention (Reid et al., 2013). Along with further cross-sectional studies, longitudinal methods might be applied to examine the natural course of the development of ADHD and investigate when and how hypersexuality and/or problematic pornography use may appear. The self-medication hypothesis should also be tested regarding hypersexuality and problematic pornography use simultaneously with other problematic behaviors that were previously associated with ADHD (Gudjonsson et al., 2012; Wilens et al., 2007). Also, diary studies (Wordecha et al., 2018) or cross-sectional studies may be fruitful to identify whether experiencing stronger or more severe ADHD symptoms results in more severe manifestations of hypersexuality or potential mediator and/or moderator variables has to be taken into account.

VI/5. CONCLUSIONS

Despite some limitations (e.g., using self-reported cross-sectional methods), the present findings suggest that ADHD symptoms may play a differentiated role in the severity of hypersexuality and problematic pornography use, especially in the case of women. A better understanding of the similarities and possible differences between the psychological background of problematic pornography use and hypersexuality considering potential gender differences may help to develop improved diagnosis and treatment for different types of excessive sexual behaviors.

VII. GENERAL DISCUSSION

The present chapter summarizes and reflects on the findings of the present dissertation in general. It includes the main findings of the five studies, the theoretical and practical implications and the limitations of the present studies. Then, it closes with proposed future directions in hypersexuality and problematic pornography use research and with the main conclusions of the findings.

VII/1. BRIEF SUMMARY

Hypersexuality and problematic pornography use research has started to flourish in the past decades (for detailed reviews, see Karila et al., 2014; Kingston & Firestone, 2008; Montgomery-Graham, 2017; Wéry & Billieux, 2017). However, there are still several unanswered questions in the literature that deserves scientific attention. The present dissertation aimed to address some of the controversies in the problematic sexual behaviors (i.e., hypersexuality and problematic pornography use) research by investigating the similarities and dissimilarities of hypersexuality and problematic pornography use from the perspective of impulsivity, compulsivity and ADHD symptoms.

Both the Hypersexual Behavior Inventory (HBI) and the Problematic Pornography Consumption Scale (PPCS) showed strong psychometric properties suggesting that these measurement tools can be reliably and validly use to assess the level of hypersexuality and problematic pornography used in general populations (*Study 1-3*). Both similarities and dissimilarities were demonstrated regarding the associations of hypersexuality and problematic pornography use in relation to transdiagnostic features (i.e., impulsivity and compulsivity) and psychiatric comorbidity (i.e., ADHD symptoms). Hypersexuality and problematic pornography use showed similar relationship patterns in relation to compulsivity among both gender, while they demonstrated differences in relation to impulsivity and ADHD symptoms (*Study 4-5*). A brief summary and the main results of the present findings can be seen in VII/Table 1.

VII/Table 1. Brief summary of the studies the present dissertation is based on

Study	Running title	Aims	Main findings
1	Psychometric properties of the Hypersexual Behavior Inventory (HBI)	(1) Examination of the factor structure and reliability of the HBI in a large, nonclinical sample. (2) Determination of a cutoff score for the HBI.	(1) The three-factor, first-order model of the HBI is a valid and reliable measure in terms of structural validity, relevant correlates, and reliability as well. (2) On the basis of latent profile analysis, sensitivity, specificity, positive predictive value, negative predictive value and accuracy, it was not possible to determine a reliable cutoff score for the HBI.
2	Gender and sexual orientation-based differences on the Hypersexual Behavior Inventory (HBI)	(3) Investigation of whether men and women, or heterosexual and LGBTQ individuals respond to the HBI similarly or whether they have gender- or sexual orientation-based differences in their response patterns.	(3) When gender and sexual orientation were considered together, the latent means of LGBTQ men were significantly higher than the other groups' means on the HBI (i.e., heterosexual men, LGBTQ women, and heterosexual women). Moreover, LGBTQ men and LGBTQ women had significantly higher latent means on the coping factor of the HBI than heterosexual men and heterosexual women.
3	Psychometric properties of and gender-based differences on the Problematic Pornography Consumption Scale (PPCS)	(4) Development of a theory-based, psychometrically strong scale that can reliably and validly assess problematic pornography use. (5) Investigation of whether men and women respond to the PPCS similarly or whether they have gender-based differences in their response patterns. (6) Determination of a cutoff score for the PPCS.	(4) The six-factor, second-order model of PPCS is a valid and reliable measure in terms of structural validity, relevant correlates, and reliability. (5) When gender was considered, high levels of invariance were demonstrated across gender indicating that gender based comparisons are meaningful. (6) Based on latent profile analysis, sensitivity, specificity, positive predictive value, negative predictive value, and accuracy, a score of 76 points was suggested as an optimal cutoff to be classified as problematic pornography user.

4	Impulsivity and compulsivity in relation to hypersexuality and problematic pornography use	(7) Simultaneous examination of impulsivity and compulsivity in association with hypersexuality and problematic pornography use in a large, nonclinical sample with taking into consideration possible gender differences.	(7) Based on the results of structural equation modeling, impulsivity was moderately and positively related to hypersexuality, while compulsivity was only weakly related to it, suggesting that impulsivity contributes more strongly to hypersexuality than compulsivity in both men and women. However, impulsivity and compulsivity related only weakly and positively to problematic pornography use among both genders.
5	ADHD symptoms in relation to hypersexuality and problematic pornography use	(8) Simultaneous examination of ADHD symptoms in association with hypersexuality and problematic pornography use in a large, nonclinical sample with taking into consideration possible gender differences.	(8) Based on the results of structural equation modeling, ADHD symptoms were positively and moderately related to hypersexuality among both men and women. Regarding men, ADHD had a positive, moderate association with problematic pornography use, while ADHD had a positive, but weak association with problematic pornography use in the case of women.

Note. LGBTQ = Lesbian, Gay, Bisexual, Transgender, and Queer Communities; ADHD = Attention Deficit Hyperactivity Disorder.

VII/2. MAIN FINDINGS OF THE PRESENT STUDIES

In the following, the main findings of the present investigation are described. First, the results of the validation and adaptation studies are discussed (*Study 1-3*) focusing on the main results and main conclusion. Then, the findings of the models examining the background of hypersexuality and problematic pornography use are presented (*Study 4-5*) highlighting the potential differences between hypersexuality and problematic pornography use in terms of impulsivity, compulsivity and ADHD symptoms.

VII/2.1. Adaptation and Validation of Scales to Assess Hypersexuality and Problematic Pornography Use

Despite that Hypersexual Behavior Inventory was validated on a clinical sample of treatment seeking men (Reid et al., 2011), it demonstrated adequate reliability and validity on a nonclinical, diverse sample in the present study in line with previous studies also applying diverse samples (Klein et al., 2014; Yeagley et al., 2014). Although the HBI was developed on the basis of Kafka's (2010) proposed diagnostic criteria for HD, and showed strong psychometric properties in the present study and in previous studies as well (Klein et al., 2014; Reid et al., 2011; Yeagley et al., 2014), a reliable cutoff score could not be determined in Study 1. Several possible explanations can be considered, but only the most important ones are mentioned here. First, latent profile analysis resulted in a seven-class solution which was statistically adequate, but it did not differentiate reliably between hypersexual individuals based on the severity of hypersexuality. Second, given the potentially low prevalence of hypersexuality in the general population, it is possible to achieve high sensitivity and specificity, but the ratio of false positive cases will be high, leading to a low positive predictive value (Maraz et al., 2015). Third, the coping factor of HBI did not differentiate adequately between the seven classes emerging in latent profile analysis, presumably as a result of that the coping factor is rather a motivational factor and it is not so strongly related to the severity of the problem (see Reid, 2015). To conclude, HBI is a reliable and valid measure to assess the levels of hypersexuality not only in clinical male populations (e.g., Reid et al., 2011), but in general, more diverse populations as well. Although a reliable cutoff score could not be determined, the HBI may be used as a first step of the diagnostic process of hypersexuality, as it can rule out hypersexuality (Streiner, 2003).

Both hypersexuality among women and among sexual minority groups are understudied topics in the field of problematic sexual behaviors (e.g., Dhuffar & Griffiths, 2016; Montgomery-Graham, 2017; Reid et al., 2011; Yeagley et al., 2014). In Study 2, the HBI showed strong psychometric properties again in terms of factor structure and measurement invariance. However, when both gender and sexual orientation were considered, latent mean invariance was not achieved: LGBTQ men had significantly higher scores on all the HBI dimensions and on other possible indicators of hypersexuality as well, while LGBTQ women also had higher scores on the coping factor of the HBI. It is suggested that LGBTQ individuals experience more negative emotions as a result of their sexual orientation (e.g., homophobia; stigmatization), thus, it is possible that they engage in sexual behaviors to reduce these negative feelings and emotions (Grubbs et al., 2017; Montgomery-Graham, 2017; Muench & Parsons, 2004; Parsons et al., 2008). Moreover, it has to be noted that LGBTQ men also reported higher scores on possible indicators of hypersexuality (e.g., frequency of masturbation, number of sexual partners) than individuals in the other groups, but these results cannot only indicate higher levels of hypersexuality, but they can also be considered as manifestations of high sexual desire (e.g., Starks et al., 2013; Stulhofer, Jurin, & Briken, 2016). In sum, LGBTQ men are the most at risk population to develop hypersexuality, but LGBTQ women are also at risk possible as a result of coping problems. The characteristics of sexual life (e.g., frequency of sexual activities) were not proved to be reliable indicators of hypersexuality without taking into consideration the related negative affects and the consequences of the given behavior.

Pornography use is arguably the most studied behavior in relation to hypersexuality, but previously, no theory-based scale existed that could reliably and validly assess the level of problematic pornography use (Short et al., 2012). In Study 3, the Problematic Pornography Consumption Scale was developed on the basis of the six-component addiction model (Griffiths, 2005) that was previously successfully applied in the case of other problematic online behaviors or behavioral addictions (e.g., Andreassen et al., 2012; Bányai et al., 2017; Orosz, Bőthe, et al., 2016, Orosz, Tóth-Király, et al., 2016). The PPCS demonstrated strong psychometric properties not only in factor structure, reliability and validity, but measurement invariance was established among gender indicating that gender-based comparisons are meaningful. Based on latent profile analysis, three groups of pornography users were identified with one consisting of at-risk pornography users. Using the at-risk pornography users group as a

gold standard, 76 points was suggested as an optimal cutoff score with excellent sensitivity, specificity, accuracy, positive predictive value and negative predictive value. These results indicate that the PPCS can reliably and validly assess not only the level of problematic pornography use among both men and women, but it may differentiate between non-problematic and at-risk pornography users as well.

To summarize the findings of *Study 1-3*, the Hypersexual Behavior Inventory and the Problematic Pornography Consumption Scale did not only demonstrate strong psychometric properties in terms of reliability and validity, but they had solid theoretical backgrounds as well. Thus, the HBI and PPCS can be applied in future studies among diverse populations to assess the level of hypersexuality and problematic pornography use.

VII/2.2. Impulsivity and Compulsivity in relation to Hypersexuality and Problematic Pornography Use

Despite Compulsive Sexual Behavior Disorder is now included in the ICD-11 (World Health Organization, 2018), the classification of hypersexuality and problematic pornography use is still controversial and debated in the literature (e.g., Griffiths, 2016; Kraus et al., 2016; Potenza et al., 2017). Based on the results of Study 4 examining the impulsivity and compulsivity background of hypersexuality and problematic pornography use, compulsivity had only weak, but positive associations with both hypersexuality and problematic pornography use indicating that general compulsivity may not play an important role in these problematic sexual behaviors. However, impulsivity can be considered as an important predictor of hypersexuality given their moderate positive association in both genders, while in the case of problematic pornography use, impulsivity also showed positive, but only weak association with it.

Thus, the present study supported both the notions that hypersexuality could be classified as an impulse-control disorder or as a behavioral addiction. However, when taking into consideration neurobiological data (see the recent reviews of Kowalewska et al., 2018 and Stark et al., 2018) and the central elements of other disorders that are classified as impulse-control disorders (e.g., kleptomania) or addictive behaviors (e.g., gambling disorder), the classification of hypersexuality as an addictive behavior appears to be better supported. However, the classification problematic pornography use appears to be more difficult as the present results suggest that problematic pornography use may differ from hypersexuality. It is possible that impulsivity may have a stronger

association with problematic pornography use via mediating variables, such as pornography use motivations (Reid et al., 2011), pornography use frequency (Carroll et al., 2008), or self-efficacy regarding different aspects of pornography use (e.g., reducing pornography use – Kraus et al., 2015; avoiding possibly tempting situations – Kraus et al., 2017). However, it is also possible that the role of impulsivity and compulsivity in problematic pornography use has been overestimated as no single personality traits may result in problematic behaviors (e.g., Conway et al., 2003; Griffiths, 2017; Kerr, 1996; Szalavitz, 2016). To conclude, hypersexuality and problematic pornography use demonstrated similarities with respect to their associations with compulsivity, but dissimilarities can be observed regarding their associations with impulsivity. Thus, considering specific forms of problematic sexual behaviors would be important because different individuals with different temperamental features may be vulnerable to different types of problematic sexual behavior.

VII/2.3. ADHD Symptoms in relation to Hypersexuality and Problematic Pornography Use

Besides mood disorders and anxiety disorders, ADHD showed the highest psychiatric comorbidity with hypersexuality among treatment seeking men in previous studies (Kraus et al., 2016; Reid, Davtian et al., 2013). However, with respect to problematic pornography use, only one study assessed its association to ADHD reporting a comorbidity rate of 3% among treatment seeking men (Kraus et al., 2015). These results indicate that ADHD symptoms may potentially show differences in relation to hypersexuality and problematic pornography use. Based on the present findings, utilizing a large-scale, non-clinical sample, the associations between ADHD symptoms and hypersexuality and problematic pornography use were positive and moderate in general. When taking into consideration gender, the association between ADHD symptoms and hypersexuality severity remained the same effect size in both genders. Regarding problematic pornography use, its association with ADHD symptoms was stronger in the case of men, whereas it was weaker in the case of women.

Therefore, self-reported ADHD symptom severity may play similar roles in hypersexuality and problematic pornography use in the case of men, while in the case of women, it is more likely that ADHD symptoms would rather contribute to hypersexuality than to problematic pornography use. It is possible that women may not choose pornography as a way to cope with or reduce their stress and negative feelings

deriving from ADHD symptoms, but they rather engage in other types of sexual behaviors (e.g., sex with romantic partner or casual partners). This explanation may be plausible as pornography use is more normative among men than women (Grubbs, Kraus, et al., 2018; Hald, 2006; Rissel et al., 2017). As for the similarities and dissimilarities of hypersexuality and problematic pornography use, the present findings in support of the previous results (Werner et al., 2018; Wéry & Billieux, 2016) that problematic pornography use may not be unambiguously considered as a manifestation of hypersexuality as different social and psychological mechanisms may lead to the development and maintenance of hypersexuality and problematic pornography use especially when considering gender differences (Gola, Lewczuk et al., 2016; Lewczuk et al., 2017).

VII/3. IMPLICATIONS OF THE PRESENT DISSERTATION

VII/3.1. Theoretical Implications

The present investigation aimed to answer some theoretical questions related to hypersexuality and problematic pornography use that are currently gaining more and more scientific attention (e.g., components/manifestations of hypersexuality - Kafka, 2010; Reid, Carpenter, et al., 2012; Werner et al., 2018; Wéry et al., 2016; Wordecha et al., 2018, classification of hypersexuality and problematic pornography use – e.g., Gola et al., 2017; Grant et al., 2014; Kraus et al., 2018; Potenza et al., 2017; Stein et al., 2016). However, the present dissertation also raised further issues that need to be answered in future research (e.g., associations of other excessive or problematic sexual behaviors in relation to impulsivity and ADHD symptoms).

First, results of Study 1 indicated that the coping factor of HBI may not differentiate reliably between individuals who experience and individuals who do not experience problems related to hypersexuality. Thus, it raised the question whether coping (using sexual activities to reduce stress and negative feelings and emotions) may be considered as a key domain of hypersexuality or rather it should be assessed as a potential motivational factor that is highly related to hypersexuality but not an essential criterion of it. In line with the present findings, the exclusion of the criteria related to stress and negative feelings and emotions from the ICD-11 diagnosis of CSBD (World Health Organization, 2018) (compared to the proposed diagnostic criteria of HD in DSM-5 – Kafka, 2010) is a welcomed alteration as it may contribute to a more accurate

diagnosis of hypersexuality without overpathologizing normal sexual behaviors (Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015).

Second, although several empirically valid and reasonable changes has been carried out to improve the diagnosis of hypersexuality in ICD-11 (e.g., distress based on moral judgement regarding sexual behaviors is not sufficient to meet the requirements of CSBD diagnosis – World Health Organization, 2018), some problems regarding the classification and nomenclature of hypersexuality should be mentioned here. As for classification, hypersexuality is now categorized as an impulse-control disorder in ICD-11 accompanied by other disorders as pyromania, kleptomania, and intermittent explosive disorder (World Health Organization, 2018). Although empirical results indicate positive, moderate associations between impulsivity and hypersexuality (Study 4, Pachankis et al., 2014; Reid et al., 2014), other empirical findings suggest that important characteristics of behavioral addictions also appear in hypersexuality (e.g., similar brain activity can be observed in hypersexuality as in substance abuse, pathological gambling or internet gaming disorder – Kowalewska et al., 2018; Love et al., 2015; Stark et al., 2018). Therefore, the reclassification of hypersexuality as an addictive disorder may be considered when revising ICD-11, such as it previously happened in the case of gambling. In DSM-IV-TR (American Psychiatric Association, 2000), pathological gambling was categorized as an impulse-control disorder, but it was later reclassified to the Substance-Related and Addictive Disorders in DSM-5 (American Psychiatric Association, 2013).

Third, as for the nomenclature of hypersexuality, Kafka (2010) describes several problems in relation to the names used to describe excessive sexual behaviors (e.g., sexual addiction, sexual impulsivity, or sexual compulsivity). In ICD-11, hypersexuality is included under the name of Compulsive Sexual Behavior Disorder, however, according to the results of the present study and previous findings (e.g., Carpenter et al., 2013; Kafka, 2015; Reid & Carpenter, 2009), hypersexuality is only weakly related to compulsivity, indicating that CSBD might not be the most appropriate term to refer to hypersexuality, thus, it might be revised in future versions of diagnostic manuals.

Fourth, the findings of the present investigation (Study 4 and Study 5), may not only question the classification of hypersexuality, but also lead to more questions regarding the categorization of problematic pornography use as well. On the one hand, hypersexuality and problematic pornography use showed dissimilarities in their relationship patterns with respect to impulsivity and ADHD symptoms. These results in

line with previous studies (Werner et al., 2018; Wéry et al., 2016) might suggest that problematic pornography use may not be best categorized under the umbrella of hypersexuality, but future research is needed to examine further similarities and dissimilarities between hypersexuality and problematic pornography use. On the other hand, problematic pornography use was positively, but weakly related to impulsivity in Study 4. These results may suggest that the categorization of problematic pornography use (especially problematic online pornography use) as an impulse control disorder–due to the fact that hypersexuality is currently classified as an impulse control disorder and problematic pornography use is considered as a manifestation of hypersexuality–may not be the most appropriate classification.

To conclude, the present five-study investigation may not only contribute to the ongoing debate regarding the classification and nomenclature-related problems in hypersexuality and problematic pornography use (Gola et al., 2017; Grant et al., 2014; Kowalewska et al., 2018; Kraus et al., 2018; Love et al., 2015; Potenza et al., 2017; Stark et al., 2018; Stein et al., 2016), but it may raise further questions regarding the etiology and development of both hypersexuality and problematic pornography use.

VII/3.2. Practical Implications

Beyond the theoretical implications, the practical implications of the present research should be mentioned. First, both the HBI and the PPCS demonstrated strong psychometric properties in terms of reliability and validity as well, indicating that these scale can be appropriate to assess the level of hypersexuality and problematic pornography use in general populations (Study 1-3). In the case of PPCS, a reliable cutoff score was determined that can be used to differentiate between potentially problematic users and non-problematic users. However, it has to be noted that the clinical validation of the PPCS has not been carried out yet. Regarding the HBI, a reliable cutoff score could not be determined as a result of low positive predictive value. Therefore, HBI can be used to assess the level of hypersexuality and to rule out the possibility of hypersexual disorder (Streiner, 2003), but it cannot be used to categorize people on the basis of HBI scores.

Thus, in the diagnostic process, a two-step evaluation process would be ideal. In the first step, self-report reliable and valid scales (such as the HBI or the PPCS) should be administered accompanied by several questions regarding sexual behaviors (e.g., frequency of pornography viewing, frequency of casual sexual relationships) to rule out

the possibility of hypersexuality or problematic pornography use. In the next step, if the aforementioned scales and questions suggest that hypersexuality and/or problematic pornography use may be present in the given individual's life, a thorough clinical interview should be conducted to determine whether the symptoms indicate hypersexuality and/or problematic pornography use in fact or other problems are present (e.g., moral incongruence regarding pornography use – Kraus & Sweeney, 2018). Moreover, it is also worth mentioning that according to the proposed diagnostic criteria for HD (Kafka, 2010), at least three criteria should have been met to be diagnosed with hypersexuality. However, in the description of CSBD in ICD-11, there is no suggestion regarding how many symptoms have to be met to be diagnosed with hypersexuality. This modification is in line with the results of Study 1 suggesting that hypersexuality may be considered as a continuum rather than distinct categories.

Second, LGBTQ men may be considered most at-risk, but LGBTQ women are also at risk of developing hypersexuality on the basis of the results of Study 2, possibly as a result of negative discrimination and obstacles forming romantic relationships (Montgomery-Graham, 2017; Muench & Parsons, 2004). LGBTQ individuals may use sexuality-related activities as a way of coping with negative feelings and emotions. Consequently, when considering therapeutic approaches in the treatment of individuals with hypersexuality (especially in the case of LGBTQ individuals), the promotion of negative emotion management and more adaptive coping strategies should be one focus. According to previous results (Hook et al., 2015; Reid, Bramen, et al., 2014; Reid, Temko et al., 2014), lower levels of mindfulness, self-compassion and self-forgiveness could be observed among individuals with hypersexuality further corroborating the indications that interventions focusing on emotion regulation, self-compassion or self-forgiveness (such as acceptance and commitment therapy) may be effective reducing hypersexuality (Grubbs et al., 2017; Van Gordon et al., 2016).

Third, from the perspective of interventions, it might be beneficial to develop interventions that focus on specific manifestations of problematic sexual behaviors (e.g., problematic pornography use) and tailored to specific groups (e.g., men versus women) as some dissimilarities have been observed between hypersexuality and problematic pornography use in Study 4-5. For example, in the case of problematic pornography use, neither impulsivity, nor compulsivity seem to play important roles (Study 4), thus, these domains may not be emphasized during the therapies or interventions. While in the case of hypersexuality, impulsivity may be a focus of therapy. Moreover, ADHD

symptoms may play a role in problematic pornography use only in the case of men, while these symptoms were related to hypersexuality in the case of both genders (Study 5). Considering these results simultaneously with previous studies (see Reid et al., 2013), both the inattention and the hyperactivity- and impulsivity-related symptoms of ADHD may contribute to hypersexuality. However, in the case of problematic pornography use, it could be assumed that inattentive symptoms may contribute to problematic pornography use. These assumptions are in agreement with previous studies indicating that boredom susceptibility or boredom reduction motivation may be a risk factor of developing problematic pornography use (e.g., Bőthe, Tóth-Király, Demetrovics, & Orosz, 2018; Chen et al., 2013; Grubbs et al., 2017; Paul & Shim, 2008; Rothman et al., 2015). In sum, differentiated mechanisms may lead to the development and maintenance of hypersexuality and problematic pornography use, thus, differentiated therapeutic approaches focusing on a specific problematic sexual behavior might be more effective in the treatment as well (e.g., Crosby & Twohig, 2016; Twohig & Crosby, 2010).

Fourth, from a diagnostic perspective, when individuals assessed for ADHD, hypersexuality-related measures (and problematic pornography use related measures in the case of men) should also be administered. In case of high levels of hypersexuality, it is possible that the given individual shows ADHD-like symptoms, such as inattention or difficulties in sustaining prolonged attention due to the intrusion of sexuality-related thoughts or fantasies or as a result of deprived sleeping (Reid, Carpenter et al., 2011; Reid, Davtian et al., 2013). Thus, thorough clinical assessments could be fruitful to identify whether the presented symptoms are only related to hypersexuality (i.e., they are not generalized to other aspects of life) or whether they existed before the onset of hypersexuality (Reid, Davtian et al., 2013). Having in mind hypersexuality, it should never be forgotten that it showed high comorbidity with mood disorders, anxiety disorders, and substance use, as well as with ADHD (Kraus et al., 2016). Thus, it might be hypothesized that ADHD developing in childhood may lead to the aforementioned disorders as individuals with ADHD often experience difficulties in social relationships and obligations as well, which in turn, may results in higher levels of stress and negative emotions (de Boo & Prins, 2007; Paulson et al., 2005; Reid, Carpenter et al., 2011; Reid, Davtian et al., 2013). As self-medication, individuals may try to reduce or eliminate these negative feelings and emotions in different ways (e.g., using drugs or engaging in different types of sexual behaviors), that may potentially lead to further

problems in their life (e.g., Gudjonsson et al., 2012; Wilens et al., 2007). To conclude, in case of individuals seeking treatment for hypersexuality (or men seeking treatment for problematic pornography use), ADHD as a potentially comorbid disorder should considered along with mood disorders, anxiety disorders or substance abuse.

Taken together, the present research contributed to the assessment of hypersexuality and problematic pornography use in general, non-treatment seeking populations as both the HBI and the PPCS may be applied to reliably and validly measure the extent of hypersexuality and problematic pornography use with relatively short scales. LGBTQ men were identified as a potential at-risk group of developing hypersexuality, thus, hopefully, they will be paid more attention in relation to hypersexuality. With the identification of possible transdiagnostic features and comorbid disorders, more focused prevention and intervention programs can be developed in the future.

VII/4. LIMITATIONS AND FUTURE DIRECTIONS

VII/4.1. Limitations of the Present Dissertation

Besides the strengths of the present investigation, some limitations have to be noted. The limitations of each study were described in detail, thus, only those limitations are mentioned here that apply to all studies in the present dissertation. Although the sample sizes were large and comprehensive, data were cross-sectional and the samples were self-selected and nonrepresentative limiting the generalization of the results. Due to the utilization of cross-sectional data, causality cannot be inferred. The studies excluded those individuals who did not use the Internet, therefore, future research should try to recruit individuals applying different recruitment strategies, as well as try to increase the representativeness of the sample. Online anonymous data collection is beneficial in sexuality-related studies (especially when asking about topics that may not only be problematic, but sensitive in nature), as anonymity could decrease stress and could result in more honest responses, but the real identity of the respondents may be questioned (e.g., Griffiths, 2012). The scales assessed self-reported ratings, which may distort the reality (e.g., under-reporting or over-reporting can appear or individuals can perceive their behavior as problematic due to moral judgements, even though there is no objective evidence for it being problematic – see Grubbs, Perry, Wilt & Reid, 2018). The results may also be distorted as a result of recall and social desirability biases.

VII/4.2. Future Directions

Addressing all of the aforementioned limitations would be difficult, but there are some strategies or methods that can be fruitful in future studies. Besides cross-sectional data, the application of longitudinal (e.g., Grubbs, Wilt et al., 2018) or diary-based research designs (e.g., Wordecha et al., 2018) would be beneficial to have a greater understanding of the developmental process of hypersexuality and problematic pornography use. This way, not only the unique course of problematic sexual behaviors may be examined but the interaction or the co-occurrence of them may be identified. Self-report and behavioral measures of the same constructs could diverge (e.g., Krishnan-Sarin et al., 2007), it may be important for future studies to investigate both behavioral and self-report assessments while respecting the individual's privacy (e.g., assessing the actual amount of pornography use by applying tracking methods in collaboration with pornography site operators). Research on representative samples would not only be fruitful for determining accurate prevalence for hypersexuality and problematic pornography use, but differences between cohorts could be examined regarding their preferences of sexual behaviors (e.g., "classic" or online pornography). The present studies were conducted on Hungarian samples, thus, it is possible that differences in sexual behaviors may be observed in more liberal or more conservative countries. Collaborations between research groups from different countries and/or continents may help to resolve this question (see Király et al., 2018).

Besides the aforementioned research directions that are strongly related to the limitations of the present investigation, there are other future direction that deserve scientific attention. Results of Study 4 and Study 5, in line with recent results (Werner et al., 2018), may imply that the detailed examination of the similarities and dissimilarities of different problematic sexual behaviors (e.g., masturbation, cybersex) would be fruitful in order to have a clearer view of what kind of sexual behaviors may be potentially considered as manifestation of hypersexuality. From a broader perspective, although the examined constructs (i.e., impulsivity, compulsivity, and ADHD symptoms) explained some of the variance of hypersexuality and problematic pornography use, the results suggest that other variables should also be taken into account (especially in the case of problematic pornography use) when examining the antecedents or correlates of these problematic sexual behaviors (Conway et al., 2003; Griffiths, 2017; Kerr, 1996; Szalavitz, 2016). Systematic and comprehensive examination of structural, situational, psychological, biological and genetic

characteristics (Griffiths, 2005; Tóth-Király et al., 2018) may lead not only to deeper theoretical knowledge regarding the development and maintenance of hypersexuality and problematic pornography use, but it could serve as a practical basis for developing sexual behavior specific preventions and interventions (e.g., Crosby & Twohig, 2016). Recent results suggest that a general psychopathology factor (p factor) may be attributable for the comorbidities of different psychiatric disorders (Caspi et al., 2014). This p factor was positively related to higher levels of life impairment, greater possibility of family history liability to psychiatric disorders, difficulties in regulation and control, and worse developmental history (Caspi et al., 2014). When the associations of several psychiatric disorders (e.g., obsessive-compulsive disorder, major depression) were examined with taking into consideration the higher-order p factor, the associations substantially decreased or disappeared between the disorders. These results raise the possibility that the associations between hypersexuality, problematic pornography use and ADHD symptoms were a result of the general p factor, but this hypothesis should be empirically tested.

VII/5. FINAL CONCLUSIONS

Although problematic sexual behaviors have been paid more and more attention in the recent years, it has to be noted that in most cases, sexual activities are not problematic and are essential parts of human functioning. However, in some case, these behaviors can become problematic and can cause severe distress and impairment in the individuals' life (e.g., Chatzittofis et al., 2017). As a first step in the examination of these behaviors, proper conceptualizations, definitions, categorizations and measurement tools are needed. Next, the identification of potential risk and protective factors may be aimed through comprehensive, theoretically supported models. Presumably, the conceptualization and definition of hypersexuality will converge as it is now included in ICD-11 as a mental disorder. The present investigation aimed to contribute to the adequate measurement and classification of hypersexuality and problematic pornography use and to the identification of potential risk factors of developing such sexual problems. Although the results of these studies were promising, further large-scale, intercultural, representative studies are needed to clarify several important questions such as whether problematic pornography use may be considered as a manifestation of hypersexuality or whether the quantity of given behaviors may be acknowledged as indicators of problematic behaviors (e.g., Grubbs, Perry et al., 2018).

VIII. REFERENCES

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IX. APPENDICES

IX/1.HYPERSEXUAL BEHAVIOR INVENTORY – HUNGARIAN VERSION

Hiperszexuális Viselkedés Leltár – Magyar verzió

Az alábbiakban olyan állításokat olvashatsz, amelyek különböző gondolatokat, érzéseket és viselkedéseket írnak le. Kérjük, minden állításnál jelöld, hogy az milyen gyakran jellemző rád!
A kérdőív szexnek tekint minden olyan cselekvést vagy viselkedést, amely stimulál vagy felizgat valakit és célja szexuális gyönyör vagy orgazmus elérése (pl. önkielégítés, pornográfia nézése, partnerrel való közösülés bármely formája stb.). Ne feledd tehát, hogy szexuális viselkedés egyaránt létre jöhet egyedül és partnerrel!

		soha	ritkán	néha	gyakran	nagyon gyakran
1	A szexet a napi gondok feledtetésére használom.	1	2	3	4	5
2	Bár megfogadtam, hogy felhagyok egy bizonyos szexuális viselkedéssel, mégis újra és újra visszatérek hozzá.	1	2	3	4	5
3	A szex segít, hogy kevésbé érezzem magam magányosnak.	1	2	3	4	5
4	Részt veszek olyan szexuális tevékenységekben, amikről tudom, hogy később meg fogom bánni.	1	2	3	4	5
5	A szexualitás érdekében feláldozok olyan dolgokat, amik tényleg fontosak az életemben.	1	2	3	4	5
6	Szexuális tevékenységekhez folyamodom olyankor, amikor kellemetlen érzéseket élek át, például ideges, szomorú, vagy dühös vagyok.	1	2	3	4	5
7	A szexuális szokásaim megváltoztatására tett kísérleteim kudarcba fulladnak.	1	2	3	4	5
8	Amikor nyugtalan vagyok, szexszel nyugtatom meg magam.	1	2	3	4	5
9	Szexuális gondolataim és fantáziáim akadályoznak fontos feladataim elvégzésében.	1	2	3	4	5
10	A szexben olyan dolgokat is megteszek, amelyek egyébként az értékeim és meggyőződésem ellen valóak.	1	2	3	4	5
11	Bár szexuális viselkedésem felelőtlen és meggondolatlan, nehezemre esik ellenállni.	1	2	3	4	5
12	Úgy érzem, hogy a szexuális viselkedésem olyan irányba visz engem, amerre nem szeretnék menni.	1	2	3	4	5
13	A szexualitás segít a stressz kezelésében.	1	2	3	4	5
14	A szexuális viselkedésem uralja az életem.	1	2	3	4	5
15	Nem tudok uralkodni a szexuális sóvárgásomon, vágyaimon.	1	2	3	4	5
16	A szex segít megküzdeni a lelki fájdalommal, amit átélek.	1	2	3	4	5
17	Úgy viselkedem a szexualitással kapcsolatban, amit magam is helytelennek tartok.	1	2	3	4	5
18	A szex számomra egy módja a problémákkal való megküzdésnek.	1	2	3	4	5
19	A szexuális viselkedésem zavart okoz az életem egyéb területein, mint a munkámban vagy a tanulmányaimban.	1	2	3	4	5

Kiértékelés:
A faktorokhoz tartozó tételek pontszámait össze kell adni, majd el kell osztani a faktorhoz tartozó tételek számával.

Megküzdés faktor: 1, 3, 6, 8, 13, 16, 18
Kontroll faktor: 2, 4, 7, 10, 11, 12, 15, 17
Következmények faktor: 5, 9, 14, 19

IX/2. INVESTIGATING THE LATENT STRUCTURE OF HYPERSEXUALITY IN A LARGE, NONCLINICAL SAMPLE WITH TAXOMETRIC ANALYSIS

In order to investigate whether hypersexuality has a dimensional or categorical latent structure in a large, nonclinical population, three taxometric analysis procedures were implemented (MAMBAC, MAXEIG and L-Mode) with using the *RunCCFIProfile* function of the *RTaxometrics* package in R (Ruscio and Wang, 2017). First, the requirements of taxometric analysis were checked. Next, taxometric analysis was conducted on the basis of two different indicator sets applying three methods and CCFI profiles were calculated to determine whether hypersexuality had a dimensional or a categorical latent structure.

Checking the assumptions for the taxometric analysis

The data have to meet certain requirements for the taxometric analysis to provide reliable and informative results about the latent structure of hypersexuality. During the assumption check, the parameters in question were examined by following the criteria of Ruscio et al (2011). These criteria are based on an extensive examination of simulated categorical and dimensional data (Ruscio, Walters, Marcus, & Kaczetow, 2010).

The *first parameter* which must be considered is the sample size of the data. The final sample used for the taxometric analysis consisted of 18,034 observations with no missing values. The sample size of the present data exceeds the minimum sample size of 300 observations that are needed to identify a dimensional latent data structure with good accuracy (Ruscio et al., 2010).

The *second and third parameters* are the number of indicators and the number of their ordered categories. On the basis of the literature (Reid, Garos & Carpenter, 2011; Reid et al., in prep.), two indicator sets were used to conduct the taxometric analysis. For the first indicator set, the 19 items of the HBI were combined on the basis of the three factors of HBI ($N_{(Control)}$ = 8 items; $N_{(Coping)}$ = 7 items; $N(_{Consequences)}$ = 4 items). Therefore, three composite indicators with 40, 35 and 20 order categories were employed to further analysis. (Ruscio et al., 2010) demonstrated that even three indicators can lead to an accurate decision about the underlying data structure in more than 80% of the cases. Moreover, (Walters & Ruscio, 2009) highlighted that the number of ordered categories are more important than the number of indicators. Especially in

those cases when the number of ordered categories is larger than four, there is a quality improvement in the accuracy of the results. However, at least five indicators are suggested to get notably more accurate results. Therefore, the eight-item version of the HBI (HBI-SF) were used for the second indicator set (Reid et al., in prep.). The items of the HBI-SF were strongly correlated with the original items in the present sample (r = .95). All the eight items with five ordered categories were used in the analysis without creating composite indicators from them as the HBI-SF items load on a single factor (Reid et al., in prep.).

The *fourth parameter* is the base rate of the putative taxon that has to be at least P = 0.1 according to (Meehl, 1995) or larger than P = 0.05 estimated by Ruscio et al. (2010), for the taxometric analysis to detect the categorical data structure if it exists. To check whether the data is suitable for the taxometric analysis, a base rate has to be assigned to the empirical data even if during the calculation of the CCFI profile several base rates are used to draw the conclusion about the latent structure of the construct. Because there is no valid cut-off score for the HBI to identify people with a high-risk of hypersexuality in the nonclinical population, we used the 53 cut-off score suggested by Reid & Garos (2007) for a male population. According to this classification, 6% of the present sample were assigned to the putative taxon. For the HBI-SF indicator set, we used 26 points as a cut-off score (Reid et al., in prep.), which classified only 2.84% of the sample as a taxon member.

The *fifth parameter* that must be taken into account is the number of the taxon members. Even with the lowest base rate (P = 0.0284) computed with the HBI-SF indicator set, the number of taxon members ($N_{(HBI\text{-}SF)}$ = 513) exceeds the minimum number of 50 participants (Ruscio & Ruscio, 2004).

The *sixth parameter* is the indicator validity that is measured by the standardized mean difference (Cohen's d) between the taxon and the complement group. To compute the indicator validity for the HBI and HBI-SF indicator sets, the *CheckData* function was applied from the *RTaxometrics* package by Ruscio and Wang (2017). To create the putative groups for the test, the same method was implemented as in the case of the estimation of the number of participants belonging to each putative group. The indicator validity of the HBI indicator set ranged from d = 2.23 to d = 3.17 with a mean of 2.76. The indicator validity for the HBI-SF indicator set was lower as it ranged from d = 1.77 to d = 2.54 with a mean of 2.23. In the case of both indicator sets, each indicators

validity surpassed the Cohen's d = 1.25 rule of thumb suggested by Meehl (1995) and confirmed by the simulation analyses of (Ruscio et al., 2010).

The *seventh parameter* is the within-group correlation between the indicators. The correlation between the indicators should not be higher than r_{wg} = 0.3 within each group (Meehl, 1995; Ruscio et al., 2010). To compute the within-group correlations the same group classification procedure was applied as for the test of indicator validity. For the HBI indicator set, this assumption was violated in the complement group between the Control and Consequences composite indicators with r_{wg} = 0.53 (for all the correlations see IX/Table A1). In the case of the taxon group, the correlation between the Control and Consequences composite indicators was positive but only moderate (r_{wg} = 0.29). In case of the HBI-SF indicator set, the within-group correlations were higher than in the case of the HBI indicators (IX/Table A2). The within-group correlations were especially high between the items HBI-SF 3, HBI-SF 4 and HBI-SF 8.

Calculating a CCFI profile

Traditionally, the interpretation of the result of a taxometric analysis requires the graphical examination of the figures that the applied taxometric procedures yields (Ruscio, Carney, Dever, Pliskin, & Wang, 2017). Throughout the examination, the shape of the resulted curves were compared to the ideal curves of categorical and dimensional data. Ruscio, Ruscio, & Meron (2007) introduced a method that generates and analyzes categorical and dimensional comparison data with the same parameters as the empirical data. Therefore, the method can deal with the potential distorting effect of skewness and kurtosis of the distribution of the empirical data. Moreover, the method calculates the Comparison Curve Fit Index (CCFI) which is a standard indicator of whether the empirical data fit better the categorical or the dimensional comparison data (Ruscio et al., 2017, 2007; Ruscio & Kaczetow, 2009). A CCFI value closer to 0 supports a dimensional latent structure, whereas a value closer to 1 supports a categorical latent data structure. CCFI values between 0.45 and 0.55 are considered ambiguous (Ruscio et al., 2010).

To generate a CCFI profile for the construct of hypersexuality, multiple populations of categorical comparison data were generated with 39 base rates ranging from 0.03 to 0.10. As there is no agreement among the experts in the field about the prevalence of hypersexuality, the aforementioned range was chosen as most of the estimations are between 3 – 10% (Black, 2000; Långström & Hanson, 2006; Laumann,

1994; Stewart & Fedoroff, 2014; Sussman et al., 2011). The size of the populations were 50,000 and ten random samples of comparison datasets were analyzed for each base rate. The CCFI profile (Figure A1 and Figure A2) consists of plotted average CCFI scores for the 39 populations with different base rates (Ruscio & Walters, 2009). During the classification of observations to either the taxon or the complement group by the base-rate classification procedure, there were several observations with tied-scores due to the large sample size. To overcome the distorting effect of the arbitrarily determined cut-off points of the classification procedure, cases were resorted and reanalyzed ten times in each case, and the results were averaged as suggested by Ruscio et al. (2011).

The functioning of the used taxometric procedures

As mentioned before, for the taxometric analysis the *RunCCFIProfile* from the *RTaxometrics* package was used. This function uses the MAMBAC, MAXEIG and L-Mode procedures by default, as it is recommended to use several non-redundant procedures on the same data and then aggregate their result to gain better accuracy (Meehl, 1995).

The Mean Above Minus Below A Cut (MAMBAC; Meehl & Yonce, 1994) procedure operates with two indicators paired at a time. In the present study, the scores of the composite indicator of the summarized Control factor items (Control indicator) were distributed from lowest to highest scores, and 25 cuts were placed at an equal distance from each other starting from the value at the 0.025 left tail of the distribution to the 97.25 value at right tail. The mean scores of the paired indicator (e.g. Consequences indicator) are then calculated below and above the cutting score for each cut. The mean score of the Consequences indicator scores above the cut was subtracted form the mean score calculated from the scores below the cut each time (Beauchaine, 2007). To illustrate the result of the MAMBAC procedure, each cutting score of the Control indicator is plotted on the x axis in an ascending order, while each correspondent difference of the mean scores of the Consequences indicator is plotted on the y axis. In the present analysis, the MAMBAC procedure was implemented with all possible indicator pairs (six different configurations) as a default setting of the *RunCCFIProfile* function. However, according to Walters & Ruscio, (2009), there is no essential difference between the accuracy of the results when using the pairwise method or a different method to compare more than two indicators.

The MAXimum EIGenvalue (MAXEIG; Waller & Meehl, 1998) is a procedure that requires at least three indicators and implements all of them in the calculation at the same time. Similarly to the MAMBAC procedure, MAXIEIG also sorts the cases along one indicator (e.g. the Control indicator). Then this indicator is divided into 50 windows (the value that was used in the present analysis) for which subsamples of the remaining indicators (e.g. Consequences and Coping indicators in our case) are extracted. For each subsample, the covariance matrix between Consequences and Coping indicators are calculated and the largest eigenvalue is extracted (Ruscio et al., 2011). The procedure assumes that the eigenvalue will be the highest in the subsample which consists of a mixture of taxon members and complement members if the data is categorical indeed. As a result of the low within-group correlation between the indicators, there should be no joint variability in a subsample consists only members of either the taxon or the complement group. Therefore, participants in the subsample with the lowest mean score on the Control indicator were most likely belonging to the complement group only. Participants in the subsample with the highest mean score on the Control variable would belong only to the taxon group if the data had a categorical latent structure. In these subsamples, the eigenvalues are going to be low, as the within-group correlation between the Consequences and the Coping indicator is usually moderate or low. To illustrate the results of the MAXEIG procedure, the mean scores of the subsamples along the Control indicator on the x axis and the corresponding eigenvalues on the y axis can be plotted. The windows that we based the subsamples on were 90% overlapping, therefore, more subsamples were gained than it would have been gained if the discrete intervals and the sampling error were kept constant as well (Walters & Ruscio, 2010).

In the Latent Mode (L-Mode; Waller & Meehl, 1998) procedure, all indicators are analyzed at the same time with factor analysis. By this in our analyses the three composite indicators (Control, Consequence and Coping) were analyzed with the HBI indicator set, whereas the eight items of HBI-SF were passed along to the analysis for the HBI-SF indicator set. The factor scores of the first factor is extracted with Bartlett's (1937) weighted least squares method. For illustration, the density distribution of factor scores is plotted. A unimodal density distribution would suggest a dimensional latent data structure, but a bimodal density distribution implies a categorical latent data structure.

Results of the taxometric procedures and the CCFI profile

The code for the analysis can be found on OSF (https://osf.io/afrkz/). All the aggregated CCFI values of the three taxometric procedures were under the 0.45 threshold of ambiguous results that suggest a dimensional latent structure ($CCFI_{MAMBAC}$ = 0.44; $CCFI_{MAXEIG}$ = 0.32; $CCFI_{L\text{-}Mode}$ = 0.42). However, neither of the CCFI values indicated univocal evidence towards either of the latent data structures. The resulting CCFI values of the HBI-SF indicator set further increased the uncertainty about the accuracy of the outcome, as the mean CCFI value for the MAMBAC procedure implies a categorical data structure ($CCFI_{MAMBAC}$ = 0.64; $CCFI_{MAXEIG}$ = 0.34; $CCFI_{L\text{-}Mode}$ = 0.32).

The inconclusive results could be explained by the high within-group correlations in some cases in both indicator sets. Also, the range of the base rates examined during the generation of the CCFI profile were lower than the suggested P = 0.1. In sum, a large variability could be identified in the CCFI values based on the applied method and the examined indicator sets (HBI vs. HBI-SF). Therefore, further research is needed to support or disprove the latent structure of hypersexuality.

IX/Table S1. Within-group correlations in the taxon group and in the complement group between the HBI composite indicators

	Consequences	Control	Coping
Consequences	—	.53	.33
Control	.29	—	.28
Coping	-.05	-.23	—

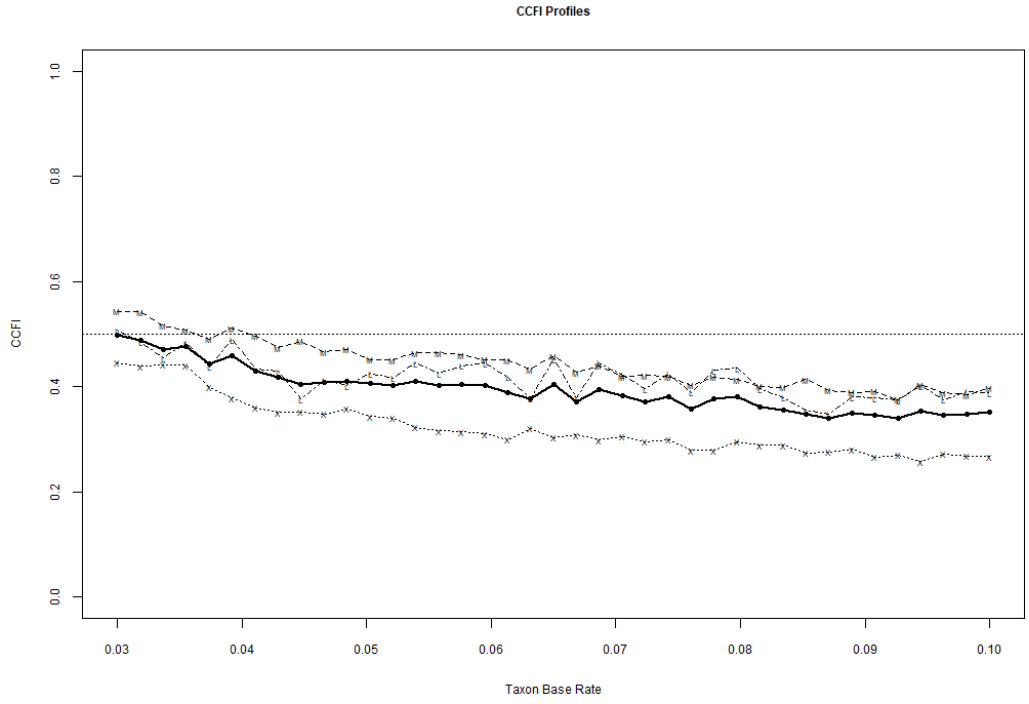
Notes. Values above the diagonal are the within-group correlations in the complement group; values below the diagonal are the within group correlations in the taxon group.

IX/Table S2. Within-group correlations in the taxon group and in the complement group between the HBI-SF indicators

	HBI-SF1	HBI-SF2	HBI-SF3	HBI-SF4	HBI-SF5	HBI-SF6	HBI-SF7	HBI-SF8
HBI-SF1	—	.24	.22	.21	.22	.27	.24	.17
HBI-SF2	.02	—	.22	.18	.27	.34	.28	.19
HBI-SF3	-.12	.05	—	.62	.20	.18	.19	.49
HBI-SF4	-.14	-.08	.44	—	.24	.17	.21	.51
HBI-SF5	-.02	.12	-.09	-.09	—	.28	.42	.21
HBI-SF6	.18	.08	-.18	-.16	.02	—	.34	.18
HBI-SF7	-.03	.01	-.16	-.06	.20	.10	—	.24
HBI-SF8	-.18	-.11	.27	.35	-.11	-.09	-.02	—

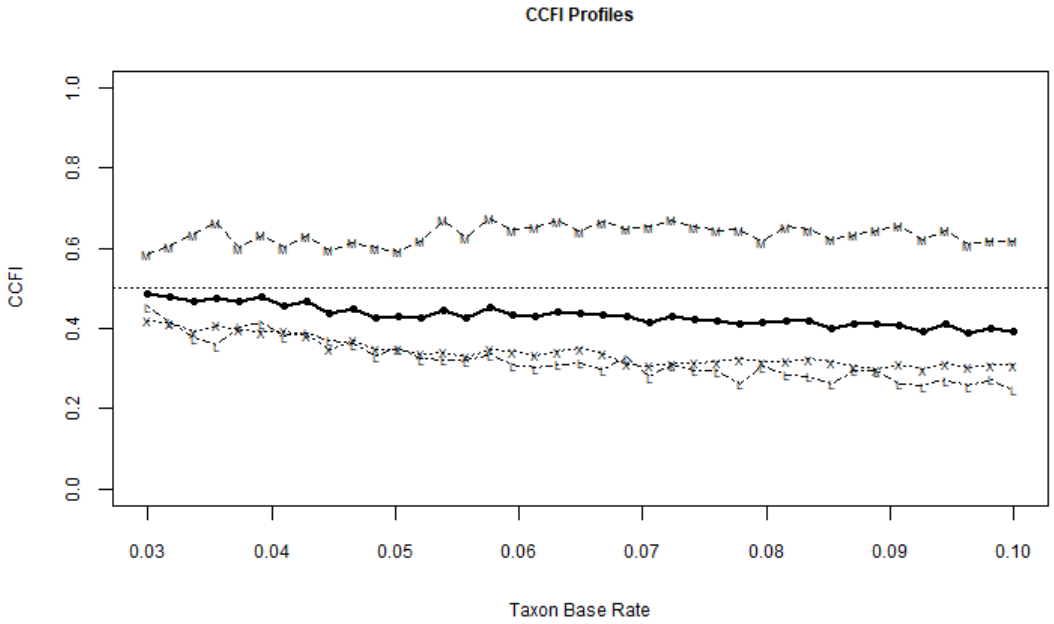
Notes. Values above the diagonal are the within-group correlations in the complement group; values below the diagonal are the within group correlations in the taxon group.

IX/Figure S1. The CCFI profiles of the HBI indicator set



Notes. The averaged CCFI values of the three taxometric procedures (MAMBAC, MAXEIG, L-Mode) across the possible range of taxon base rates from *P* = .03 to *P* = 0.1 for the HBI indicator set. The dotted line at CCFI = 0.5 on the y axis presents the CCFI values that shows equal support for the categorical and dimensional data structure. The values under the dotted line suggest a dimensional data structure, while the values above the dotted line rather suggest a categorical latent date structure. The closer the values to 0.0 and 1.1 on the y axis, and further from the dotted line, the stronger the results support the latent data structure at that direction.

IX/Figure S2. The CCFI profiles of the HBI-SF indicator set



Notes. The averaged CCFI values of the three taxometric procedures (MAMBAC, MAXEIG, L-Mode) across the possible range of taxon base rates from *P* = .03 to *P* = 0.1 for the HBI-SF indicator set.. The dotted line at CCFI = 0.5 on the y axis presents the CCFI values that shows equal support for the categorical and dimensional data structure. The values under the dotted line suggest a dimensional data structure, while the values above the dotted line rather suggest a categorical latent date structure. The closer the values to 0.0 and 1.1 on the y axis, and further from the dotted line, the stronger the results support the latent data structure at that direction.

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IX/3. PROBLEMATIC PORNOGRAPHY CONSUMPTION SCALE (PPCS)

Please, think back to the last six months and indicate on the following 7-point scale how often or to what extent the statements apply to you. There is no right or wrong answer. Please indicate the answer that most applies to you.

1- Never *2- Rarely* *3- Occasionally* *4- Sometimes* *5- Often* *6- Very often* *7- All the time*

	1	2	3	4	5	6	7
1. I felt that porn is an important part of my life	O	O	O	O	O	O	O
2. I used porn to restore the tranquility of my feelings	O	O	O	O	O	O	O
3. I felt porn caused problems in my sexual life	O	O	O	O	O	O	O
4. I felt that I had to watch more and more porn for satisfaction	O	O	O	O	O	O	O
5. I unsuccessfully tried to reduce the amount of porn I watch	O	O	O	O	O	O	O
6. I became stressed when something prevented me from watching porn	O	O	O	O	O	O	O
7. I thought about how good it would be to watch porn	O	O	O	O	O	O	O
8. Watching porn got rid of my negative feelings	O	O	O	O	O	O	O
9. Watching porn prevented me from bringing out the best in me	O	O	O	O	O	O	O
10. I felt that I needed more and more porn in order to satisfy my needs	O	O	O	O	O	O	O
11. When I vowed not to watch porn anymore, I could only do it for a short period of time	O	O	O	O	O	O	O
12. I became agitated when I was unable to watch porn	O	O	O	O	O	O	O
13. I continually planned when to watch porn	O	O	O	O	O	O	O
14. I released my tension by watching porn	O	O	O	O	O	O	O
15. I neglected other leisure activities as a result of watching porn	O	O	O	O	O	O	O
16. I gradually watched more “extreme” porn, because the porn I watched before was less satisfying	O	O	O	O	O	O	O
17. I resisted watching porn for only a little while before I relapsed	O	O	O	O	O	O	O
18. I missed porn greatly when I didn’t watch it for a while	O	O	O	O	O	O	O

Scoring: Add the scores of the items of each factor. For the total score add all the scores of the items. 76 points or more indicate possible problematic pornography use

Salience: 1, 7, 13
Mood modification: 2, 8, 14
Conflict: 3, 9, 15
Tolerance: 4, 10, 16
Relapse: 5, 11, 17
Withdrawal: 6, 12, 18