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Final dissertation

Impulsive Compulsive Behaviours in Older Adults:
Rethinking Our Approach to Predictors, Breadth and Assessment

Supervisor
Professor Elisa Di Rosa

Co-supervisor
Professor Nicky Edelstyn

Candidate: *Lina Nickmann*
Student ID number: *2037910*

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Table of Contents

Abstract

Individuals with Impulsive Compulsive Behaviours (ICBs) experience difficulties in resisting an urge to engage in a reward-based action, resulting in problematic excessive engagement in the behaviour. While seven subtypes of ICBs have been commonly researched as non-motor symptoms in Parkinson's disease (ICD), the breadth of ICBs, the harm related to them, and the risk factors involved in the development and maintenance of heterogeneous expressions of ICBs have been overlooked in the general population. This cross-sectional study explores ICBs among the general population, highlighting their prevalence in non-clinical populations and proposing a framework for future studies among clinical populations. A sample of 71 older adults from the UK completed a survey comprising seven adapted self-report questionnaires that were proposed as reflective of components of the first model on the addictive cycle of ICBs (I-PACE). Qualitative analyses revealed a variety of behaviours considered problematic among older adults, suggesting that ICBs reflect phenotypical expressions of difficulties with impulse-control, obsessive-compulsivity and substance-use. Correlations between outcome measures of ICBs revealed a strong association between the severity of symptoms and ICB-related harm (i.e., financial, social, health). Principal Component Analyses reduced the dimensionality, while linear regression analyses and between-group ANOVAs explored the key components contributing to ICBs and their subtypes and the main predictors of the *ICB-Checklist*, *SGHS-18 Harm Screen* and *QUIP-rs*. Assessment of ICBs needs to be sensitive to both problematic impulses and compulsions, while their consequences on well-being need to be viewed from a medical and biopsychosocial perspective. Future studies should further explore the risks of obsessions, compulsions and the motivation for ICBs.

Keywords: Impulsive Compulsive Behaviours, ICD, OCD, I-PACE, Older Adults, RDoC

Abbreviations

ICB   Impulsive compulsive behaviours

DRT   Dopamine Replacement Therapies

PwP   People with Parkinson's disease

ICD   Impulse Control Disorder

DDS   Dopamine Dysregulation Syndrome

RDoC   Research Domain Criteria

I-PACE The Interaction of Person-Affect-Cognition-Execution model

Framing & Position Statement of the Study

This project explores the nature of Impulsive Compulsive Behaviours (ICBs) in older adult populations. The study is part of a larger international research project, examining impulsive-compulsive behaviours in the general and clinical populations. This project will be used to firstly highlight the occurrence of problematic behaviours among the general population, and secondly as a basis to later propose a framework for researching ICBs among Parkinson's patients in cooperation with the Movement Disorders Department of Neurology at the Charité (Berlin, Germany) and the Neurology Department of the Venizeleio Hospital (Crete, Greece) afterwards.

The novel aspects introduced in this study are providing data on a wider range of ICBs; moving the focus beyond the traditional Impulse Control Disorders (ICD) in Parkinson's disease and to reflect the influence of societal leisure activities. This requires exploring both impulsivity and compulsivity, while viewing behaviours on a continuum in line with the Research Domain Criteria. The second novel aspect is relocating ICBs in the frame of harms rather than just the medical model. A third novel aspect is revealing the main dimensions accounting for variability in the addictive cycle of ICBs, based on components of the first framework (I-PACE) on the development and maintenance of ICBs. Lastly, this information is interesting in its own right since there is paucity of research on ICBs in the general population.

To justify investigating the breadth of ICBs among the general population (Hypothesis 1), the outcome measures administered (Hypothesis 2), and the relative contribution of predictors in the I-PACE model (Hypothesis 3), the current literature will be reviewed accordingly. Firstly, ICBs and its central constructs will be defined, followed by reviewing the diverse terminology used. The types, prevalence, and public relevance of ICBs will be clarified, as well as the risk factors explored based on research on gambling disorder and people with Parkinson's disease. Afterwards, the three unmet needs targeted in this study will be introduced. Firstly, the breadth of ICBs will be proposed, based on ICBs across various populations and their diverse expression (RDoC). Secondly, the limitations of the medical model will be reviewed, to shift the focus on ICB-related harm. Lastly, the I-PACE model is summarised and partially operationalised, to explore factors relevant in the development of ICBs.

Chapter 1

Introduction to Impulsive Compulsive Behaviours (ICBs):

Types, Burden, & Risk Factors

Impulsive compulsive behaviours (ICBs) refer to a spectrum of behaviours that are characterised by the inability to resist an urge to engage in a reward-based action. Consequently, individuals experience a subjective loss of control and exhibit the behaviour repetitively, which leads to significant distress for the individual and others close to them (Kelly et al., 2020; American Psychiatric Association, 2013). This compulsive pursuit irrespective of its consequences, resembles that of "Substance-Related and Addictive Disorders" (DSM-5), which has influenced the conceptual approaches of behavioural addictions (Potenza, 2006). Impulse Control disorders (ICDs) being such behavioural addictions, have been increasingly investigated as a relevant non-motor symptom of Parkinson disease (Averbeck et al., 2014). Specifically, because dopamine replacement therapies (DRTs) targeting Parkinsonism symptoms have shown to be a risk for developing ICDs among people with Parkinson (PwP) (Erga et al., 2017; Weintraub et al., 2010; Molde et al., 2018). The most commonly explored types of ICDs in PwP have been pathological gambling, compulsive sexual behaviour, compulsive buying and binge-eating disorder (Averbeck et al., 2014; Weintraub, 2009). However, they only represent a component of the broader category of Impulsive Compulsive Behaviours (ICBs).

1.1 Definition Impulsivity and Compulsivity

The focus on impulse control disorders (ICD) in Parkinson's disease has shaped the direction of research toward investigation of impulsivity, incentive driven decision making and inhibitory control. Neglecting however, the obsessive and compulsive elements that are inherent within the broader superordinate category of impulsive compulsive behaviours (ICBs). Therefore, the next section will discuss the definition of impulsivity and compulsivity, followed by discussing the variety of term currently used in this field.

Impulsive behaviours are "actions which are poorly conceived, prematurely expressed, unduly risky or inappropriate to the situation and that often result in undesirable consequences" (Daruna & Barnes, 1993). The level of impulsivity varies among individuals, with more extreme

expressions of impulsivity characteristic of various disorders, such as ADHD, substance use disorders, anti-social behaviour and behavioural addictions (Grant & Potenza, 2012). Impulsivity is a complex construct, with its multidimensionality and types of facets having been debated (Dalley et al., 2011). For the psychological modelling of ICB in PwP, Kelly and colleagues (2020), describe four facets central to impulsivity. Acting (motor impulsive /response inhibition) or deciding without thinking (decision making impulsivity), as well as choices for immediate gratification (choice impulsivity) and gathering little information in order to make a decision (reflection impulsivity). Although differing operationalisations of the facets of impulsivity emphasise the varying focus on immediate reward or lacking motor inhibition, they all encompass some "lack of control".

Similarly, compulsivity reflects "failures of response inhibition or 'top-down' cognitive control" (Dalley et al., 2011; Robbins et al., 2012). Therefore, despite compulsivity being of very distinct nature from impulsivity, the constructs share "motor disinhibition" and an "impaired ability to stop a response or sequence" (Robbins et al., 2012). This overlap is supported by studies demonstrating similar neurobiological correlates for impulsivity and compulsivity (Fineberg et al., 2014; Grant & Kim, 2014). Robbins and colleagues (2012) explored this overlap and further suggested this intersection as an endophenotype for drug addiction. More specifically, the increased formation of habits within highly impulsive individuals instigates the transition from impulsively engaging in a rewarding behaviour to compulsive behaviours that mark behavioural addictions (Hogarth et al., 2011; Everitt & Robbins, 2005; Starcevic 2016). Once the behaviours are a compulsion, they will persist despite their negative consequences and will be repetitively engaged in in a stereotyped manner that is resistant to fading or active control to stop it. From a medical perspective on substance use disorder, the loss of control defines the change from a problematic use to an addictive use (Piazza & Deroche-Gamonet, 2013). Compulsivity being "Actions which persist inappropriate to the situation, have no obvious relationship to the overall goal and which often result in undesirable consequences" are therefore relevant in the context of behavioural addiction as well (Dalley et al., 2011).

Consequently, disorders due to substance use or addictive disorders (ICD-11) are marked by both impulsivity and compulsivity (Cuzen & Stein, 2014). Supportive of this conceptual

focus, the *Diagnostic and Statistical Manual of Mental Disorders* re-categorised gambling disorder from "Impulse Control Disorders" to "Substance-Related and Addictive Disorders" (American Psychiatric Association, 2013). Therefore, this study will use 'impulsive compulsive behaviours' (ICBs) as the most inclusive term to describe impulses to execute a rewarding behaviour, as well the distressing urge or compulsion that can result from it in a behavioural addiction. ICBs will thus comprise both characteristics of Impulse-Control disorders (ICD) and Obsessive-Compulsive disorders (OCD).

1.2 Confusion in the Nomenclature

It is important to acknowledge the variety of terms used to describe problematic ICBs and what could have resulted in this vast nomenclature. Research advances in the conceptualisation of the behaviours have generated multiple terminologies, which are used interchangeably across studies in this field and can lead to confusion when reviewing the literature. When in 1990, Isaac Marks defined behavioural (non-chemical) addiction as the repeated urges to engage in counter-productive behaviours, he laid the groundwork for research on problematic behaviours. Later, such behavioural addictions referred to various disorders marked by compulsivity and/or impulsivity (eg.: obsessive-compulsive disorder, impulse-control disorders, eating disorders, etc.) (Starcevic, 2016). Consequently, behavioural addictions (also referred to as 'process addictions') attained more scientific attention and the concept was broadened. However, as emphasised in a review by Starcevic (2016), behavioural addictions were commonly examined within the substance addiction framework involving tolerance and withdrawal. Furthermore, research on behavioural addiction often focused on descriptive symptoms, rather than the course and aetiology of problematic behaviours (Kardefelt-Winther et al., 2017). With the lack of models and an insufficient consensus on the definition of behavioural addictions, the nosology for diagnostics of disorders falling on the repetitive and problematic behaviours became unclear. As a result, behavioural addictions have been classified under various categories in the DSM-5: "Substance-related and Addictive Disorders' (eg.: gambling disorder), 'Disruptive, Impulse-control and Conduct Disorders' (eg.: kleptomania), 'Obsessive-compulsive and related Disorders' (eg.: skin picking disorder, trichotillomania) or have not been included at all.

Similarly, various terms have been used for describing problematic behaviours in the research literature and will be used respectively when referencing to them throughout this study. For example, 'Impulse Control Disorders' (ICD) has been often used to refer to behavioural addictions (Holden, 2010). The individual cannot resist the impulse to perform a pleasurable activity and will engage in it repetitively and excessively. The resulting significant distress and harm caused for oneself and/or others around that individual, is what characterises it as a pathological disorder (American Psychiatric Association, 2022). However, 'ICD' is commonly used when investigated as a non-motor symptom in Parkinson's disease (eg.: Weintraub & Claassen, 2017; Voon et al., 2010; Lehman et al., 2012) and comprises the four main: pathological gambling, compulsive sexual behaviour, compulsive buying and binge eating disorder (Potenza et al., 2002; Weintraub, 2009). While the term ICD highlights impulsivity as central, other studies have referred to the compulsive aspect of these behaviours; "compulsive dopaminergic drug use" (Evans et al., 2005). Alternatively, other studies exploring compulsive behaviours associated with dopaminergic medication in PwP used "hedonistic homeostatic dysregulation" (Giovannoni et al., 2000; Pezzella et al., 2003) and "dopamine dysregulation syndrome" (Evans et al., 2004). Suggestive of a dimensional diagnostic approach and to include more heterogeneous types of problematic behaviour, various other studies further decided to used 'behaviour' contrary to 'disorder': "Impulse control and repetitive behaviours" (Voon et al., 2007), "Impulsive and compulsive behaviours" (Averbeck et al., 2014), "Repetitive and reward-seeking behaviours" (Voon et al., 2006) and "Impulse control behaviours" (Okai et al., 2013).

Having established the inconsistencies regarding the nosology used, it is suggested to use "Impulsive Compulsive Behaviours" as the overarching terminology that is used in various other studies (Martini et al., 2020; Di Rosa et al., 2022; Ricciardi et al., 2018; Maloney et al., 2018). The use of "ICB" highlights the relevance of both impulsivity and compulsivity, as well as the transition from healthy behaviour to a harmful repetitive nature that is central to addictive disorders (Kardefelt-Winther et al., 2017).

1.3 Types of ICB & Confusion in Current Diagnostics

With ICBs comprising ICDs, its four main researched pleasurable activities in Parkinson's will be defined next: pathological gambling, binge-eating, compulsive sexual behaviour and compulsive buying/shopping (Kelly et al., 2020; Weintraub, 2009; Weintraub et al., 2015; Voon et al., 2006).

Pathological gambling (gambling disorder) being the most reviewed ICD, is a DSM-5 acknowledged behavioural addiction, categorised under 'Non-substance Related Addictive Disorders'. Pathological gambling is the "persistent and recurrent problematic gambling behaviour leading to clinically significant impairment or distress" (American Psychiatric Association, 2013). Under 'binge-eating disorder', the DSM-5 diagnoses individuals suffering from recurrent episodes of eating a large amount of food within a period of time, throughout which they feel no control over their eating behaviour (American Psychiatric Association, 2013). The other types of ICDs have not been included in the DSM-5 due to insufficient peer-reviewed evidence. However, the *International Classification of Diseases 11th Revision,* included 'compulsive sexual behaviour disorder' as a "persistent pattern of failure to control intense, repetitive sexual impulses or urges resulting in repetitive sexual behaviour" (WHO, 2019). Interestingly, compulsive sexual behaviours have been conceptualised as an impulse control disorder, whereas gambling disorder was categorised as an addictive behaviour. Similarly, compulsive buying-shopping disorder has been suggested as an example for 'other specific impulse control disorders'; although many researchers support its categorisation as an 'other specified disorder due to addictive behaviours' (Brand et al., 2020; Granero et al., 2016). Compulsive buying-shopping disorder is the experiencing of intrusive or irritable urges/impulses for shopping, that are associated with little control over the behaviour despite the various negative consequences it has (Müller et al., 2021).

Other additional ICDs proposed among individuals with Parkinson's disease are punding, hobbyism and dopamine dysregulation syndrome. Punding is the intense fascination with a repetitive, non-goal oriented, stereotyped activity and compulsively engaging in it (Voon, 2004; Evans et al., 2004). These could be simple activities such as collecting, arranging, assembling or grooming. Hobbyism is when the excessive, stereotyped activities are of more complex nature

(for example going fishing, using the internet or driving). Lastly, Dopamine Dysregulation Syndrome (DDS) is the compulsive overuse of a dopamine replacement drug in PwP. Patients become addicted to the dopaminergic medication they are administering, which relieves them from their motor symptoms and avoids an "off" phase. Especially PwP using L-Dopa appear to have a risk for developing DDS (Evans et al., 2005). The DSM-5 and ICD-11 acknowledge that substances (such as medication) can induce problems with impulse control ('Substance-induced impulse control disorders') or obsessive-compulsive behaviours ('Substance/Medication-Induced Obsessive Compulsive and Related Disorder'). However, no diagnostic criteria have been included for the aforementioned ICD types in Parkinson's disease.

1.4 Epidemiology of ICBs

Having established the nature of ICBs, the next to consider is the prevalence of such problematic behaviours. However, the diverse types of ICBs have again been mainly recognised in the context of neuropsychiatric non-motor symptoms in Parkinson's disease (ICD). The assumed heightened prevalence and harms of ICB in PwP lead to the majority of studies being conducted within that population. Consequently, the occurrence of ICBs in the healthy adult population has often been overlooked. Therefore, the current epidemiological literature available will be discussed and used to suggest ICBs prevalence in general and clinical populations.

Prevalence estimates of ICBs in PwP display a large range from 3.53% to 42.5% (Fan et al., 2009; Joutsa et al., 2012; Poletti et al., 2013). Potential explanations are variations in the sample size and culture, methodological approaches to assess ICDs and the types and extent of dopaminergic treatment administered. In the largest cross-sectional study including 3090 PwP, 13.6% of PwP had at least one active ICD (Weintraub et al., 2010). A more recent study recorded 30.4% of PwP reporting an ICD (Erga et al., 2017). Being one of the few studies including normal control subjects, a direct comparison of prevalence rates of ICB in the general population was possible. While 30.4% of PwP indicated any ICD or related behaviour, **11.9% of normal controls also reported at least one ICB. Although it highlights PwP being at a higher risk for developing ICBs, their relevance for the general population should not be undermined and needs further exploration.** Isaias & colleagues (2008) speculated that if DRT triggers

higher rates of ICD in treated PwP, untreated PwP might display the same rates of ICD as healthy populations. This led to the first study screening for ICD in PwP before they received DRT and comparing them to healthy controls. The results indicated that 18% of drug-naïve patients with Parkinson's Disease had impulse control symptoms (Antonini et al., 2010). Interestingly, this prevalence rate matched with that of their previous study, with 20% in the general population having at least one ICD (Isaias et al., 2008). Another study explored the similar rates between pre-medication PwP and the healthy population, but using instruments validated for Parkinson's disease and analysing the control data within the same study. 18.5% of unmedicated PwP and 20.3% of healthy controls self-reported any ICD or related behaviour (Weintraub et al., 2013). This suggests, that **before the initiation of DRT, individuals with Parkinson's disease might be at the same risk as individuals in the general population to develop ICBs;** Parkinson's disease itself might not confer an increased risk for ICBs. Instead, dopaminergic medication appears to be the central factor for PwP being at a higher risk for ICB (Ambermoon et al., 2011; Dodd et al., 2005; Potenza et al., 2007), while other risk factors irrespective of Parkinson's disease need to be explored in the general population.

It is important to consider, that most studies reporting significantly greater rates of ICDs associated with Parkinsonism, compared medically treated PwP to healthy controls. A meta-analysis summarised these findings and showed significantly higher rates (Odd Ratios between 2.07 and 4.26) of gambling, hypersexuality, eating, punding and hobbying (not shopping) in PwP on DRT compared to healthy individuals (Molde et al., 2018). One study that was included, specified these higher frequencies of ICBs in PwP compared to healthy control for all types of ICDs: "compulsive gambling 1.6% vs. 0.6%, hypersexuality 5.6% vs. 0.6%, compulsive shopping 4.8% vs. 2.5%, and compulsive eating 11.2% vs. 2.5%." (Erga et al., 2017). The higher rates of ICD among PwP further appear to remain stable over time. In a longitudinal study by Erga & colleagues (2020), patients displayed more ICBs than controls at baseline, as well as after 2 and 4 years. During this period, 47% of PwP and 18% of healthy control reported ICBs, with symptoms resolving (in 30% PwP) or persisting (in 13% PwP) throughout. **Again, a substantial proportion of the healthy control participants experienced ICBs yet remained disregarded when compared to PwP on dopaminergic medication.**

Furthermore, it is important to consider that the prevalence rates vary depending on the assessment tools, as well as the breadth and types of ICBs included. Moreover, some types of ICBs are more common depending on the individual's gender; with compulsive sexual behaviour being more frequent in men, while compulsive buying and binge-eating are slightly more prevalent in in women (Weintraub et al., 2010). This is especially relevant to take into account, due to the risk of developing Parkinson's disease being twice as high in men than women, which could impact the estimated prevalence rates of ICBs when investigated in PwP (Cerri et al., 2019). Unfortunately, little general population estimates are available for all the specific types of ICB, but studies in both healthy and PwP have revealed the following.

Pathological gambling occur in approximately 3.4 - 7.0% of PwP (Lesieur et al., 1987; Grosset et al., 2006; Weintraub et al., 2008; Lu et al., 2006). These rates also vary with cultural differences or environmental access to gambling, with higher rates of 5.5% in the United States and 0.32 - 1.3% in Korea and China (Weintraub et al., 2010; Fan et al., 2009; Lee et al., 2009). Similarly, the estimated rates vary within the general population from 0.2 - 5.3% across Norway, Hong Kong and the United States (Hodgins et al., 2011).

Compulsive sexual behaviour was estimated in 2.4 - 3.5% of PwP, although a study with small sample size revealed estimates of 10% (Voon et al., 2006; Weintraub et al., 2008; Isaias et al., 2008).

Prevalence estimates for compulsive shopping ranged between 0.4% and 5.7% of PwP (Weintraub et al. 2010; Christenson et al., 1994; Weintraub et al., 2008). Binge eating was estimated in 4.5% to 7.2% of PwP (Weintraub et al., 2008; El Otmani et al., 2019), while the prevalence is approximated at 0.3% to 4.5% in the general population (Hudson et al., 2007; Sonneville et al., 2013).

Regarding the Parkinson specific types of ICB, punding was reported within a range of 1.4 to 14% (Miyasaki et al., 2007; Evans et al., 2004), while DDR occurred among 0.6 - 4% of PwP (Giovannoni et al., 2000; Weintraub et al., 2009).

It is believed that ICBs are underestimated, due to reduced reporting and recognising of their symptoms. A study revealed ICBs in 40% of the sample, that had not been clinically recognised before (Phu et al., 2014). This could be the result of lacking routine screening in

clinical practice, as well as problematic behaviour (sub-clinical) often not being acknowledged until it impacts the individuals social and occupational functioning (clinically significant). In addition, individuals affected by ICBs might experience shame and will consequently avoid reporting the symptoms. Alternatively, there might be little awareness about the ICB itself and the consequences. Or the link between the ICB and the dopaminergic medication administered might not have been established. Interestingly, PwP with multiple ICBs also displayed elevated difficulties in "identifying feelings and difficulty describing feelings" (Goerlich-Dobre et al., 2014). Therefore, the self-reporting of ICB symptoms in PwP could be especially difficult, due to alexithymia being substantially more prevalent in PwP with severe ICBs. However, it appears that alexithymia could also be a general risk factor for ICBs in any population, due to it increasing the risk of gambling disorder in the general population as well (Bibby & Ross, 2017).

1.5 Public Health Concern: The Burden of Impulsive Compulsive Behaviours

It can be assumed, that the burden of ICBs is immense in both general and clinical populations. However, with the diversity and prevalence of ICBs in the general population remaining rather under-recognised, researching the scope of consequences and associated burden has mainly been limited to gambling disorder. Therefore, the burden associated with gambling in the general population will be reviewed, followed by a discussion on the relevance and added burden of ICBs on PwP.

Gambling in the general population has been emphasised as a public health issue, with more people having gambled than not in the last year and up to 6.5% developing problematic gambling throughout their life (Calado & Griffiths, 2016). Although the rates vary depending on culture and country, negative consequences associated with gambling are evident. Browne & colleagues (2017) reviewed the various domains that can be impacted by gambling: "decrements to health, emotional or psychological distress, financial harm, reduced performance at work or education, relationship disruption or breakdown, criminal activity". Pathological or more severe gambling has been associated with homelessness (Edens et al., 2011), unemployment and divorce (Castrén et al., 2013). Within a Japanese sample, individuals problem gambling lasted for 12.3 years on average, throughout which 12,1% attempted suicide and 10.6% had a history of

bankruptcy (Komoto, 2014). However, this could have also been related to the heightened comorbidity with psychiatric disorders (mood disorder, schizophrenia, substance abuse) among problem gamblers. Problematic and pathological gambling is highly comorbid with various other disorders. A review showed 60.1% of pathological gamblers were also nicotine users, 57.5% had a substance use disorder and around 37% suffered from a mood or anxiety disorder (Lorains, Cowlishaw & Thomas, 2011). Furthermore, medical disorders and emergency visits appear more prevalent in individuals with pathological gambling (Morasco et al., 2006). However, not only the individual gambling will suffer the consequences associated with it, but it will also strongly impact the families financial, emotional and social well-being (Mathews & Volberg, 2013).

Consequences associated with other common ICBs have been less explored but are expected to show similarities to the consequences described above. Compulsive shopping or buying has also been associated with problems in psychological, social, occupational and financial domains (Müller, Mitchell & de Zwaan, 2015). Hypersexuality, not being a compulsive spending behaviour, has more work-related, personal and relationship problems associated with it (Koós et al., 2020). Individuals with compulsive binge eating suffer consequences from overconsuming calories, leading to 30.7% being overweight and 32.8% being troubled by obesity (Kessler et al., 2013). Consequently, binge eating is associated with various physical health problems, such as cardiovascular problems and type 2 diabetes (Sheehan & Herman, 2015). In addition, 67% of those binge eating will have received a comorbid psychiatric diagnosis, with anxiety and mood disorders being most prevalent (Grilo, 2013). Interestingly, the types of ICB also occur comorbid with each other, with for example 5.7% of individuals with binge-eating also displaying pathological gambling (Jiménez-Murcia et al., 2013).

Moreover, the additional ICB burden in PwP is concerning, especially with Parkinson's disease being the second most common neurodegenerative disease. Many people worldwide are affected by this neurological condition, with the incidence rates rising drastically as the population is ageing, growing and clinically identifying individuals with Parkinsonism better. Between 1990 and 2019, the global incidence of Parkinson's disease has increased by 159.73% (Ou et al., 2021). In 2019 it was estimated that 8.5 million individuals had Parkinson's disease worldwide. However, with the prevalence more than doubling in the last 25 years, the number of

individuals affected by this condition is expected to continue to increase. Consequently, further increases in years lived with disability and deaths are predicted (Ou et al., 2021). Only in the UK, around 145,000 received a diagnosis of Parkinson's disease in 2020, with this prevalence rate presumed to increase up to 243,877 by 2055 (Parkinson's UK, 2018). With up to 42.5% of PwP experiencing ICBs (Joutsa et al., 2012), around 100,000 individuals in the UK could then be suffering from the neuropsychiatric symptomatic of impulsive compulsive behaviours additional to their motor symptoms.

Parkinsonism, with motor symptoms central to the neurodegenerative disorder, affects various domains of functioning and reduce the quality of life experienced (GPDS, 2002). However, the possible additional neuropsychiatric non-motor symptoms need to be increasingly recognised to avoid the secondary burden carried with them (Aarsland et al., 2007). The quality of life in PwP with impulse control and related disorders (ICRD) is lower than that of PwP without ICRD (Phu et al., 2014). Furthermore, this study showed ICRD in PwP to be associated with worse emotional wellbeing, having less social support and a reduction in activities of daily living. ICDs appear to specifically impact other non-motor symptoms in Parkinson's disease more strongly, while the motor symptoms experienced in PwP with or without an ICD resemble each other (Jesús et al., 2020). For example, Parkinson's symptoms regarding sleep, fatigue, bodily discomfort, communication, urinary and sexual function were more frequent or problematic in PwP with ICD.

The additional burden caused by ICBs was also seen in caretakers of PwP. Carers (i.e. mostly family and friends) of PwP with ICDs suffered from a greater burden, than carers that supported PwP without any behavioural disturbances (Leroi et al., 2012). Johnson & colleagues (2023) suggest that depressive symptoms, as well as apathy and disinhibition can account for the majority of carer burden caused. Neuropsychiatric symptoms, especially those reflecting executive dysfunction, were most predictive of the burden that caretakers of PwP with ICD experience.

Additional to the lower quality of life that patients and their carers encounter, ICBs can also lead to drastic social, occupational or financial consequences depending on the type of behaviour displayed. As explored above, such consequences of ICBs occur in individuals,

regardless of a diagnosis of Parkinson's.

To conclude, ICBs cause extensive burden for anyone engaging in the behaviour, as well as their environment or caretakers. Both individuals in the general population and PwP experiencing ICBs, suffer detriments in emotional, mental, and physical well-being. Depending on the type of ICB engaged in, individuals face additional financial, occupational or personal consequences. Therefore, ICBs need to be considered as an urgent public health concern for the general population and among the increasing number of individuals with Parkinson's disease.

1.6 General Risk Factors for ICB: Socio-Demographic, Personality and Cognitive Risk

With numerous studies exploring the heightened prevalence of ICBs in association with Parkinson's disease, various studies have examined factors that are more frequent in PwP with an ICB compared to PwP without an ICB. Dichotomising ICD is problematic, as behaviours exist on a continuum and will therefore be discussed using the Research Domain Criteria later. Nevertheless, the resulting risk factors identified encompass socio-demographic and cognitive aspects, as well as Parkinson-related factors. This could suggest ICBs being a phenomenon of higher complexity than currently assumed and the risk factors explored in PwP occurring before the onset of their neurological condition. **The socio-demographic risks discussed next might be relevant for the general population and need to be explored irrespective of Parkinson's disease.** Especially with many of the risk factors having already been mirrored in the general population by research on a specific type of ICB (i.e., gambling disorder). Therefore, the risk factors for ICBs will be discussed based on PwP with behavioural addictions and emphasised as relevant for the general population with studies on problematic gambling behaviour that reflect similar risks.

It appears, that many demographic factors are involved in the development of ICB. Individuals with Parkinson and additional ICB symptoms are more frequently of younger age and male (Antonini et al., 2017; Kim et al., 2013; Liu et al, 2019). For example, one sample displayed individuals with ICBs that had a mean age of 66.3 years, whereas the non-ICB group was 70.5 years on average (Kim et al., 2013). It has been discussed whether the risk of being younger is the result of patients receiving more dopamine agonists in earlier stages (Leroi et al.,

2012). Although it is an important aspect to consider, young age has continued to be risk factor even when controlling for the DRT administered (Weintraub et al., 2010) and could be a risk irrespective of the disease. Furthermore, ICBs marked men more strongly, even throughout a longitudinal study of 4 years (Carvel et al., 2018). Other factors associated with a higher risk for ICD are being unmarried and having received more education, with the latter still requiring more exploration (Weintaub et al., 2010). Interestingly, the same factors of being male, young, single, and possibly more educated have been identified in the general population as increasing the risk for problematic gambling (Moreira et al., 2023).

Further, the use and abuse of certain substances has been more prevailing in individuals with gambling disorder and PwP with ICBs (Moreira et al., 2023). Alcohol consumption, smoking cigarettes (current and former), and drinking caffeine was more common in ICB samples (Bastiaens et al., 2013; Corvol et al., 2018; Liu et al., 2019; Voon et al., 2011; Weintraub et al., 2010). However, not only the individual's problematic drinking gives rise to a risk for ICBs, also a family history of alcohol use disorder has been identified as a risk for gambling disorder in the general population and ICBs in PwP (Buth et al, 2017; Voon et al., 2007). The latter study further revealed, that PwP frequently experiencing manic or hypomanic episodes on their dopaminergic medication, reflected a heightened likelihood to develop pathological gambling. This is suggestive of comorbid psychiatric symptoms displaying a risk for ICBs in Parkinson. Furthermore, it highlights the psychiatric comorbidities that arise in individuals with gambling disorder in the general population. More specifically, Moreira & colleagues (2023) recently reviewed the risk factors of problematic gambling in the general population and revealed depression, anxiety, mood disorders and substance use disorders commonly co-occurring with gambling disorder.

Similarly, psychiatric symptoms such as depression, state & trait anxiety and obsessive-compulsivity have been predictors of ICBs in PwP (Auyeung et al., 2011; Joutsa et al., 2012; Leroi et al., 2012; Voon et al., 2011). Depressive symptoms had a stronger predictive value for ICBs, compared to other demographic risk factors, and were associated with all the main types of ICBs (Joutsa et al., 2012). Overall, PwP with ICBs scored higher on depressive measures, with 34.3% classifying for a comorbid depressive disorder (Leroi et al., 2012). Within the same

sample, 37.1% indicated a family history of psychiatric disorders, suggestive of a cross-generational genetic and environmental risk. ICBs in PwP have been associated with various symptoms of depression, including irritability, appetite disturbance, anhedonia and apathy (Antonini et al., 2017; Martini et al., 2018; Pontone et al., 2006). Possibly, the apathetic tendencies regard everything outside the behavioural addiction, whereas heightened interest for that specific rewarding behaviour remains. With depression, anxiety, and obsessive-compulsive features predicting ICB in PwP, Voon & colleagues (2011) suggested psychiatric traits being more associated with ICBs than neurological factors. In line with this, a meta-analysis concluded negative affect having a higher predictive value for ICBs than other cognitive and motivational factors (Martini et al., 2018). Therefore, psychiatric comorbidity must be considered as an evident risk factor for developing ICBs.

Individuals' personalities further put some people at risk for ICBs. Cognitive impulsivity has been highlighted as a psychological risk factor for gambling among the general population (Browne et al., 2019; Dufour et al., 2020; Flórez et al, 2016). Correspondingly, compared to PwP without ICBs, those engaging in behavioural addictions display more impulsivity, compulsivity and risky decision making (Isaias et al., 2008; Voon & Thomsen; 2007; Voon et al., 2010). Although ICBs were associated with overall higher impulsivity, especially the impulsivity instigating choices for smaller immediate gratification (choice impulsivity) was pervasive in PwP with ICBs (Averbeck et al., 2014; Voon et al., 2011). Averbeck & colleagues (2014) speculated that although PwP with ICBs can gather information for reflective decisions, it appears not to influence impulsive decisions regarding future rewards. In addition, ICB patients demonstrated higher novelty seeking, which was mainly related to disorderliness and impulsivity (Voon et al., 2011). Interestingly, they also exhibited less overall motivation, which is supportive of apathy as the extreme on this continuum being more prevalent in ICB population as discussed above.

While research on substance addiction also emphasised higher impulsivity in individuals addicted, poor executive functions were also shown to occur more commonly (Dolan et al., 2008). This instigated investigating possible cognitive risk factors for behavioural addictions as well. A systematic review including 25 studies, revealed ICBs in PwP to be associated with worse reward-related decision making and poorer set-shifting (Martini et al., 2018). This could

suggest an altered executive functioning in PwP with ICBs, similar to individuals with a substance addiction. However, various other cognitive functions, such as concept formation, reasoning, inhibition, cognitive flexibility and working memory, were not exacerbated in PwP with ICBs (Martini et al., 2018). Consequently, various studies have questioned the association between ICBs in PwP and cognitive impairment, by PwP reflecting similar cognitive functions regardless of any impulsive behaviours (Antonini et al., 2017; Djamshidian et al, 2011; Voon et al., 2011). It is important to acknowledge however, that the progression of Parkinson's disease itself results in an altered cognitive state (Fang et al., 2020). Therefore, neurodegeneration and consequential impaired cognitive functioning within PwP occur irrespective of ICBs and need to be carefully considered as such.

Lastly, risk factors considered as Parkinson-related will be discussed. Given the parallelism of the aforementioned risk factors between individuals with gambling disorder and PwP with ICBs, other "Parkinson-related" factors could propose further risk factors also relevant for the general population and will thus be discussed below.

Various aspects were more pervasive in PwP with ICBs compared to PwP without any problematic impulsive behaviour. Individuals at risk for ICBs, received a diagnosis of Parkinson's disease at an earlier age (early onset) and have been experiencing the disorder for a longer duration (Antonini et al., 2017; Auyeung et al., 2011; Biundo et al., 2017; Kim et al., 2013; Leroi et al., 2012; Weintraub et al., 2010). These independent risk factors for developing ICBs, have been estimated at 59.5 years of age for an early Parkinson onset and 6.9 years as a longer disease duration (Kim et al., 2013). Likewise, gambling was more severe in non-neurological patients that had an early and short-term onset of their gambling behaviour (Guillou Landreat et al., 2020). Furthermore, PwP with ICBs displayed a poorer Parkinson related quality of life and more severe non-motor symptoms, mainly affecting "sleep/fatigue, mood/apathy, attention/memory and sexual functions" (Antonini et al., 2017). PwP exhibiting higher impulsivity suffered from worse sleep, especially due to poor sleep efficiency (waking up at night) and consequently being sleepy throughout the day (Scullin et al., 2013). Moreover, it has been discussed whether REM sleep behaviour disorder as a symptom marking the prodromal phase of Parkinson's disease, is associated with developing ICBs with the progression of

Parkinson. Although studies have inferred mixed results, a recent meta-analysis concluded that REM sleep behaviour disorder predicted a two-fold increase in risk for ICBs (Lu et al., 2020). In line with this, a systematic review suggested hypersexuality being associated with other behavioural symptoms occurring before the administration of DRT (Nakum & Cavanna, 2016). Therefore, other non-motor symptoms characteristic of Parkinson's disease have demonstrated to increase the risk for ICBs. Nevertheless, it is again important to note that moderate to high severity gamblers generally also tend to display poorer health, irrespective of having a neurological disorder. For example, Butler & colleagues (2020) identified, that severe gamblers were more likely to physically exercise less, make poorer dietary choices and display lower mental wellbeing. **Possibly, ICBs are associated with certain health issues in various populations.**

Motor symptoms however, have indicated mixed results regarding their association with ICBs. Studies have reflected both more severe motor complications in ICB groups, as well as a similar motor performance to PwP without ICBs (Antonini et al., 2017; Bastiaens et al, 2013; Giladi et al., 2007). Possibly, the impact of motor symptoms in PwP depends on the resulting embarrassment experienced. Those enduring public discomfort due to their motor symptoms, might withdraw from social situations and become more likely to engage in online gambling and shopping (Delaney et al., 2012).

In conclusion, various factors have predicted an increased risk for developing ICBs. Furthermore, **the majority of risk factors proposed by research on PwP have also been identified as increasing the risk for gambling disorder in the general population.** Risk factors, such as being a young male, using substances, having a comorbid psychiatric condition and making impulsive decisions, have been replicated numerous of times for gambling disorder and PwP. However, these factors could propose risks for various types of ICBs and could be relevant for anyone, regardless of clinical or general population. These and other factors possibly relevant for the development of ICBs continue to require more exploration, especially in the general population. Studies have undermined the relevance of ICBs in the general population or disregarded risk factors occurring before the onset of Parkinsonism. Furthermore, studies have

been varying in assessment approaches of ICBs, the inclusion and exclusion criteria for participants, and the size of samples analysed.

1.7. Why are ICBs Commonly Discussed Within the Context of Parkinson's Disease? The Role of Dopamine as a Risk for ICBs

Having established, that the aforementioned risk factors might not be unique to PwP but reflect overall risks for ICBs in any population, the question arises why the prevalence rates of ICBs appear higher in association with Parkinsonism. Therefore, the following section will firstly review the role of dopamine in addiction and the brain areas possibly underlying the development of behavioural addictions, to emphasise the relevance of both impulsivity and compulsivity among clinical and general populations. Then dopaminergic treatment will be discussed as the additional risk factor for ICBs associated with Parkinson's disease, to emphasise that although it triggers the surfacing of ICBs, it cannot account for some PwP not experiencing ICB following DRT or the general population facing ICB burden as well. Additionally, it highlights that the majority of literature on ICBs has been influenced by the commonality of dopamine in impulses for reward-driven behaviours (ICDs) and Parkinson's disease, while overlooking its diverse expressions in various populations.

1.7.1 Addiction:

Dopamine and Neuroanatomical Substrates of Impulsivity & Compulsivity

Research on substance addiction has long emphasised the key role of the neurotransmitter dopamine, with most drugs acting on the dopaminergic system for a rewarding experience (Koob & Bloom, 1988). In 1993, the Incentive Sensitisation Theory hypothesised, that the increase in dopaminergic neurotransmission following substance use, instigates associating the rewarding feeling with the drug and consequently reinforces its use (Robinson & Berridge, 1993). However, with repeated drug use, neural changes reflective of associative learning will result in the individual becoming sensitised to the drug itself and the cues indicating it (Schultz et al., 1997). As a result, individuals will display addictive behaviours that are marked by craving, compulsively 'wanting' and administering the drug, regardless of 'liking' it. Dopamine is central to the transition to forming addictive habits, due to mediating the assigning of incentive salience

to stimuli (Schultz, 2007). Specifically, the mesolimbic dopamine system has been identified as the neural pathway involved in the motivation for rewarding stimuli; incentive salience, pleasure and addiction (Wise, 2002). Alterations in its projections from the ventral tegmental area (VTA) to the ventral striatum are attributable to the primary changes of developing compulsive habits, which are followed by "a cascade of neuroadaptations" (dorsal striatum, OFC, PFC, amygdala) (Koob & Volkow, 2010). Volkow & colleagues (2002) reviewed the aforementioned brain areas and suggested their involvement in different stages of addiction. The nucleus accumbens (within the ventral striatum) was indicated as relevant for experiencing reward by altering the presence of dopamine 2 (D2) receptors. Later, the craving a drug was associated with higher activity in the orbitofrontal cortex (OFC), suggesting its role as the motivational driver for attaining the rewarding stimuli again. The amygdala and hippocampus were proposed as involved in learning the association of the reward with its cues. Ultimately, weaker inhibitory control exerted by the PFC in drug users could underly the administering of drugs becoming compulsive and addictive.

Interestingly, these brain areas have been implicated in neuroanatomical models of impulsivity and compulsivity. Fineberg & colleagues (2014) proposed an impulsive and compulsive circuit, each entailing a striatal and prefrontal node. Within the impulsive circuit, it is suggested that an impulsive drive originates from the ventral striatum and nucleus accumbens, while prefrontal regions (ACC/vmPFC) exert inhibitory control over it. Compulsive behaviours however, are proposed to be driven by the caudate nucleus and putamen, while being inhibited and controlled by the OFC. Possibly, the shift in striatal nuclei and corresponding PFC sub-regions involved represents the transition from impulsive behaviour to compulsive, addictive behaviours.

With behavioural addictions being marked by impulsivity and compulsivity, the reward-related processes mediated by the mesolimbic dopaminergic pathway are probably not specific to substances; the dysregulation of reward circuits could also mark behavioural addictions. In line with this, has been neuroimaging research exploring pathological gambling in healthy individuals and ICBs in Parkinson samples. More specifically, ICBs in PwP have been associated with alterations of the mesolimbic dopamine system, with increased striatal dopamine release in response to craving tasks or visual cues of rewards (Frosini et al., 2010; O'Sullivan et

al., 2011) and reduced top-down activation in the dlPFC (Filip et al., 2018). Furthermore, individuals with a gambling disorder showed reduced frontal activity during tasks involving response impulsivity, compulsivity, and risk/reward, similar to individuals with a substance addiction (Leeman & Potenza, 2013). This comparable dysregulation of addiction-related brain circuits for ICB and substance users has been explored for various brain areas (eg.: ventral striatum, OFC) (Dagher & Robbins, 2009; Koob & Volkow, 2010). However, results across studies have not always been consistent and vary in their focus on certain brain regions and study populations used. Furthermore, although neuroimaging findings reveal underlying mechanisms associated with ICBs, the results can currently not predict individuals at risk for problematic behaviours nor explain PwP assumedly showing higher frequencies of ICBs. Nevertheless, this review emphasises the central role of dopamine and its related brain networks in developing behavioural addictions, highlighting the involvement of both impulsivity and compulsivity.

1.7.2 Can Dopaminergic Medication & Deep-Brain Stimulation Account for Higher ICB Prevalence in Parkinsonism?

With socio-demographic, personality, and psychiatric risks for ICBs seemingly corresponding across studies using different populations, the past research focus on mainly PwP can be questioned. What is the distinctive factor associated with Parkinson's disease, that could account for the suggested higher prevalence of ICBs? To explore and explain the vast majority of research referring to PwP, Parkinson's disease is firstly explained briefly, followed by a discussion on Dopamine Replacement Therapies to reveal dopamine agonists as the additional risk factor possibly central to the higher prevalence of ICB.

The neuroanatomical pathology underlying Parkinson's disease is the neurodegeneration of dopaminergic neurons in the substantial substantia nigra pars compacta (SNpc) (Bernheimer et al., 1973). The resulting dopamine deficiency in the basal ganglia and nirgostriatal pathway leads to the cardinal motor features characteristics of Parkinsonism: tremor at rest, rigidity, akinesia/ bradykinesia, flexed posture, freezing and postural instability (Jankovic, 2008). While Parkinsonism entails the aforementioned symptoms that can be characteristic of various disorders, Parkinson's disease accounts for the majority of individuals affected. Additional to dopamine's dysregulatory effect on motor functioning, abnormalities also occur in sleep and

autonomic, cognitive, and neurobehavioral domains (Jankovic, 2008). ICBs represent such a neurobehavioral feature, that has an estimated heritability of 57% in PwP predicted by genes involved in the signalling and metabolism of dopamine (Kraemmer et al., 2016). The dopamine depletion could contribute to PwP being "hyper-responsive to punishment and hypo-responsive to reward" (Leemann etc al., 2012). However, as investigated by Frank & colleagues (2004), impaired leaning in PwP is reversed when DRT is administered. PwP off their medication learn more from negative outcomes, whereas those on dopaminergic medication displayed a higher sensitivity towards positive outcomes. These results indicate that DRT increases the responsiveness to rewards in PwP. While dopamine agonists lower the learning from punishment, they have further been associated with increased novelty seeking (Bódi et al., 2009). In combination with enhanced processing of rewards it could potentially lead to seeking for more rewarding behaviours which is central to developing ICBs.

In accordance has been the vast research emphasising dopamine replacement therapy (DRT) in PwP as a risk factor for developing ICBs. Various studies have shown a predictive value of DRT for ICBs (Ambermoon et al., 2011; Auyeung et al., 2011; Molde et al., 2018). The timing of developing ICBs after beginning dopaminergic treatment can vary largely, with a sample displaying onsets between 3 to 114 months after starting DRT (Bastiaens et al., 2013). Nevertheless, dopaminergic medication has been proposed as the main factor accounting for heightened rates of ICBs in PwP compared to the general population (Antonini et al., 2011; Weintraub et al., 2015). Especially dopamine agonists as a DRT medication exhibit an increased risk for ICB. Weintraub & colleagues (2010) explored the rates of ICDs associated with the main types of medication. Of those administering a dopamine agonist (Pramipexole, Ropinirole and Pergolide) 14% displayed an ICD, whereas only 7.2% of PwP on Levodopa screened for an ICD; dopamine agonists have a 2-3.5 times higher risk for ICBs. Dopamine agonists have displayed a higher selective affinity for tonically stimulating D3 dopamine receptors, which are more prevalent in the ventral striatum; central for reward processing and addiction (Gerlach et al., 2003; Gurevich & Joyce, 1999). Whereas Levodopa phasically stimulates D2 and D1 receptors, which are abundant in the dorsal striatum regarding motor inhibition (Frank et al., 2004). It appears, that the differing binding properties and receptor affinity could underly the heightened

risk of dopamine agonists for ICBs. The risk of dopamine agonists has not differed depending on the type administered (Voon et al., 2006) and has further been associated with ICBs in other clinical populations, such as restless legs syndrome, fibromyalgia, and progressive supra nuclear palsy (Cornelius et al., 2010; Holman, 2009; Ondo & Lai, 2008). However, findings regarding the relevance of the dosage of dopamine agonists have been mixed. While some studies have revealed similar dopamine agonist doses in those with and without ICBs (Voon et al., 2006; Voon et al., 2011), various other studies concluded a higher dosage being associated with an increased incidence of ICBs (Hassan et al., 2011; Nakum & Cavanna, 2016). On average, PwP with an ICB administered higher doses of dopamine agonists (153.9 mg/day) and Levodopa (684.1 mg/day), while the "total daily Levodopa equivalent dose" was a stronger predictor of ICBs than the dose of dopamine agonists (Kim et al., 2013). On the contrary, a longitudinal study by the DIGPD Study Group (2018), highlighted little predictive value of Levodopa use for developing ICBs. Instead, a clear temporal association and strong prediction by the lifetime average daily dosage of dopamine agonist for an increased risk for ICBs was established. Moreover, the temporal relationship between medication and symptoms was further highlighted by 50% of PwP experienced their ICBs resolving within 1 year after discontinuing the administration of dopamine agonists. This is suggestive of the need to urgently consider dopamine agonists as a strong predictor and risk factor for developing ICBs.

While DRT could precipitate ICBs in earlier stages of Parkinson's disease, Deep Brain Stimulation (DBS) throughout later stages of the disorder has been discussed with respect to ICBs. Some studies have reported ICDs following sub thalamic nucleus (STN) stimulation, whereas others suggest no change or an improvement in the symptoms (Broen et al., 2011). In a longitudinal study, ICBs disappeared after STN brain stimulation (Kim et al., 2018), whereas the decrease in ICB symptoms was not true for binge eating and hypersexuality in a follow-up cohort study (Abbes et al., 2018). Lim & colleagues (2009) also included dopamine dysregulation syndrome and punding when examining 21 cases of PwP with ICBs. However, ICB symptoms worsened, remained, or started after DBS in the majority of individuals affected. In line with this have been reports of PwP developing pathological gambling shortly after bilateral STN deep brain stimulation (Smeding et al., 2007). Kasemsuk & colleagues (2017)

reviewed the variety of effects of DBS on ICBs and revealed that within 19 studies, on average 15.11% developed ICBs after DBS, with binge eating being most common. However, among PwP that experienced pre-operative ICBs, 73.8% displayed improvements in their ICBs following DBS. This is suggestive of DBS as a treatment option for individuals with ICB, but also a risk factor for an onset following stimulation. Interestingly, individuals at risk for developing ICBs after DBS displayed the aforementioned general sociodemographic risk of being male, young, and having a history of depression. Demetriades & colleagues (2011) proposed that the reduction of prescribed dopamine agonist associated with receiving DBS could account for ICBs improving in some individuals after the operation. However, DBS is more commonly proposed in PwP suffering from severe motor symptoms and have been receiving DRT for a longer duration. It was suggested, that this could create a susceptibility for developing ICBs after DBS, especially with STH stimulation having been associated with more impulsivity and risk taking (Ballanger et al., 2009; Evens et al., 2015). Nevertheless, results have been inconclusive, with studies facing methodological limitations such as referring to small sample sizes. Further exploration is required to understand additional factors accounting for DBS exacerbating or improving ICBs.

In conclusion, dopamine is crucial within the complex interplay of the mesolimbic pathway underlying addictive behaviours, hypo- and hyperresponsiveness to rewards in PwP, and the varying mechanisms of actions of DRT. The dopaminergic imbalance appears central to Parkinson's disease and its treatment creating a susceptibility for ICBs; Especially dopamine agonists have been identified as accounting for the heightened risk for developing ICBs in PwP. However, it can be contemplated, that **DRT is the additional factor pushing individuals that are already susceptible for problematic behaviours (based on sociodemographic and other risk factors), over the threshold for developing a compulsive behavioural addiction.** While this suggests that the heightened risk by dopamine agonists for developing ICBs must be specifically considered in clinical care of PwP, it also supports research across general and clinical populations. **Only by understanding what makes someone vulnerable for developing ICBs, the final trigger by administering dopamine agonists in PwP could be avoided and the exacerbation of problematic behaviours prevented.**

Chapter 2

The Breadth, Outcome Measures & the Addictive Cycle of ICBs (I-PACE)

Based on the literature reviewed, the first unmet need arises. The different types of ICBs have not been researched in the general population, despite facing similar risk factors and Parkinson-related factors currently not fully accounting for the developmental trajectory and maintenance of the cases of ICBs. Additionally, only a limited number of types of ICBs is currently examined. These concerns will be discussed next and an approach for investigation using the RDoC framework will be proposed; since it justifies examining variation on a trait in the general population that could infer understanding the clinically significant expression in clinical populations.

2.1 Research Domain Criteria (RDoC): Framework of Dimensionality & Breadth of ICBs

2.1.1 Relevance of RDoC - Problematic Behaviours Across Various Populations

Having discussed the current research on ICBs and their risk factors, it becomes apparent that ICBs in the general population have been largely under-recognised. As reviewed above, research on behavioural addictions has commonly focused on gambling disorder or clinical Parkinson populations, with research on the latter additionally revealing dopamine agonists increasing the likelihood of developing ICBs. However, it is important to consider that DRT increasing the likelihood of developing ICBs, cannot explain why its administration will trigger ICBs only in some PwP. The Yin-and-Yang model of appetitive drive and inhibitory control emphasises, that administration of dopaminergic medication overly increases the appetitive drive and lowers inhibitory control only in vulnerable individuals that are already susceptible for ICBs (Cilia & van Eimeren, 2011). Features specific to Parkinson disease have not consistently contributed to predicting symptoms of ICB (Voon et al., 2011), while ICBs have also developed previous to the progression of Parkinsonism (Weintraub et al., 2006). In line with this are ICBs being prevalent in the general population; research exploring factors underlying ICBs irrespective of Parkinson disease are required.

The US National Institute of Mental Health (NIMH) proposed a refocus of research approaches that could support comprehending the complex facets involved in ICBs in the general

and clinical population. The Research Domain Criteria (RDoC) offers a dimensional framework to investigate mental health based on its genetic, neural, and behavioural features (Morris & Cuthbert, 2012). Continuous constructs need to be examined as such and researched beyond developed diagnostic categories, by including the distribution of traits among clinical and healthy populations using RDoC (Cuthbert, 2014). RDoC was motivated by the tradeoff of categorical conceptualisation of disorders, including the diverse expression of the same diagnosis, high comorbidity among mental illnesses and excluding subclinical individuals from studies that are displaying similar symptoms (National Institute of Mental Health). Furthermore, as discussed by Insel & colleagues (2010), recent revelations from neuroscientific, genetic and behavioural studies have conflicted with categorical diagnostics. RDoC assumes that mental illnesses are dysfunctional brain circuits and can supposedly be revealed using neurobiological research methods (eg.: neuroimaging, electrophysiology). Therefore, research using the RDoC framework examines pathologies as deviations of normality in order to develop a dimensional classification system, contrary to the number and types of symptoms specific to a diagnostic label (Cuthbert, 2014). Research using this theoretical framework will thus need more lenient exclusion criteria to mirror the natural variation for a trait and will allow investigating behaviours in the general population, while inferring similar presentations among clinical groups.

Addictions, behavioural and substance-use, share features in clinical and general populations that cannot be explored as qualitatively distinct. In agreement, Yücel & colleagues (2019) found a consensus on RDoC constructs primary to both substance and behavioural addictions. Various traits were suggested as involved in the addictive cycle; reward valuation, expectancy, action selection, reward learning, habit, response selection/inhibition and compulsivity. In line with RDoC it could be speculated, that all humans lays on the dimensions of these constructs, with extremes of normality or dysregulated combinations putting some individuals at risk for developing problematic addictive behaviours. Engaging in the behaviours is per se not harmful, the transition to executing the behaviour in a repetitive manner leading to harmful consequences and distress is problematic. Therefore, ICBs should be examined

regardless of the possible diagnostic labels individuals have received; researching factors that are crucial for the development of ICBs in the general population within the RDoC framework.

In line with a dimensional approach, has been the variety of disorders displaying impulsive and compulsive elements, or developing ICDs as a comorbid diagnosis (Robbins et al., 2012). Many disorders have been proposed on an impulsivity-compulsivity continuum, including "OCD, body dysmorphic disorder, hypochondriasis, impulse-control disorders, behavioural addictions, eating disorders, repetitive self-injurious behaviours (e.g., skin picking), some personality disorders, substance use disorders, autistic and Asperger's disorders, chronic tics, Tourette's disorder, stereotypic movement disorders and others" (Starcevic, 2016). Additionally, problematic impulsive compulsive behaviours have co-occured among various psychiatric diagnoses, with around one-third of an inpatient psychiatric sample suffering from comorbid impulse-control disorders (Grant et al., 2005). Moreover, ICDs have been associated with depression, as well as with anxiety and features of obsessive-compulsive disorder (Voon et al., 2011). ICBs are also commonly displayed in the general population, with 10.4% of a large sample of college students indicating at least one ICD throughout their life (Odlaug & Grant, 2010). The twelve-month prevalence in the general population has been estimated at 9.5% for overall impulse control disorders (Kessler et al., 2005). However, this rate does not include subclinical problematic behaviours, which could occur in an even larger substantial part of the population. Therefore, there is an urgent need to explore ICBs in the general population.

As argued by Okai & colleagues (2011), researching symptoms irrespective of a diagnosis could be advantageous. It could facilitate understanding the variety of manifestations of the symptom; "their aetiology and maintenance, both in general and in relation to the particular pathophysiological circumstances" (Okai et al., 2011). Therefore, this study will investigate ICBs within the theoretical framework of RDoC.

2.1.2 Relevance of RDoC - The Variety of ICBs

Furthermore, a spectrum inclusive of the various types of ICBs needs to be established, to recognise the breadth of ICBs in the general population. Similar to the different hobbies individuals find enjoyable, it could be assumed that the behaviours that are experienced as

rewarding can be rather diverse across people. Unfortunately, it is probable, that the diverse expressions of ICBs have not been recognised. Screening for problematic ICBs has commonly been restricted to gambling, hypersexuality, buying and eating behaviours, as well as additional Parkinson related behaviours; punding, hobbyism and walkabout (Weintraub et al., 2009). Although, these types of ICBs have displayed a heightened prevalence in clinical and general populations, it is a very narrow range of behaviours focusing on impulses. Various other types of problematic behaviours are currently failed to be acknowledged and will be discussed below.

Robbins & Clark (2015) emphasised the diversity of phenotypical expressions of behavioural addictions. Individuals have displayed excessive indulgence of various behaviours, such as exercise, tanning, cutting, video games and internet use. Specifically, behaviours using the internet are increasingly relevant, especially by being designed for a repetitive use that could lead to an uncontrollable urge for it. With the majority of the population using the internet and its increasing use in both younger and older people, it could be assumed that the dependant and problematic use of the Internet will continue to rise and exacerbate. Therefore, internet addiction, suggested as associated with distress, functional impairment, and comorbid psychiatric disorder, urgently needs to be recognised as an ICB (Shapira et al., 2000; Tao et al., 2010). Similarly, pre-clinical expressions of the impulse control disorders kleptomania (Clemm von Hohenberg & Dreßing, 2017) and trichotillomania, could be considered as ICBs (Robbins & Clark, 2015).

The motivation to explore more phenotypical expressions of ICBs is further supported, by case studies in medicated PwP displaying currently unrecognised impulsive or compulsive behaviours. For example, being generous can be experienced as rewarding (e.g.: donating) and has led to case reports of PwP with excessive generosity (Moll et al., 2006; O'Sullivan et al., 2010). Other ICBs revealed by case studies and summarised by Zhang & colleagues (2021) have been excessive hoarding (O'Sullivan et al., 2010), compulsive smoking (Bienfait et al., 2010) and cocaine addiction (Riedman & Chang, 2013), risky driving behaviours with signs of mania (Avanzi et al., 2008), an uncontrollable compulsive urge to sing (Bonvin et al., 2007) and tattooing (Maltête et al., 2016). More extreme ICBs described in patients with an additional history of drug abuse and psychiatric disorders, have been the compulsive killing of cats and zoophilia comorbid with hypersexuality (Micheli et al., 2015; Raina et al., 2012). However, the

aforementioned harmful behaviours, have only been examined in relation to DRT in PwP, while their occurrence in the general population has been neglected. As a consequence of past research overly focusing on ICBs in relation to Parkinson's disease, individuals suffering from ICBs in the general population or with differing types from the discussed ICB have been clinically completely disregarded.

Therefore, Guo & colleagues (2017) developed a questionnaire examining 34 problematic repetitive behaviours that could more accurately reflect ICBs in the general population. The *Impulsive-Compulsive Behaviours Checklist* includes various behaviours that have been suggested by experts or described in the DSM-5 as characteristic of problematic repetitive behaviours. Example items include distress caused by repeating actions or routines, excessively cleaning or rearranging, and checking, swearing or hair picking. Including such measures that reflect the breadth of ICBs and using an RDoC research approach to reveal ICBs in various populations, could tackle the current unmet need of researching the prevalence and heterogeneity of problematic behaviours among the general population. It is expected for ICBs to be expressed more diverse than commonly assumed, reflecting difficulties with both impulse-control and obsessive-compulsive behaviours.

2.2 Outcome Measures: Limitation of Assessment Based on the Medical Model

Having established, that a more diverse approach to assessing ICBs is required and that their occurrence needs to be emphasised in the general population as well, the next to consider is another unmet need regarding the limitations of assessing the outcomes of ICBs within the medical model.

2.2.1 Measure for the Severity of ICB Symptoms: QUIP-rs

With the urgency to recognise individuals with ICBs to minimise the associated distress caused, the most appropriate approach to characterise the outcomes of problematic behaviours becomes increasingly relevant. Measures indicative of the impact of ICBs are required, to reveal individuals whose recreational behaviours have transitioned to problematic behavioural addictions, as well as to operationalise the outcomes of their ICB. Due to the limited assessment tools available for ICBs, Weintraub & colleagues (2009) developed the *Questionnaire for*

Impulsive-Compulsive Disorders in Parkinson's Disease (*QUIP*) to screen for such ICB symptoms. While the items are in line with the DSM-5 diagnostic criteria, the binary answer scales prevent from measuring the extent of problems associated with the ICB experienced. Therefore, the *QUIP-Rating Scale* (*QUIP-rs*) was proposed, which examines the frequency of ICB symptoms on a continuous answering scale (Weintraub et al., 2012). This valid and reliable tool was supported by a critical review published in the Movement Disorder Society (Evans et al., 2019). The *QUIP-rs* was recommended for diagnostic screening based on the proposed cut-off scores, as well as for rating the severity of symptoms of ICB. Moreover, this questionnaire has been suggested for differential screening of the severity of symptoms and monitoring possible changes of the ICB symptoms (Leplow & Ringendahl, 2022). The *QUIP-rs* has been translated into 35 languages and can be administered by both self-reporting of patients and rating by clinicians; it has been the gold-standard measure for identifying ICBs (Evans et al., 2019; Guerra et al., 2020; Marques et al., 2019; Probst et al., 2014; Takahashi et al., 2022).

Although this questionnaire has been commonly used to assess ICBs, it has the following shortcomings that need to be considered. Firstly, it has been used to assess ICB symptoms exclusively in Parkinson's patients, despite the scales regarding Parkinson-related behaviours being of lower psychometric sensitivity and the authors explicitly stating the need to "examine its use in non-PD populations" (Probst et al., 2014; Weintraub et al., 2012). Secondly, the questionnaire only examines a limited number of types of behaviours: gambling, sex, buying, eating, performing tasks or hobbies, repeating simple activities, taking Parkinson medications (Weintraub et al., 2012). Consequently, individuals suffering from other heterogeneous types of problematic behaviours, such as the ones discussed in the previous section, remain unnoticed. Lastly, the measure explores the obsessive-compulsive nature of ICBs, rather than the outcome of ICBs that would be reflected by the impact that the problematic behaviour has on the individuals' well-being. While the items of the *QUIP-rs* successfully represent the urges for the behaviour, its use for screening the execution of the behaviour and its consequences can be questioned. The severity of ICB symptoms measured by the *QUIP-rs*, does not reflect the real-world harm caused by ICBs. Furthermore, the proposed diagnostic cut-offs are not generalisable beyond North American PwP and imply that the extent of obsessional compulsivity for the

behaviour can define the control over the impulse being pathological; an Impulse Control Disorder. This is in line with considering ICBs as a public health concern within the medical model, that has possibly been influenced by the conceptualisation of substance addiction. As a result, the severity of ICBs is indexed by the urge to engage in it, instead of capturing the significance of impact the ICB has on the individual's life.

2.2.2 The Medical Model: Limitations & Shifts in Focus

Within the Medical Model, clinical practice and research is guided by "problematic thoughts, feelings and behaviours" being considered as mental disorders that have an underlying biological cause or medical condition (Huda, 2021). However, the DMS-5 highlights that this binary distinction between normal and having a disorder is questionable when used for mental health, due to the current knowledge gap for biological markers and the lack of severity measures (American Psychiatric Association, 2013). Additionally, subsyndromal or heterogeneous symptom expressions would remain unrecognised, despite possible consequences experienced. Viewing behavioural addiction within the medical model has further been challenged, by the disagreement among people and health professionals over considering gambling addiction as a disease (Tikkien et al., 2012). The binary conceptualisation could imply that only individuals receiving the diagnosis of an ICD experience harmful consequences, whereas those not displaying the symptoms are not experiencing any impact on their well-being. However, as criticised by Langham & colleagues (2015) regarding gambling addiction, the harm caused by gambling is not necessarily proportionate to the extent of engaging in gambling; harm is also relevant for clinically subsyndromal individuals. With medical practice using the "pattern recognition model" for diagnostics (Yazdani et al., 2017), treatment might currently only be targeted at individuals displaying severe symptoms of ICB as indexed by the *QUIP-rs*, while neglecting the harm caused among subsyndromal individuals. As proposed by Abbott & colleagues (2013), clinical relevance for problematic behaviour should possibly be distinguished based on harmful on non-harmful instead.

Other limitations of the medical model for ICBs, have been put forth by the Productivity Commission (2010) by discussing the shortcomings of its biological focus for behavioural

addictions. The medical model appears to undermine the relevance of social factors in determinants of the harm caused by ICBs. However, non-medical approaches could be effective in treatment, and social support could help, while social stigma could prevent, the treatment progress of behavioural addictions. Therefore, ICBs should be viewed within the shift in framework of the medical model proposed by Farre & Rapley (2017); ICBs need to be operationalised using the biopsychosocial model and its outcome measure should be constructed as such.

2.2.3 Introducing an Alternative Outcome Measure: ICB-Related Harm

Whereas harmful outcomes of substance addiction can be reflected by medical health consequences (National Institute on Drug Abuse, 2022), the consequences of problematic behaviours are at the present time far more complex to operationalise. In order to discuss a possible outcome measure for ICBs, the most researched and first recognised behavioural addiction in the Diagnostic manual will be used; gambling disorder. Langham & colleagues (2015) argued that harm caused by gambling is measured poorly by using diagnostic criteria, behavioural symptoms or experiences of negative consequences. Diagnostic criteria fail to identify harm caused among the various expressions and severities of gambling. Behavioural symptoms could support understanding the development of harmful consequences, but are not precise proxies for the harm caused. Lastly, the outcome measure of experiencing negative consequences has been too oversimplified. Consequently, Langham & colleagues (2015) put forth a definition of gambling related harm that outcomes measures should reflect: "Any initial or exacerbated adverse consequence due to an engagement with gambling that leads to a decrement to the health or wellbeing of an individual, family unit, community or population.".

Accordingly, ICB related harm should reflect WHEN harm occurs, WHO is affected by it, and WHAT domains are impacted. The study proposed a conceptual framework targeting these domains to operationalise gambling related harm. The dimensions of harm include a temporal aspect of harm at different stages of gambling behaviour (general, crisis, legacy harms), as well as the extent of impact throughout the life course or across generations. Furthermore, a dimension on the scope of the harm caused was included; harmful consequences affecting the

person gambling, but also close ones and the broader community. Lastly, 6 domains of harm outcomes were proposed, reflecting that gambling can cause financial harms, relationship disruption/conflict or breakdown, emotional or psychological distress, decrements to health, cultural harm, reduced performance at work or study and criminal activity. Possibly, assessing these domains of harm that are impacted by individuals' problematic behaviour could allow for a more suitable outcome measure of ICBs within the bio psychosocial model.

A study administering this framework emphasised, that due to the higher prevalence of low and moderate-risk gamblers, they could "account for a majority of the aggregate years of health life lost" (Browne et al., 2016). This is supportive of using harm to measure the outcome of ICB, irrespective of fulfilling the diagnostic criteria. Especially relationships were affected by gambling, accounting for 24.9% of the relative impact of harm, followed by health and emotional/psychological consequences. Moreover, the majority of harm (86.2%) affected the individual gambling, while 13.8% of harm was faced by others.

Therefore, an alternative or additional outcome measure for ICBs is proposed, that examines the real-life impact (ICB related harm), rather than only the severity of symptoms. Conforming to the conceptual framework by Langham & colleagues discussed above, the *Short Gambling Harm Screen* assesses the consequences of gambling by its effect on the 6 domains: financial, work/study, health, emotional/psychological, relationship, and social deviance (Latvala et al., 2021). Assessing the outcome of ICBs, by investigating the harm and issues caused by ICB on those domains of life, reflects the real-life impact of problematic behaviours and recognises individuals in need for support that do not fulfil the diagnostic criteria. In conclusion, outcome measures such as the *Short Gambling Harm Screen*, that index the harm caused by ICBs, are advocated to be explored as an additional outcome measures and expected to overlap little with the severity of the symptoms experienced.

2.3 The I-PACE Model: Operationalisation of the Addictive Cycle

Having discussed the breadth of ICBs and approaches to assessing their outcomes, the need to disentangle the factors contributing to the development and maintenance of ICBs arises. To establish effective preventative measures, the relevant factors need to be revealed and

operationalised to identify vulnerable individuals at risk for ICBs. Therefore, the third unmet need discussed next within this study, focuses on the first framework (I-PACE) that has proposed factors interplaying in an addictive cycle that could explain the exacerbation from problematic to addictive behaviours. Being the first model proposing the underlying mechanisms of ICBs, the following concerns arise:

1. What measures could operationalise components of the model?
2. Does the model hold true for the various types of ICBs?
3. Does it have a predictive value for the outcome measures of ICBs?

The I-PACE model will be summarised, followed by proposing self-report questionnaires that could operationalise components of the model. Lastly, it will be discussed why the model needs to be explored with respect to various types of ICBs.

2.3.1 The Interaction of Person-Affect-Cognition-Execution (I-PACE) model

In order to develop interventions and treatment approaches for individuals vulnerable for ICBs, the development and maintenance of behavioural addictions has to be understood. The Interaction of Person-Affect-Cognition-Execution (I-PACE) model was the first theoretical framework to explore the various factors and their interactions relevant for the onset and exacerbation of problematic behaviours (Brand et al., 2016). While the first model focused only on Internet-use disorder, Brand & colleagues (2019) updated the model to be inclusive for all addictive behaviours (see Figure 1). The authors became aware of the different applications, the I-PACE model offered to investigate the various manifestations of ICBs, such as pathological gaming, gambling, sexual behaviours, shopping, and internet use (Deleuze et al., 2017; Starcke et al., 2018; Wéry et al., 2018; Vogel et al., 2018; Zhou et al., 2018). Additionally, the revised I-PACE model (I-PACEr) considers certain processes to differ at early and later stages of addiction. The following section will explain the I-PACE model in order to explore the factors relevant for the etiology of ICBs and the transition from a recreational pleasurable activity to a problematic addictive behaviour.

The pathways of the addiction process described by the I-PACE model, occur within the context of predisposing variables (P), that can "stabilise and intensify" the exacerbation to

developing an addiction. This P-component is composed of various core or behaviour-specific characteristics that make individuals vulnerable for ICBs. General risk factors included, regard biopsychological characteristics (genetics, early childhood experiences, stress vulnerability), as well as certain psychopathologies (eg.: social anxiety), the social support perceived, the overall tendency of coping and certain personality traits (eg.: impulsivity) (Prizant-Passal et al., 2016; Ioannidis et al., 2019; Brand et al., 2016). Additionally, the specific behaviour that the individual is prone to engage in, is suggested to depend on the personal "needs, motivates and values". These aforementioned characteristics vary across people and may influence the subjective perception of triggers (external or internal) such as stress, and consequently affect the cognitive and emotional responses the individual will have. More specifically, the way of coping and urge to regulate mood could impact the response to the trigger, as well as if the individual reacts to it by craving (cue-reactivity and craving) or overly focusing (attentional biases) on a behaviour that they expect would help them (cognitive biases). According to the authors, whether the behaviour is then engaged in, depends on the interaction between impulsive and reflective reasoning. This E-component appears to be critical in addictive behaviours, where it can be speculated that a heightened decision impulsivity outweighs a reduced executive function of inhibitory control. In earlier stages, the model proposes that deciding to engage in the behaviour leads to a pleasurable experience; gratification. However, doing this behaviour repetitively can shape the expectations about how rewarding it is, as well as its functionality for coping. With time and positive experiences, the associations regarding this behaviour may strengthen and result in associating certain cues with the behaviour and craving it. In combination with diminishing inhibitory control, the once pleasurable behaviour transitions into a habitual addictive behaviour; The individual develops little control over engaging in the behaviour, despite its negative consequences. It appears, that inhibitory control as a core executive function moderates such behaviours becoming a habit, which becomes increasingly challenging with the strengthening of associations with the behaviour. In line with this, has been a study by Wegmann & colleagues (2020), that concluded attentional impulsivity being associated with more severe symptoms of social-network use disorder, especially in individuals with lowered inhibitory control. As a

consequence, during later stages of the I-PACE model, the behaviour being compensatory outweighs any gratifying or pleasurable experiences from it, as in the earlier stages.
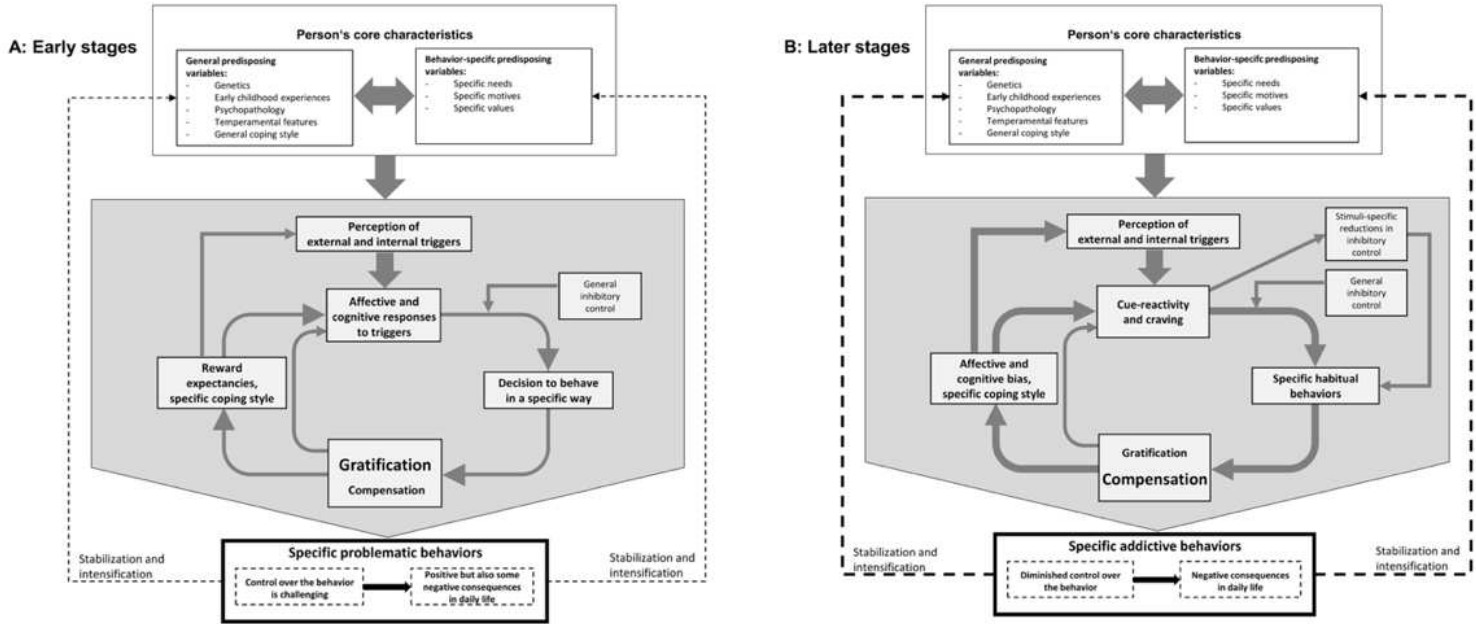
Figure 1.

The revised I-PACE model of addictive behaviors

Note. "The revised I-PACE model for addictive behaviors. Figure A shows early stages of the development of addictive behaviors. Figure B illustrates later stages of the process and factors contributing to the maintenance of addictive behaviors. Bolder arrows indicate stronger connections/accelerated mechanisms.". Reprinted under the terms of the Creative Commons CC BY-NC-ND 4.0 DEED by Brand et al. (2019).

2.3.2 Utility of the Model and Needs for Operationalisation

This complex interplay of various factors is the first framework that allows investigating the development of specific problematic behaviours, as well as its exacerbation to an addictive behaviour. It provides a basis to strive for comprehending the mechanisms underlying individual differences that put some more at risk for ICBs than others. Furthermore, although the I-PACE model was developed based on the general population, exploring the constructs contributing to the development and maintenance of ICBs, provides a framework to investigate such processes

in people with Parkinson disease. Although various Parkinson-related factors (eg.: DRT) heighten the risk for developing ICBs, they cannot account for studies screening similar ICB prevalences to the general population or some PwP not developing addictive behaviours (see Part 1.6 Risk Factors for ICBs). Various other predisposing, cognitive, affective and executive characteristics could give rise to vulnerability for ICBs, previous to neurodegeneration central to Parkinson disease. However, this requires approaches for operationalising the different stages of the addictive process firstly in the general population, to then secondly propose its investigation in clinical populations. Tools reflective of the factors involved in the I-PACE model need to be established, as a basis to then review the central factors in developing addictive behaviours in both general and clinical populations (in line with RDoC).

To discuss and propose possible measures reflective of the different factors involved in the I-PACE model, the components will be broadly divided into the interplaying factors central to the stabilising and exacerbating of problematic behaviours (A-,C-,E-components; see grey boxes in Figure 1) and the defining features of Stage A (specific problematic behaviour) and Stage B (specific addictive behaviour).

2.3.2.1 The I-PACEr model: Measures of the Addictive Cycle (A,C,E Components)

Contrary to the individuals' general core characteristics that could incline susceptibility for developing any problematic behaviour, the proposed factors within the addictive cycle start focusing on the specific behaviour that the individual could struggle with. As discussed by Brand & colleagues (2016), the levels of stress subjectively perceived when faced with a trigger, may influence affective and cognitive processes, that could consequentially impact the decision to engage in the behaviour (Dickerson & Kemeny, 2004; Morgado et al., 2015). Especially rewarding or negative stimuli in uncontrollable or unpredictable situations could have a heightened stress response (Koolhaas et al., 2011). As a result, those perceiving such stressful triggers could experience cognitive consequences such as making more risky decisions or engaging in behaviours such as eating more sweets and high-fat foods (Oliver et al., 2000; Porcelli & Delgado, 2009; Putman et al., 2010; Starcke et al., 2008; Starcke et al., 2012). In early stages (A) the aspects of cognition or affect influenced, depend on the specific situation

encountered. For example, perceiving an external trigger (eg.: food) could guide attention to aspects associated with it (eg.: restaurants, feeling hungry). Alternatively, internal triggers (eg.: feeling upset) could motivate urges for certain behaviours (eg.: online shopping). Such diverse affective and cognitive responses vary substantially across individuals and would currently necessitate an unfeasible scope of measures.

Instead, inhibitory control should be operationalised to investigate the extent of control individuals have over deciding to engage in the behaviour following stressful triggers. More specifically, inhibitory control could suppress attention to certain stimuli, while its aspect of self-control could influence the emotions experienced and the consequential behaviours engaged in (Diamond, 2013). According to Friedman & Miyake (2004), inhibiting a distractor or prepotent behavioural response are strongly correlated, suggesting the moderating role inhibition could have on making a decision. Experimental psychological tasks, such as the Stroop task (MacLeod, 1991), Flanker task (Mullane et al., 2009) and go/no-go tasks (Cragg & Nation, 2008) are needed to operationalise and investigate the role of inhibitory control as a moderator and across the stages of developing addictive behaviours. According to Brand et al. (2019), it is predicted for later stages of addictive behaviours to be marked by the impulsive system outweighing the reflective/deliberate system that is based on executive functions such as inhibitory control.

Furthermore, while in the early stages of developing a problematic habit the behaviour is experienced as pleasurable, a shift to increasing compensating effects is predicted with the progression of addiction. In collaboration with Brand, Wegmann & Antons (2022) recently developed the *Experience of Compensation Gratification* questionnaire, that is a self-report measure operationalising the experience of gratification and compensation for an addictive behaviour. The items effectively represent the gratification of needs and experiencing pleasure by the behaviour (*Gratification*), as well as the compensation of needs and experiencing relief from negative feelings (*Compensation*).

In line with the incentive sensitisation theory from research on substance addiction, the pleasure experienced by the behaviour in early stages will reinforce engaging in it again and could instigate the shift from liking to wanting the behaviour (Robinson & Berridge, 1993; Robinson & Berridge, 2001). The I-PACE model proposes that positive experiences with the

behaviour and consequentially adjusting the reward expected from it and its use for coping, could underlie the reinforcement mechanisms to repeat the behaviour again. The *Gambling Expectancy Questionnaire* is a self-report tool, investigating the outcomes individuals expect when engaging in gambling (Gillespie et al., 2007). Adapting a non-behaviour-specific phrasing for the items, could allow operationalising the reward expectancies of various problematic behaviours. Furthermore, it allows researching the contribution of expecting *positive outcomes* (joy, excitement, self-enhancement) or *negative outcomes* (shame, over-involvement) by the behaviour, to the development of addictive behaviours. In early stages of the development of problematic behaviour, the reward expectancies may alter whether the behaviour will be engaged in when faced with triggers. However, with repeated pleasure experienced by the behaviour, the cycle could progress to stabilise and intensify by conditioning processes and lead to reacting to cues associated with the behaviour or craving it, when confronted with triggers. This is supported by research on substance addiction, where the expectation of the drug appears to control craving and seeking for the drug when confronted with stimuli associated with it (Hogarth et al., 2007). As a result, individuals may develop difficulties inhibiting especially stimulus-specific behaviours and consequently feel compelled to that behaviour; it has exacerbated to a habitual behaviour.

2.3.2.2 The I-PACEr model: Measures Distinguishing Problematic and Addictive Behaviours

According to I-PACEr, the central components distinguishing the behaviour being problematic (A) or addictive (B), is the extent of control over it and the negative consequences experienced. In early stages, the control over the problematic behaviour has become more difficult. A measure reflecting the difficulties and worrying about controlling a behaviour is the *Temptation and Restraint Inventory* (Collins & Lapp, 1992). Although, it has been developed to assess restraint of specifically drinking behaviours, it could screen for the motivation to engage in and attempts to control/reduce various problematic behaviours; its 5 sub dimensions are proposed as representative of the control over a behaviour being challenged. In addition, the *Obsessive Compulsive Drinking Scale* could operationalise the extent of control experienced

over the behaviour and the negative consequences individuals are confronted with by it. This self-rated instrument by Anton & colleagues (1995) was originally established to quantify individual's obsessive and compulsive relationship with alcohol. However, it could represent the extent and interference by thinking about or actually executing any type of problematic behaviour. More specifically, various items of the *Obsessive Compulsive Drinking Scale* target whether thoughts about or the behaviour itself interferes with the individuals work and social functioning (Anton et al., 1995). In addition, the compulsions sub-scale could possibly distinguish individuals at early stages or later stages of addictive behaviours. Based on vast drug addiction research, the motivational shift from impulsivity to compulsivity has been central to the progression of addictions (Everitt & Robbins, 2005; Brewer & Potenza, 2008; Koob & Volkow, 2010). This transition from voluntary recreational behaviours to habits and compulsive behaviours appears to reflect a dysregulation between executive control and the reward system (Dong et al., 2015). Prefrontal cortical "top-down" control appears to minimise in its control over striatal mechanisms underlying the habitual seeking for the behaviour and can be reflected by shifts in the neural circuits involved when transitioning to compulsive addiction (Lüscher et al., 2020).

Therefore, individuals experiencing problematic behaviours in Stage A are expected to score lower on the *Compulsions* subscale of the *Obsessive Compulsive Drinking Scale* compared to when this behaviours has exacerbated to an addiction in Stage B. Moreover, the *Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease - Rating Scale* is proposed for screening addictive behaviours in later stages, due to its use for identifying pathological ICDs (Weintraub et al., 2012). By self-reporting the behaviour associated extent of consuming thoughts, urges experienced, difficulties controlling, and consequences faced, the severity of symptoms individuals have to endure can be operationalised. Similarly, an adaption of the *Short Gambling Harm Screen* could reflect the negative consequences on different life domains caused by various types of problematic behaviours, instead of only by pathological gambling (Latvala et al., 2021). This questionnaire reflects the negative consequences in daily life characteristic of later stages of I-PACEr, when the behaviour exacerbates to an addiction. It precisely covers the possible harm caused by the behaviour; negatively affecting ones finances, work/study, health,

emotional/psychological situation, relationships and displaying social deviant behaviours (Latvia et al., 2021).

With this model being discussed with respect to different types of ICBs (Deleuze et al., 2017; Starcke et al., 2018; Wéry et al., 2018; Vogel et al., 2018; Zhou et al., 2018), it is expected to describe the mechanisms for a variety of ICBs. Specifically with the terminology ICB comprising both impulse-control and obsessive-compulsive traits, it needs to be investigated if different types of ICBs have a similar presentation within this model. Especially, with the I-PACE model indexing difficulties with impulse-control by including a component of inhibitory control, while compulsivity is indexed by developing specific habitual behaviours in later stages of the addictive behaviour. This justified exploring whether this framework could be administered to investigate both ICD and OCD phenotypes, in hopes for the variety of ICBs to show similar types of presentation across components in this model.

Proposing measures for the factors discussed in the I-PACEr model, allows researching their relative contribution in the addictive process (Objective 1). Possibly, the components central to the development and manifestation of addictive behaviours could be identified and suggested for research in clinical populations or for intervention targets. Furthermore, it allows examining if the I-PACE model holds true for the variety of ICBs and measures; whether the relevance of predictors differs depending on the type of behaviour (Objective 2) and the outcome measure used (Objective 3).

<center>**Research aims and Hypotheses**</center>

Based on the discussed literature on ICBs and the unmet needs identified, the following hypotheses can be justified:

Hypothesis 1

The nature and extent of ICBs in older adults of the general population have often been overlooked, in favour of those presenting in clinical populations such as PwP. Consequently, the breadth of ICBs has not been acknowledged in the general population. This encouraged the first focus of the study; to acknowledge that older adults are also susceptible to ICBs and that the types of problematic behaviours experienced are more diverse than the limited behavioural addictions commonly screened for.

Hypothesis 1 of this study suggests that the current methods of assessing ICBs only provide patients with a limited list of 7 phenotypes, which may result in an incomplete appreciation of the range and burden of ICBs.

Therefore, it is predicted that expanding the list of predefined ICBs will increase the heterogeneity of ICB phenotypes. Specifically, it is expected for the term ICBs to reflect behaviours with both impulse-control and obsessive-compulsive characteristics. The outcome measure used will be *The Impulsive-Compulsive behaviours Checklist*. Offering individuals, a list of 34 types of ICBs and allowing for participants to specify any other behaviour that they experience as problematic, is expected to reveal more older adults of the general population indicating a problematic behaviour and the phenotypes of behaviours to be of higher diversity than currently recognised. A qualitative analysis of the recorded index behaviours will be conducted, which participants manually indicated as the behaviour being most problematic.

Hypothesis 2

Moreover, the evaluation of ICBs is currently based on the medical addiction model, by effectively assessing the severity of symptoms confronted with. However, the limitations of this medical model comprise the second unmet need targeted in this study. Although the medical model examines characteristics central to behavioural addictions, such as the intrusive thoughts

related to the behaviour and the individual's ability to control their behaviour, it overlooks the potential harms caused by ICBs. Measures reflecting the severity of symptoms, have not assessed the negative consequences on the individual's well-being and life; the ICB-related harm. Some individuals scoring sub-threshold symptoms according to the medical model might still face harmful consequences by their problematic ICB but could be disregarded in the clinical system due to the outcome measures administered.

It is hypothesised (Hypothesis 2), that the severity of symptoms associated with impulsive-compulsive behaviours (ICBs) and the harm they cause are two distinct constructs that only partially overlap.

It is predicted, that ICB symptom severity (adapted *Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease - Rating Scale*) and ICB-harm (adapted *Short Gambling Harm Screen*) will only be correlated moderately. The operationalised constructs are presumed to overlap, with a correlation greater than Pearson's r = 0.3, but are not expected to be close to a perfect correlation of 1.

Hypothesis 3

The third research aim of this study, focuses on exploring the utility of using the I-PACE model, that describes factors relevant in the development and maintenance of the addictive cycle of ICBs. Currently, the management of ICB is reactive, as it involves waiting for significant harm to have occurred before acting. Therefore, a proactive approach is advocated, which requires identifying individuals vulnerable for developing ICBs. This leads to the third unmet need focused on in this study. The main factors contributing to the exacerbation from recreational pleasurable activities to problematic and compulsive addictive behaviours need to be understood. In oder to do so, this study operationalises components of the addictive cycle of the I-PACE model and examines if the model holds true for various types of ICBs.

It is expected for the operationalised factors central to person, affect, cognition and execution (I-PACE model) to contribute to the prediction of the outcome measures of ICBs and for the different types of ICBs to reflect similarities across the predictors.

Self-report questionnaires with overlapping components are predicted to load onto the same components of the I-PACE model (Objective 1). The key dimensions accounting for variability of factors involved in the development and maintenance of ICBs, will be examined based on Principal Component Analyses (PCA). Adapted versions of following measures will be used: *The Impulsive-Compulsive Behaviours Checklist* (*ICB Checklist*), *Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease-Rating Scale* (*QUIP-RS*), *18-Item Version of the Short Gambling Harm Scree*n (*SGHS-18*), *Obsessive Compulsive Drinking Scale*, *The Experience of Compensation and Gratification scale*, *Gambling Expectancy Questionnaire* and *Temptation and Restraint Inventory*. Furthermore, it is expected for different types of ICBs to display similar presentations across the components operationalised in this model. More specifically, components of the I-PACE model should reflect similar relevance for predicting both the inability to resist an urge/impulse (impulse-control) and the difficulties to resist a compulsion (obsessive-compulsive) to behave in a particular way (Objective 2). Lastly, given that the outcome measures (*ICB-Checklist, Harm Screen, QUIP-rs*) are expected to not fully overlap, it is expected for some of the predictors of the measures to differ and will thus be explored separately (Objective 3).

Chapter 3 - Methodology

3.1 Design

This study used a cross-sectional research approach. It was under supervision of the chief investigator Prof. Nicky Edelstyn and has been sponsored by Keele University. This general population study has been reviewed and approved by the Keele University's Research Ethics Committee (REC Project Reference 0594).

3.2 Procedure

In order to develop the survey, 7 questionnaires were chosen from measures that clinicians and researchers use to examine impulsive and compulsive behaviours. To screen for the variety of ICBs expected, 5 behaviour-specific questionnaires were adapted to item phrasings not specific to the predefined behaviour. The specific item changes will be discussed respectively to the questionnaires (see Instruments).

The online survey was created and the resulting data collected via the platform Qualtrics (https://www.qualtrics.com/uk/). The individual survey link was shared with participants recruited by Prolific (https://www.prolific.com/). Participants from the platform Prolific, that finalised the survey and passed the attention checks, received a monetary compensation of £10.00 an hour for completing the survey. Additional participants were recruited by sharing the survey link via various online platforms, such as LinkedIn and Instagram. Following the debriefing of the study, participants had to consent to their participation (see Appendix F for Information sheet & Consent form). Subsequent to agreeing with all terms of consent, participants were asked compulsory demographic (gender, nationality, relationship status, level of education, employment status, religion) and optional medical questions (diagnosis of Parkinson's disease or other). Afterwards, participants proceeded with completing questionnaires referring to the behaviour individuals considered as most problematic (Part 1), followed by other questionnaires (Part 2). The complete survey of 14 questionnaires comprised a total of 440 questions that were completed within 45 to 60 minutes (see Appendix F). The recorded anonymised data was downloaded onto password protected servers from University Keele and analysed using the programme Jasp.

3.3. Participants

A sample of 110 older adult participants was established. In order to avoid confounding influences of language constraints, only individuals from the United Kingdom that were sufficient in English were included in the sample. Furthermore, only older adults between the ages of 60 and 80 could participate in this study. This age criteria was based on this study laying the groundwork for exploring ICBs in people with Parkinson and the average age of onset of Parkinson's disease being most commonly observed between ages 60 and 69 (Pagano et al., 2016). The use of Prolific for the recruitment of participants, has biased including individuals that signed up to this platform to receive payment for completing surveys. Nevertheless, monetary reward was necessary to ensure the completion of the vast amount of questions, and over 2600 people in the UK were eligible for participation on Prolific based on the age and balanced sample criteria.

3.4 Instruments

Participants were assessed on the types of behaviour they perceived as problematic for them. *The Impulsive-Compulsive Behaviours Checklist* (*ICB Checklist*) is composed of 33 items referring to overt behaviours (eg.: washing, repeating actions, exercising, checking) that have been selected as characteristic of repetitive, impulsive and compulsive traits from various conditions such as OCD and ICD (Guo et al., 2017). Individuals had to indicate the frequency that they or others have perceived this behaviour as problematic for that individual over the past 12 months, on a four point Likert scale from 1 ("Never") to 4 ("Always"). An additional item "eating" was included, due to research on ICD frequently screening for binge-eating habits (Weintraub et al., 2010) and the other types of common ICDs having been incorporated in the measure already (shopping, gambling, sexual activities, repeating actions, medication use). Thus, total scores on the various behaviours that were most problematic for individuals ranged between 34 to 136, with higher scores suggesting more problematic behaviours experienced. This self-report measure yielded very good reliability (Cronbach's α of 0.84 to 0.89) for both factors represented (Impulsive-Compulsions and Compulsive-Impulsions), as well as good validity by significant correlation with similar measures on impulsivity and compulsivity.

Participants were asked to review their scoring on the *ICB-Checklist*, to then manually note the behaviour they scored highest on. More specifically, respondents chose an index behaviour that reflected the behaviour that the individual considered as most problematic and causing them the most trouble or distress. This "Index behaviour" was referred to when responding to the succeeding questionnaires of Part 1, instead of the predefined problematic behaviours the individual questionnaires were based on. This individualised approach, by adapting the item phrasings not specific to the predefined behaviour, enabled yielding the variety of problematic behaviours in the general population, as well as exploring factors associated with that specific problematic behaviour in mind.

Therefore, the 4 questions of the *Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease-Rating Scale* (*QUIP-RS*) were used irrespective of the suggested ICDs. This self-report scale has been the golden measure for operationalising the severity of symptoms of impulse-control disorders in Parkinson's disease (Weintraub et al., 2012). Participants are asked to indicate the frequency of thoughts about and urges for the behaviour, as well as the difficulty controlling it and the risky consequences engaged in to continue this behaviour. Respondents were asked to indicate the severity of their index behaviour on a 5-point Likert scale from "Never" (1) to "Always" (5), leading to total scores between 4 and 20. Participants with higher scores reflected more severe symptoms associated with their problematic behaviour. Based on the convenience sample used to develop the QUIP-rs, the author even proposed cut-off scores indicating individual pathological ICDs (gambling ≥6, eating ≥7, buying and sex ≥8). The QUIP-rs has adequate psychometric properties, with satisfactory validity and good interrupter and retest reliability (Weintraub et al., 2012). It has consistently displayed valid screening abilities among PwP, even for translations of the questionnaire (Marques et al., 2019; Papay et al., 2011; Probst et al., 2014; Tanaka et al., 2013).

The *18-Item Version of the Short Gambling Harm Screen* (*SGHS-18*) was administered to operationalise the negative consequences of the index behaviour (Latvala et al., 2021). Although originally developed to assess the domains impacted by gambling, the adaptation of specific item phrasings allowed measuring the outcomes of the behaviour problematic for individuals. For example item 7 ("Felt ashamed of my gambling") was adapted to "Felt ashamed of my *Index*

behaviour". The 18 items are scored on a 4-point Likert-scale, indicating the extent respondents agree with the harm experienced as a result of the behaviour (1 "Never", 4 "Always"). Participants attaining higher scores, spent more money on their behaviour, neglected social activities, performed worse at work and suffered from reductions in their emotional and psychological well-being. Based on the various sub dimensions, the main aspects impacted could be identified: financial, work/study, health, emotional/psychological, relationships and social deviance. This self-report measure has good internal consistency and validity (Latvala et al., 2021).

Another questionnaire used to measure the severity of thought occupation and urges for the behaviour is the *Obsessive Compulsive Drinking Scale* (Anton et al., 1995). This self-rated scale was developed for assessing thoughts about and the compulsive use of drinking alcohol. Similarly, the item phrasing was adapted to refer to the index behaviour instead (eg.: item 3 "How much do these ideas, thoughts, impulses or images related to *the index behaviour* interfere"). In addition, the answer options of 4 items asking about the frequency of thoughts and behaviours was adjusted ("Never" to "Always", instead of the number of drinks). The 14 items are scored on a 4-Likert scale, with half of the items composing the obsessive subscale and compulsive subscale, each ranging between total scores of 5 to 25. Therefore, higher scores suggest more severe thoughts about the problematic behaviour, as well as a heightened compulsive engagement in the behaviour or difficulties to control it. This self-report measure has displayed good to high reliability, and appears sensitive to the severity of the behaviour (Anton et al., 1995; Cordero et al., 2009; Wang et al., 2021).

Following the development of the I-PACE model, Wegmann, Antons & Brand (2022) developed *The Experience of Compensation and Gratification* scale to capture whether individuals engage in online activities to feel less negative emotions, or whether it is motivated by wanting to feel additional pleasure instead. The subscale *Compensation* is composed of 26 items, whereas the "Gratification" subscale is represented by 27 items. Respondents are asked to indicate the extent that the statements reflect their experience with the index behaviour in mind, by choosing between "Never" to "Always" regarding feeling that way when engaging in the behaviour on a 5-point Likert scale. Higher scores on the *Compensation subscale* would indicate

that this behaviour allows for relief from negative feelings, whereas individuals scoring high on the *Gratification subscale* experience pleasure by this behaviour. With the subscales not assessing entirely independent constructs, both have been associated with higher symptom severity (Wegmann et al., 2022). Furthermore, despite the two-factor structure being validated, additional studies are lacking to confirm the psychometric characteristics of this self-report questionnaire, due to the scale only having been developed recently. Besides the *ICB Checklist*, this was the only other questionnaire that did not need adaptation to refer to ICBs.

To understand the reward individuals expected by their respective index behaviour, the *Gambling Expectancy Questionnaire* was administered (Gillespie et al., 2007). This self-report questionnaire explores what outcomes are expected when gambling, since it can impact the decision to participate in it. The resulting 23 items of the instrument consist of 3 scales reflecting positive outcomes and 2 scales referring to negative outcomes. Although the phrasing of the items of this questionnaire were only adapted for 3 items, the positive subscale *money* (composed of 3 items) was not used due to the winning of money being mainly specific to gambling. Consequently, positive outcomes were only operationalised by expecting the experiencing of joy, arousal or self-enhancement as a result of the behaviour. Additionally, respondents indicated on the *negative outcome subscales*, whether they expected the behaviour to cause overinvolved engagement with the behaviour ("I want to engage in the behaviour more and more", "I'm not able to stop") and whether they predict for the behaviour to cause feelings of "guilt" and "shame" (*emotional impact* subscale). On a 7-point Likert scale, participants rated how likely they expected such outcomes as the result of their index behaviour. The administered subscales have good internal reliability, with Cronbach alpha coefficients (α) ranging between 0.81 and 0.91 (Gillespie et al., 2007). Furthermore, individuals scoring higher on the subscales have showed more frequent problematic (gambling) behaviours (Gillespie et al., 2007).

The *Temptation and Restraint Inventory* consists of 15 items measuring drinking restraint (Collins & Lapp, 1992). More specifically, it represents 5 subscales that reflect problems controlling the amount of alcohol consumed (*Govern*), the preoccupation with thoughts on drinking (*Cognitive preoccupation*), and worrying about controlling the drinking behaviours (*Concerns about drinking*) or attempts to reduce (*Restrict*) it. In addition, 3 items highlight

negative emotions as a reason for encouraging the drinking of alcohol (*Emotion*). All items were adapted to refer to the index behaviour, instead of limited to experiences with drinking alcohol. Participants responded on a 5-point Likert scale from 1 ("Never") to 5 ("Always"), to questions such as "When you feel anxious, are you more likely to engage in the *index behaviour*?" or "Do thoughts about the *index behaviour* intrude into your daily activities?". Total scores ranged from 15 to 75, with higher scores being indicative of stronger temptations to engage in the index behaviour, as well as more attempts to control it. This measure has been predictive of alcohol use and has displayed good psychometric properties in both clinical samples and colleague students (Connors et al., 1998; Cox et al, 2001; MacKillop et al., 2006).

3.5 Data Handling

The anonymised data was downloaded from Qualtrics and cleaned by deleting incomplete data sets, as well as participants that failed 2 consecutive or 3 attention checks in total. Furthermore, the anonymised questionnaire data was normalised to minimise bias, by subtracting the mean of all data points from each individual data point.

3.6 Analytic strategy

The cleaned data set was analysed using Jasp. Descriptives statistics were used to describe the basic demographic characteristics of the sample. In addition, Chi Square analyses were conducted to present the data based on the frequencies of categorical membership (gender, nationality, relationship status, level of education, employment status, religion). The sample scoring on the individual operationalised constructs were summarised using further descriptive statistics. A qualitative analysis was conducted to examine the diversity of problematic behaviours (Index behaviours). Pearson's r correlations were administered in oder to examine the association between the outcome measures and then explored using further bivariate correlations.

Principal Component Analyses (PCA) were used to reduce the dimensionality of all the questionnaires administered. An oblique rotation (oblimin) method was firstly conducted to predefine the number of principal components, that were then manually entered into an orthogonal rotation (varimax) to identify and interpret the main principal components. The

variables loading onto the same principal component as the outcome measures (*ICB-Checklist*, *SGHS-18 Harm Screen, QUIP-rs*) were then inserted as predictors in linear regression analyses using a backward entry method. Therefore, various models were presented, but only the model with the fewest number of variables and relatively explaining the greatest variance was interpreted using an ANOVA linear regression analysis. Three separate regression analyses were administered for the different outcome measures (*ICB-Checklist, SGHS-18 Harm Screen, QUIP-rs*), using the predictors identified by the PCA.

This strategy of conducting an oblimin and varimax rotation in PCA, followed by conducting three linear regression analyses to identify the main predictors of the different outcome measures, was repeated four times in total. Firstly, the analyses were administered using the complete data set and then repeated for the subsets of participants whose problematic behaviours aligned with Impulse-control disorders (ICD), Obsessive-Compulsive disorders (OCD), or Substance-use as explored in the qualitative analyses. Chi-Square tests and descriptive statistics examined the differences of scoring among the subgroups. Exploratory between-group ANOVAs were conducted to reveal the specific groups differing on the measures. Afterwards, the statistical analyses of PCA (oblimin and varimax), followed by three linear regression analyses for the individual outcome measures, were executed for the identified three subgroups of ICB as described above.

Chapter 4 - Results

4.1 Description of the sample

Of the 110 recorded datasets, 39 were deleted due to different reasons when cleaning the data. 4 participants failed the attention checks (2 consecutive or 3 in total) and were thus excluded from the data analysis to avoid any threats to validity by random responding or inaccurate reading of the questionnaires. 14 non-prolific recruited participants were deleted because of incomplete datasets; suggestive of monetary reward being necessary for this study due to the length of the survey. Additional 3 participants were removed from the data, as a result of entering an inconclusive index behaviour or forgetting to report one. Furthermore, only 10 participants reported not having a problematic behaviour and were thus not of sufficient size to establish a control group. Therefore, those 10 respondents were deleted to focus on exploring factors associated with the ICBs reported. Lastly, 8 participants were deleted due to reporting psychiatric diagnoses (e.g.: anxiety and depression), that could have confounded questionnaire scoring by the influence of the conditions instead of revealing the associates of ICBs.

The resulting sample consisted of 71 participants, of which 55% identified with a male gender identity (39 male, 31 female, 1 non-binary). Their ages ranged from 60 to 80 years old, with an average age of 68.55 ($SD = 3.79$). Due to the recruitment via Prolific being limited to the UK to ensure a sufficient english language level, the majority of the sample indicated a British nationality; the sample consisted of 69 British people, 1 Irish and 1 Hungarian individual. Furthermore, 72% of the sample had a civil relationship status, contrary to being single. Regarding the highest level of education achieved, the majority of the sample reached either high school ($n = 20$) or a Bachelor's degree ($n = 19$), followed by a training or apprenticeship ($n = 11$), Master's degree ($n = 9$) or Doctoral degree ($n = 9$) and less than high school ($n = 3$). As a result of the included age group, 70% of the sample was retired, while the rest was part- or full-time employed, or unemployed. Lastly, most of the participants were Atheist (47.9%) or Christian (45.1%).

The descriptive statistics of the sample scoring on the individual questionnaires (see Appendix A) and the correlations between all the questionnaires administered (see Appendix B) can be found in the Appendix.

4.2 Analyses Hypothesis 1

For Hypothesis 1, the breadth of ICBs was explored. The problematic behaviours reported most often in this sample of older adults included alcohol consumption (20.5%) and excessive checking (12.8%) (e.g.: checking locks, electric switches, water tap, doors, windows, lights). Furthermore, 7 respondents entered eating as their problematic behaviour (9.0%). Individuals also mentioned over organising or planning (7.7%) and excessive online activities (6.4%) (e.g.: screen time, computer use and social media) as their most problematic behaviour. Other behaviours mentioned by 3 respondents each (3.8%) were being cautious with money and worrying/obsessing about it, shopping, cleaning excessively, speed driving and making lists. Moreover, gambling, smoking, re-reading/re-writing, collecting stuff and verbal aggression/anger were reported as most troublesome by 2 participants each (2.6%). Lastly, behaviours mentioned by only one individual each were worrying, flirting, counting, obsessive tidiness, physical aggression, hair pulling and worrying about historical events that the individual felt uncomfortable about.

As a result, this general population sample mentioned 23 different types of behaviours, that they themselves considered as most problematic. Besides the variations of reporting worrying as the problem behaviour ("worrying", "worrying/obsessing about money", "worrying about historical events"), all other index behaviours were reflected by items in the *ICB Checklist*. Furthermore, the mentioned behaviours entail characteristics of both impulse-control and obsessive-compulsive disorders. In line with this is the term Impulsive Compulsive Behaviour (ICB) including both difficulties with impulse-control and obsessive-compulsive problems. Based on the criteria described in the *Diagnostic and statistical manual of mental disorders* (5th ed.) (American Psychiatric Association, 2013), the problematic behaviours from this sample were categorised according to reflecting a phenotype of "Impulse-Control Disorders" (ICD) or "Obsessive-Compulsive and Related Disorders" (OCD) and "Substance-Related Disorders" (Substance-use). For visualisation purposes, the suggested classification of the problematic behaviours was summarised using a Sankey diagram, which highlights the diversity of behaviours recorded as well as their relative frequency in this sample (see Figure 2).
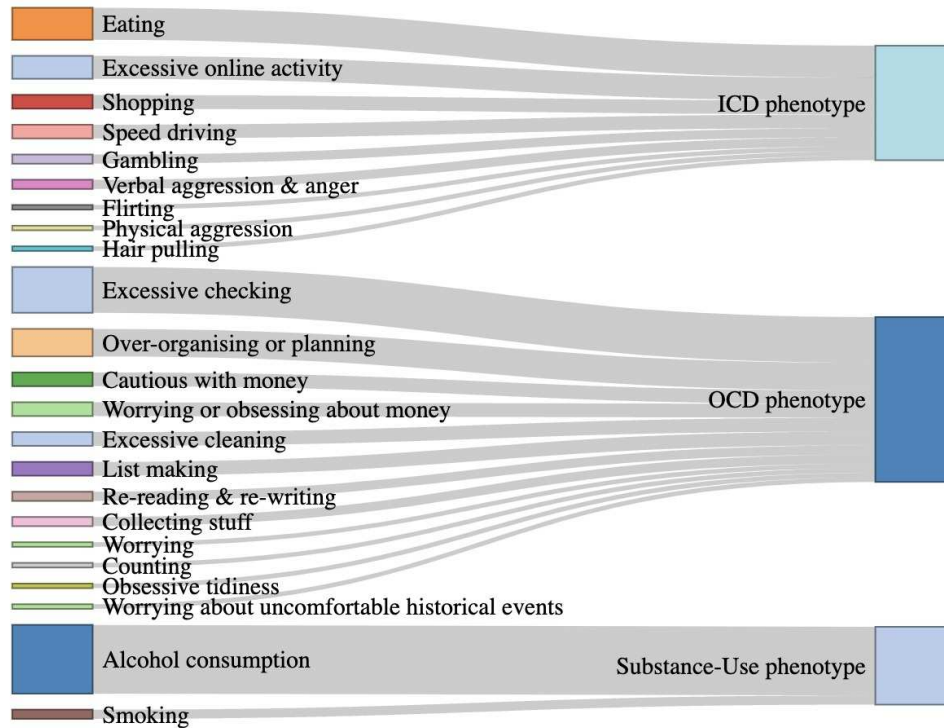
Figure 2

Breadth of ICBs in the general population & proposed phenotype classification.

Note. Sankey diagram displaying the types and frequency (see width) of different behaviours reported as problematic, as well as their phenotypical classification.

Although, this sample included the main ICD types screened for by the *QUIP-rs* (gambling, eating, shopping, sexual behaviours "flirting"), various other behaviours were reported as problematic. Therefore, Hypothesis 1 was supported by highlighting the breadth of possible ICB phenotypes in the general population and specifying their diverse expressions among a sample of older adults.

4.3 Analyses Hypothesis 2

For Hypothesis 2, the overlap between the outcome measures regarding the severity of symptoms and harm caused by ICBs was examined. The sample attained a total score mean of 8.4 (*SD* = 3.44) on the *QUIP-r*s, with scores ranging between 4 and 18. For the *SGHS-18 Harm Screen*, the sample scored 23.3 on average (*SD* = 5.56), ranging from a total score of 18 to 43. There was a significant positive relationship between the outcome measures *QUIP-r*s and

SGHS-18 Harm Screen, with Pearson's $r([69]) = .66$, $p < .001$. According to Cohen (2013), this reflects a correlation of large magnitude. It suggests that individuals that experience severe symptoms associated with their ICB, are also more likely to report harmful consequences because of their ICB (see Figure 3). Nevertheless, it appears that some older adults that sometimes or often faced harmful consequences as a result of their ICB, did not agree with always experiencing the symptoms proposed by the *QUIP-rs*. Therefore, the *QUIP-rs* and *SGHS-18 Harm Screen* appear to overlap substantially, but not absolute; Hypothesis 2 was partially confirmed. Nevertheless, it is important to consider a possibly confounding influence by the floor effect scoring on the *SGHS-18 Harm Screen*.
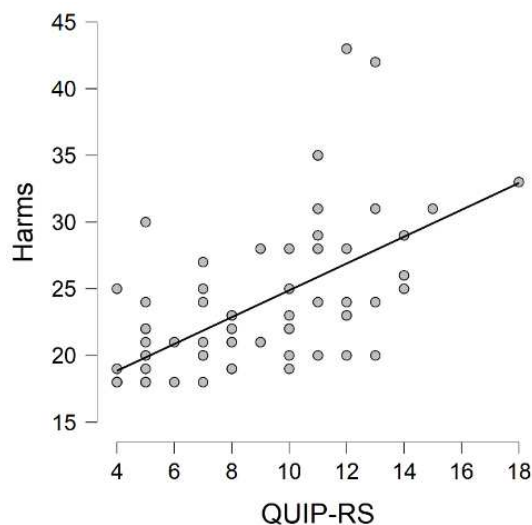
Figure 3

Correlation between QUIP-rs and SGHS-18 Harm Screen

Exploratory analyses further revealed, that both the *QUIP-rs* ($r([69]) = .33$, $p = .004$) and the *SGHS-18 Harm Screen* ($r([69]) = .28$, $p = .018$) displayed a moderate correlation with the *ICB Checklist*. Therefore, individuals frequently considering a behaviour as problematic, tend to think about this behaviour more, have urges to engage in it, face difficulties controlling it and/ or consequently involve in activities to continue the behaviour (*QUIP-rs*). Moreover, considering a behaviour as frequently problematic was also significantly associated with being confronted with more negative consequences on their well-being (*SGHS-18 Harm Screen*). Furthermore, both the *QUIP-rs* and *SGHS-18 Harm Screen* were significantly associated with both subscales

of the *Obsessive Compulsive (Drinking) Scale*, and all scales of the *Temptation & Restraint Inventory* (see Table 1).

Table 1

Significant associates with outcome measures QUIP-rs & SGHS-18 Harm Screen

Variables	QUIP-rs	SGHS-18 Harm Screen
ICB Checklist	+.33**	+.28*
Obsessive Compulsive (Drinking) Scale: Obsessions	+.68***	+.61***
Obsessive Compulsive (Drinking) Scale: Compulsions	+.70***	+.58***
Temptation & Restraint - Subscale: Govern	+.82***	+.60***
Temptation & Restraint - Subscale: Restrict	+.59***	+.37**
Temptation & Restraint - Subscale: Emotion	+.52***	+42***
Temptation & Restraint - Subscale: Concern	+.52***	+.45***
Temptation & Restraint - Subscale: Cognitive preoccupation	+.78***	+.44***
(Gambling) Expectancy - Negative Outcome Expectancies Scales	+.63***	+.42***
Experience of Compensation & Gratification - Subscale: Compensation	.32**	.50***

$* p < .05, ** p < .01, *** p < .001$

Therefore, both the severity of ICB symptoms, as well as the harm caused, are positively associated with obsessions and compulsions about the ICB behaviour (*Obsessive Compulsive (Drinking) Scale*). And reflect more difficulties controlling and thinking about the behaviour, as well as plans and attempts to reduce it (*Temptation & Restraint*). Furthermore, both outcome measures were significantly correlated with expecting more negative outcomes when engaging in the behaviour (*(Gambling) Expectancy - Negative Outcome Scale*). While the aforementioned questionnaires displayed higher correlations with the *QUIP-rs*, the *Compensation subscale* showed a stronger correlation with the *SGHS-18 Harm Screen* (see Table 2). This may suggest, that individuals that engage in the behaviour to relieve negative emotions, could more likely suffer from harmful (financial, occupational, psychological and physical health, social & relational) consequences, than experience severe symptoms.

4.4 Exploratory Analyses "Hypothesis 3"

4.4.1 PCA 1: Overall ICBs

The first Principal Component Analysis (PCA) with an oblique rotation method (oblimin), revealed two principal components that comprise all the administered questionnaires (see Table 2) based on the entire data set. Although a significant Chi-Square test (X^2 (89, $N = 71$) = 191.43, $p < .001$) indicated a poor model fit, the Eigenvalue of 6.99 for PC1 suggested a high amount of data variability captured by the model (see Figure 4). Therefore, the findings were worth exploring, with the constraint of investigating at a preliminary stage. The revealed two-dimensionality was manually entered into a PCA using an orthogonal rotation (varimax) and resulted in PC1 (Eigenvalue = 6.99) explaining 43.7% of the variance in the data, while PC2 (Eigenvalue = 2.60) accounted for an additional 16.2% (see Figure 4 & Table 2). Therefore, PC1 included components that captured the most amount of variability across participants scoring on the constructs operationalised based on the addictive process (I-PACE).
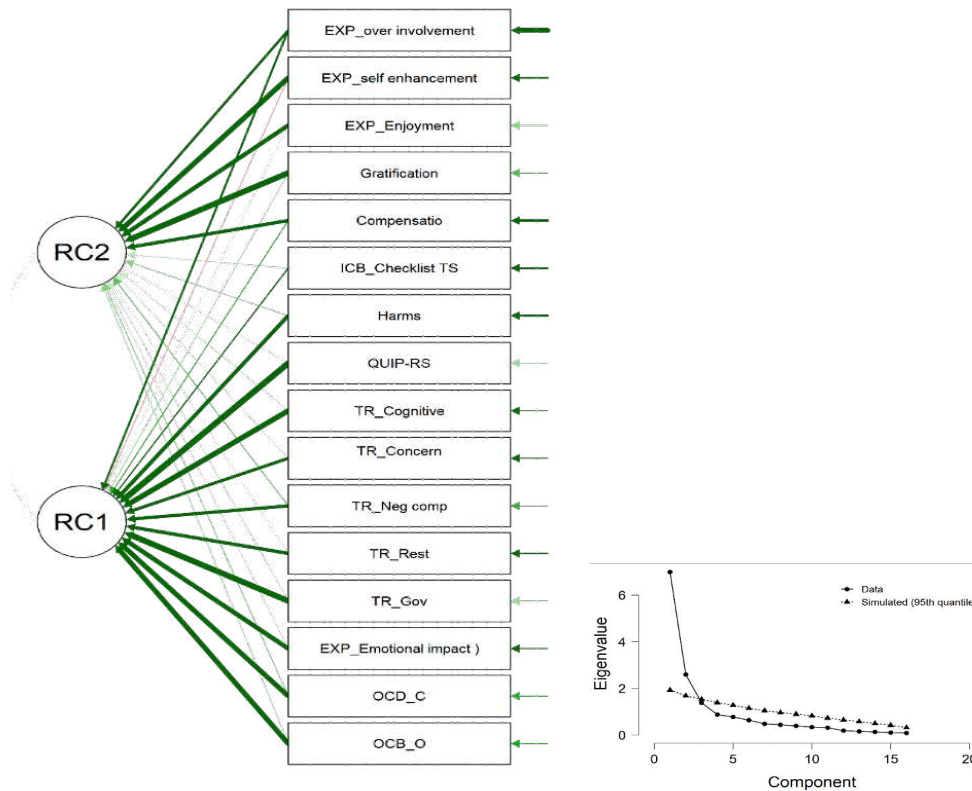
Figure 4

Path Diagram with main Principal Components of PCA 1 (& Scree plot with Eigenvalues)

In the context of PC1, the *QUIP-rs* and the *Govern* subscale (*Temptation & Restraint*) displayed very high positive loadings and were thus most influential in defining the principal component. A common theme among these components and the additional 10 variables loading on PC1 (see Table 2), is obsessively and frequently thinking about the behaviour, while facing difficulties to control engaging in the behaviour. It can be hypothesised that PC1 represents the compulsive aspects of thoughts about and engaging in the problematic behaviours, as well as the extent of their interference. Within the I-PACE framework it could represent the diminished control over the behaviour and the negative consequences in daily life. However, the component loadings on PC2 all target the expectations about the behaviour and how it is experienced. It can be hypothesised that PC2 represents the motivation for engaging in the behaviour and how it is experienced, which could reflect the compensation/gratification and reward expectancies in the early stages of the I-PACE model. Overall, the dimensions were discrete in their loadings between PC1 and PC2, apart from the *Overinvolvement* subscale (*(Gambling) Expectancy*) which loaded almost equally between the components.

Table 2

Principal Component Analysis 1 (ICBs)

PCA 1 (all ICBs)	PC1	PC2	Uniqueness
ICB-Checklist	.435		.798
SGHS-18 Harm Screen	.681		.501
QUIP-rs	**.901**		.188
Obsessive Compulsive (Drinking) Scale: Obsessions	.792		.356
Obsessive Compulsive (Drinking) Scale: Compulsions	.789		.338
Experience of Compensation & Gratification - Compensation		.677	.406
Experience of Compensation & Gratification - Gratification		**.906**	.162
(Gambling) Expectancy - Subscale: Enjoyment		.741	.451
(Gambling) Expectancy - Subscale: Self-enhancement		**.814**	.318
(Gambling) Expectancy - Subscale: Overinvolvement	.501	.559	.437
(Gambling) Expectancy - Subscale: Emotional impact	.772		.40
Temptation & Restraint - Subscale: Govern	**.913**		.159
Temptation & Restraint - Subscale: Restrict	.682		.535

PCA 1 (all ICBs)	PC1	PC2	Uniqueness
Temptation & Restraint - Subscale: Emotion	.662		.496
Temptation & Restraint - Subscale: Concern	.637		.59
Temptation & Restraint - Subscale: Cognitive preoccupation	.848		.276

Note. Applied rotation method is varimax

This dimension reduction process revealed the variables loading onto the same principal component (PC1) as the outcome measures (*ICB-Checklist, Harm Screen, QUIP-rs*), and were entered into three linear regression analyses to analyse any differences in the predictors relevant for the individual outcome measures (see light grey in Table 2). The variables loading onto PC2 did not go forward to the following linear regression analyses.

4.4.1 Linear Regression Analysis 1.1: Predictors of *ICB-Checklist*

The stepwise (Backward entry) linear regression analysis revealed Model 7 as composed of the most appropriate predictors of the *ICB-Checklist*. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 1.82 ($p = .427$). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [1.26, 1.79], Tolerance [0.56, 0.79]).

The resulting model (see Table 3) was significant ($F_{(3, 67)} = 11.06$, $p < 0.001$) and explained 30.1% of the variance in the *ICB-Checklist* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 7.09, suggestive of a rather inaccurate prediction of the observed data. However, relative to the scoring range of the *ICB-Checklist* ([34, 136]), the 7-unit deviation demonstrates that the models range of error inflates the models prediction by only 6.86%.

Table 3

Main Predictors of ICB-Checklist (for all ICBs)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Compulsions	+0.69	0.15	+0.53	4.72	<.001***
(Gambling) Expectancy - Subscale: Emotional impact	-0.54	0.22	-0.34	-2.52	0.014*
Temptation & Restraint - Subscale: Concern	+1.08	0.39	+0.35	2.77	0.007**

* p < .05, ** p < .01, *** p < .001

The *Compulsions (Obsessive Compulsive (Drinking)), Emotional impact ((Gambling)*
Expectancy)), and *Concern (Temptation & Restraint)* subscales all significantly predicted scores
on the *ICB-Checklist*. While the *Compulsions* and *Concern* subscales had a significant positive
main effect on how frequently behaviours were considered as problematic, the *Emotional impact*
subscale influenced lower scores on the *ICB-Checklist*.

4.4.1 Linear Regression Analysis 1.2: Predictors of *SGHS-18 Harm Screen*

The stepwise (Backward entry) linear regression analysis revealed Model 6 as composed
of the most appropriate predictors of the *SGHS-18 Harm Screen*. This model did not indicate any
confounding serial correlations, as the Durbin-Watson score was 1.94 ($p = .754$). Furthermore,
the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [1.40,
3.37], Tolerance [0.30, 0.72]).

The resulting model (see Table 4) was significant ($F_{(4, 66)} = 17.25$, $p < 0.001$) and
explained 48.1% of the variance in the *SGHS-18 Harm Screen* (R^2_{adj}). The model displayed a
Root Mean Square Error (RMSE) of 4.00, suggestive of a rather inaccurate prediction of the
observed data. However, relative to the scoring range of the *SGHS-18 Harm Screen* ([18, 72]),
the 4 unit deviation demonstrates that the models range of error inflates the models prediction by
only 7.40%.

Table 4

Main Predictors of SGHS-18 Harm Screen (for all ICBs)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Obsessions	+0.73	0.18	+0.52	4.08	<.001***
Temptation & Restraint - Subscale: Govern	+0.75	0.23	+0.48	3.25	0.002**
Temptation & Restraint - Subscale: Concern	+0.38	0.21	+0.18	1.81	0.075
Temptation & Restraint - Subscale: Cognitive preoccupation	-0.75	0.30	-0.40	-2.53	0.014*

* p < .05, ** p < .01, *** p < .001

The *Obsessions (Obsessive Compulsive (Drinking))* subscale, as well as the *Govern,*
Concern, and *Cognitive preoccupation (Temptation & Restraint)* subscales all predicted scores
on the *SGHS-18 Harm Screen*. Besides a significant negative effect by the *Cognitive*

preoccupation subscale, all the other scales had a significant positive main effect on how often harmful consequences were experienced as a result of the behaviour.

4.4.1 Linear Regression Analysis 1.3: Predictors of *QUIP-rs*

The stepwise (Backward entry) linear regression analysis revealed Model 5 as composed of the most appropriate predictors of the *QUIP-rs*. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 1.85 ($p = .470$). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [1.53, 4.36], Tolerance [0.23, 0.66]).

The resulting model (see Table 5) was significant ($F(5, 65) = 42.74$, $p < 0.001$) and explained 74.9% of the variance in the *QUIP-rs* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 1.72, suggestive of an imprecise prediction of the observed data. However, relative to the scoring range of the *QUIP-rs* ([4, 20]), the 1.72 unit deviation demonstrates that the models range of error inflates the models prediction by 10.75%.

Table 5

Main Predictors of QUIP-rs (for all ICBs)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Compulsions	+0.15	0.05	+0.28	3.09	.003**
(Gambling) Expectancy - Subscale: Overinvolvement	-0.09	0.04	-0.16	-2.19	.032*
(Gambling) Expectancy - Subscale: Emotional impact	+0.12	0.06	+0.18	2.02	.047*
Temptation & Restraint - Subscale: Govern	+0.29	0.12	+0.30	2.36	.021*
Temptation & Restraint - Subscale: Cognitive preoccupation	+0.40	0.12	+0.34	3.39	.001***

* p < .05, ** p < .01, *** p < .001

The *Compulsions (Obsessive Compulsive (Drinking))* subscale, as well as the *Overinvolvement & Emotional impact* subscales (*(Gambling) Expectancy*) and *Govern & Cognitive preoccupation* subscales (*Temptation & Restraint*) all significantly predicted scores on the *QUIP-rs*. Besides a negative main effect by the *Overinvolvement* subscale, all the other scales had a significant positive main effect on the severity of symptoms of the behaviour.

4.4.2 PCAs & Linear regression analyses for the different phenotypes of ICBs

Descriptive statistics of subgroups: ICD, OCD and Substance-use

The qualitative analysis revealed that the ICBs indicated as most problematic in this sample, aligned with phenotypical expressions of Impulse control disorders (ICD), Obsessive-Compulsive disorders (OCD), or substance-use (see Figure 2). Within this sample, ($N = 71$), 23 participants reported problematic behaviours in line with impulse-control difficulties (ICD) and 32 individuals declared an obsessive-compulsive behaviour (OCD) as their index behaviour. An additional 16 participants reported substance-use (alcohol and smoking) as their ICB. These subgroups of ICBs had an average age of 69.26 ($SD = 3.68$, Ra[62, 77]) for the ICD subgroup, 68.38 ($SD = 3.86$, Ra[60, 80]) for the OCD subgroup, and 67.88 ($SD = 3.88$, Ra[61, 79]) for participants that indicated problematic substance-use. Chi-square tests revealed no significant differences between the demographic information of the subgroups. The Chi-square test statistics and the number of participants in every demographic group based on their subgroup (see Appendix C), as well as the subgroup scoring on the individual questionnaires (see Appendix D) can be examined in Appendix.

Between-group ANOVAs for questionnaires

Although the subgroups had similar scoring on the majority of questionnaires, exploratory analyses revealed the following significant differences across the subgroups ICD, OCD and substance-use (see Table 6). The *Positive Outcome Expectancies Scale* (F(2, 68) = 5.49, p = .007) and one of its subscales *Enjoyment (*(Gambling) Expectancy*)* (F(2, 68) = 11.62, p < .001), were significantly affected by the type of subgroup. Post hoc comparisons using the Tukey's HSD test indicated that the ICD and Substance-use subgroup scored significantly higher than the OCD group on these measures. Furthermore, the subgroup type significantly impacted scoring on the *Negative Outcome Expectancies Scale (*F(2, 68) = 5.01, p = .009), and both its *Overinvolvement* (F(2, 68) = 3.33, p = .042) and *Emotional impact* subscales (F(2,68) = 3.25, p = .045), with the ICD subgroup scoring significantly higher than the OCD subgroup. Similarly, the ICD subgroup scored higher than the OCD subgroup for the total score on the *Temptation & Restraint* scale (F(2,68) = 4.35, p = .017) and its *Concern* subscale (F(2, 68) = 7.20, p = .001).

Lastly, there was a significant between-group ANOVA for the *Restrict* (*Temptation & Restraint*) subscale ($F(2, 68) = 10.72$, $p < .001$), with both ICD and substance-use subgroups scoring significantly higher than the OCD group. For visualisation, graphs of the post-hoc comparisons can be found in the Appendix (see Appendix E).

Table 6

Significant Post Hoc Comparisons of between-group ANOVA

Variables	Subgroup Comparison	Mean Difference	*SE*	*t*	p_{tukey}
(Gambling) Expectancy Positive Outcome Expectancies Scales	ICD - OCD	+10.54	3.98	+2.65	.027*
	OCD - Substance-use	-12.44	4.45	-2.79	.018*
(Gambling) Expectancy - Subscale: Enjoyment	ICD - OCD	+10.43	2.86	+3.64	.001***
	OCD - Substance-use	-13.75	3.21	-4.29	<.001***
(Gambling) Expectancy Negative Outcome Expectancies Scales	ICD - OCD	+7.69	2.47	+3.11	.008**
(Gambling) Expectancy - Subscale: Overinvolvement	ICD - OCD	+4.26	1.66	+2.56	.033*
(Gambling) Expectancy - Subscale: Emotional impact	ICD - OCD	+3.43	1.40	+2.46	.043*
Temptation & Restraint - Total score	ICD - OCD	+8.87	3.14	+2.83	.017*
Temptation & Restraint - Subscale: Concern	ICD - OCD	+2.55	0.69	+3.71	.001***
Temptation & Restraint - Subscale: Restrict	ICD - OCD	+2.84	0.71	+4.02	<.001***
	OCD - Substance-use	-2.88	0.79	-3.64	.002**

Note * p < .05, ** p < .01, *** p < .001

4.4.2 PCA 2: Impulse-control behaviours (ICD)

The first Principal Component Analysis (PCA) with an oblique rotation method (oblimin), revealed one principal component (PC1) based on the data of the ICD subgroup. Although a significant Chi-Square test (X^2 (104, $n = 23$) = 153.86, $p = .001$) indicated a poor model fit, the Eigenvalue of 8.06 for PC1 suggested a high amount of data variability captured by the model (see Figure 5). Therefore, the findings were worth exploring, with the constraint of investigating at a preliminary stage. The revealed one-dimensionality was manually entered into a PCA using an orthogonal rotation (varimax) and resulted in PC1 explaining 50.4% of the

variance in the ICD subgroup data (see Figure 5 & Table 7). Therefore, PC1 included components that captured the most amount of variability across participants scoring on the constructs operationalised based on the addictive process (I-PACE) and that indicated an ICD behaviour as most problematic.
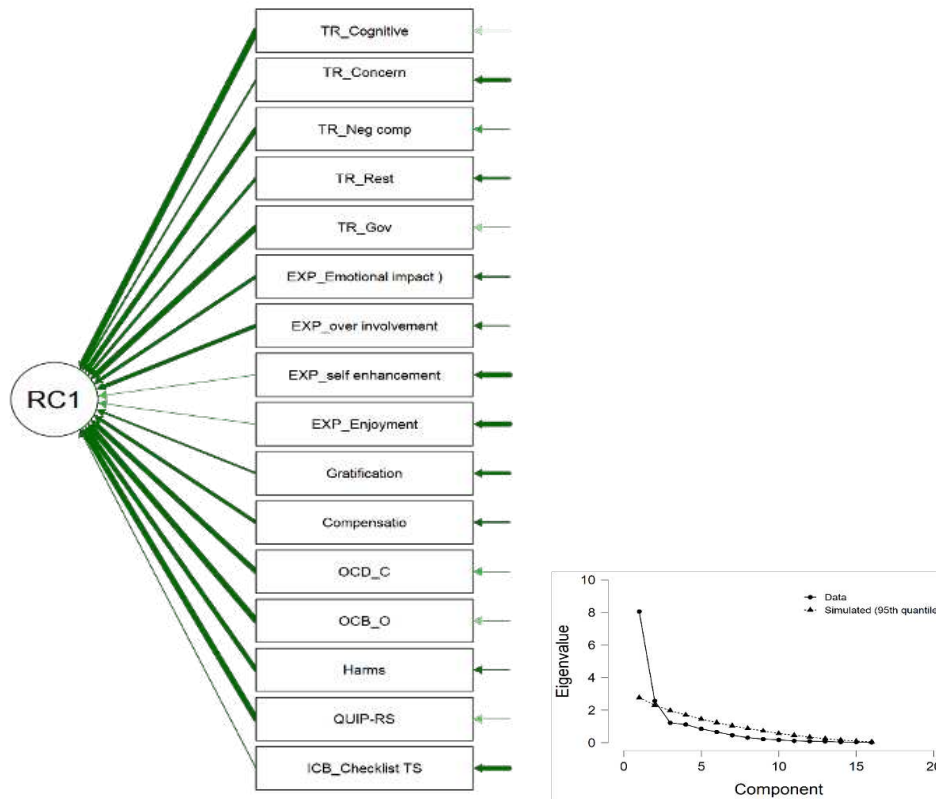
Figure 5

Path Diagram with main Principal Component for ICD subgroup (& Scree plot with Eigenvalues)

Table 7

Principal Component Analysis 2 (ICD - subgroup)

PCA 2 (ICD subgroup)	PC1	Uniqueness
ICB-Checklist	.410	.832
SGHS-18 Harm Screen	.773	.402
QUIP-rs	**.876**	.233
Obsessive Compulsive (Drinking) Scale: Obsessions	**.899**	.193

PCA 2 (ICD subgroup)	PC1	Uniqueness
Obsessive Compulsive (Drinking) Scale: Compulsions	.837	.300
Experience of Compensation & Gratification - Compensation	.694	.519
Experience of Compensation & Gratification - Gratification	.544	.704
(Gambling) Expectancy - Subscale: Enjoyment		.898
(Gambling) Expectancy - Subscale: Self-enhancement		.911
(Gambling) Expectancy - Subscale: Overinvolvement	.753	.433
(Gambling) Expectancy - Subscale: Emotional impact	.690	.523
Temptation & Restraint - Subscale: Govern	**.907**	.177
Temptation & Restraint - Subscale: Restrict	.630	.603
Temptation & Restraint - Subscale: Emotion	.805	.353
Temptation & Restraint - Subscale: Concern	.516	.734
Temptation & Restraint - Subscale: Cognitive preoccupation	**.934**	.127

Note. Applied rotation method is varimax

Based on this dimension reduction process, all variables despite the *Enjoyment* and *Self-enhancement* subscales (*(Gambling) Expectancy*) were put forth to linear regression analyses to identify the main predictors of the outcome measures (*ICB-Checklist, Harm Screen, QUIP-rs*) for the ICD subgroup.

4.4.2 Linear Regression Analysis 2.1: Predictors of *ICB-Checklist* (ICD subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 8 as composed of the most appropriate predictors of the *ICB-Checklist* within the ICD subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 1.99 ($p = .950$). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [1.44, 2.44], Tolerance [0.40, 0.69]).

The resulting model (see Table 8) was significant ($F(4, 18) = 7.20$, $p = 0.001$) and explained 53% of the variance in the *ICB-Checklist* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 5.79, suggestive of a rather inaccurate prediction of the observed data.

However, relative to the scoring range of the *ICB-Checklist* ([34, 136]), the 5.79 unit deviation demonstrates that the models range of error inflates the models prediction by only 5.7%.

Table 8

Main Predictors of ICB-Checklist (for the ICD subgroup)

Variables	*b*	*SE*	ß	*t*	*p*
Obsessive Compulsive (Drinking) Scale: Compulsions	+0.45	0.24	+0.36	1.91	.072
(Gambling) Expectancy - Subscale: Emotional impact	-1.14	0.32	-0.82	-3.59	.002**
Temptation & Restraint - Subscale: Concern	+2.23	0.54	+0.87	4.13	<.001***
Experience of Compensation & Gratification - Compensation	+0.13	0.07	+0.35	1.98	.063

* p < .05, ** p < .01, *** p < .001

The *Compulsions (Obsessive Compulsive (Drinking)), Emotional impact ((Gambling) Expectancy)), Concern (Temptation & Restraint)* and *Compensation* subscales all predicted scores on the *ICB-Checklist* within the ICD subgroup. While the *Compulsions, Concern* and *Compensation* subscales had a significant positive main effect on how frequently ICD behaviours were considered as problematic, the *Emotional impact* subscale influenced lower scores on the *ICB-Checklist*.

4.4.2 Linear Regression Analysis 2.2: Predictors of *SGHS-18 Harm Screen* (ICD subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 7 as composed of the most appropriate predictors of the *SGHS-18 Harm Screen* within the ICD subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 2.33 (p = .441). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [2.23, 2.82], Tolerance [0.36, 0.45]).

The resulting model (see Table 9) was significant ($F(3, 19)$ = 21.78, p < 0.001) and explained 73.9% of the variance in the *SGHS-18 Harm Screen* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 3.32, indicative of a possibly inaccurate prediction of the observed data. However, relative to the scoring range of the *SGHS-18 Harm Screen* ([18, 72]),

the 3.32 unit deviation demonstrates that the models range of error inflates the models prediction by only 6.1%.

Table 9

Main Predictors of SGHS-18 Harm Screen (for the ICD subgroup)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Obsessions	+0.91	0.25	+0.68	3.70	.002**
Temptation & Restraint - Subscale: Govern	+0.96	0.31	+0.54	3.11	.006**
Temptation & Restraint - Subscale: Emotion	-0.90	0.35	-0.41	-2.53	.021*

* p < .05, ** p < .01, *** p < .001

The *Obsessions (Obsessive Compulsive (Drinking))* subscale, as well as the *Govern* and *Emotion (Temptation & Restraint)* subscales all significantly predicted scores on the *SGHS-18 Harm Screen* within the ICD subgroup. Besides a significant negative effect by the *Emotion* subscale, all the other scales had a significant positive main effect on how often harmful consequences were experienced as a result of the ICD behaviour.

4.4.2 Linear Regression Analysis 2.3: Predictors of *QUIP-rs* (ICD subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 8 as composed of the most appropriate predictors of the *QUIP-rs* within the ICD subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 2.28 (p = .504). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score = 1.9, Tolerance = 0.53).

The resulting model (see Table 10) was significant ($F(2, 20)$ = 39.30, p < 0.001) and explained 77.7% of the variance in the *QUIP-rs* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 1.73, indicative of a possibly imprecise prediction of the observed data. However, relative to the scoring range of the *QUIP-rs* ([4, 20]), the 1.73-unit deviation demonstrates that the models range of error inflates the models prediction by 10.8%.

Table 10

*Main Predictors of QUIP-rs (for the ICD subgroup)*

Variables	b	SE	ß	t	p
(Gambling) Expectancy - Subscale: Emotional impact	+0.15	0.08	+0.25	1.81	.086
Temptation & Restraint - Subscale: Cognitive preoccupation	+0.81	0.16	+0.70	5.04	<.001**

* p < .05, ** p < .01, *** p < .001

The *Emotional impact ((Gambling) Expectancy)* and the *Cognitive preoccupation* (*Temptation & Restraint*) subscales predicted scores on the *QUIP-rs* within the ICD subgroup. Both scales had a significant positive main effect on the severity of symptoms of the ICD behaviour.

4.4.2 PCA 3: Obsessive-Compulsive behaviours (OCD)

The first Principal Component Analysis (PCA) with an oblique rotation method (oblimin), revealed two principal components based on the data of the OCD subgroup. Although a significant Chi-Square test (X^2 (89, $n = 32$) = 114.14, $p = .037$) indicated a poor model fit, the Eigenvalue of 6.8 for PC1 suggested a high amount of data variability captured by the model (see Figure 6). Therefore, the findings were worth exploring, with the constraint of investigating at a preliminary stage. The revealed two-dimensionality was manually entered into a PCA using an orthogonal rotation (varimax) and resulted in PC1 (Eigenvalue = 6.80) explaining 42.5% of the variance in the data, while PC2 (Eigenvalue = 3.09) accounted for an additional 19.3% (see Figure 6 & Table 11). Therefore, PC1 included components that captured the most amount of variability across participants scoring on the constructs operationalised based on the addictive process (I-PACE) and that indicated an OCD behaviour as most problematic.
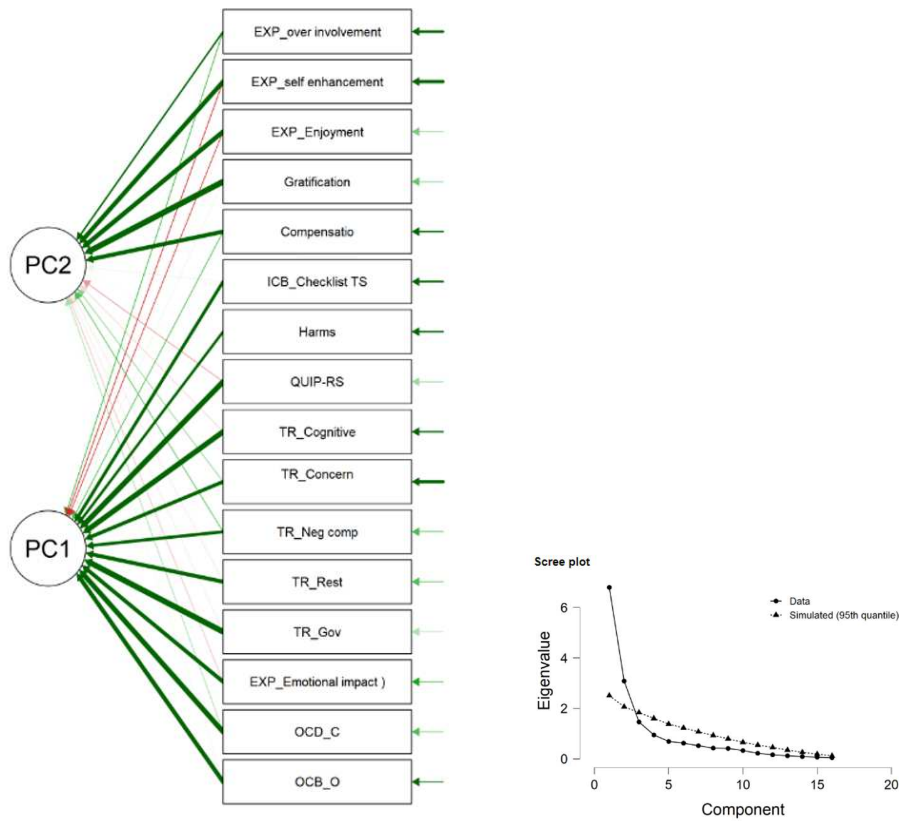
Figure 6

Path Diagram with main Principal Component for OCD subgroup (& Scree plot with Eigenvalues)

Table 11

Principal Component Analysis 3 (OCD - subgroup)

PCA 3 (OCD subgroup)	PC1	PC2	Uniqueness
ICB-Checklist	.652		.575
SGHS-18 Harm Screen	.591		.651
QUIP-rs	**.876**		.205
Obsessive Compulsive (Drinking) Scale: Obsessions	.769		.408
Obsessive Compulsive (Drinking) Scale: Compulsions	.846		.269
Experience of Compensation & Gratification - Compensation		.749	.358
Experience of Compensation & Gratification - Gratification		**.934**	.126
(Gambling) Expectancy - Subscale: Enjoyment		**.803**	.266

71

PCA 3 (OCD subgroup)	PC1	PC2	Uniqueness
(Gambling) Expectancy - Subscale: Self-enhancement		.786	.275
(Gambling) Expectancy - Subscale: Overinvolvement		.483	.670
(Gambling) Expectancy - Subscale: Emotional impact	.729		.459
Temptation & Restraint - Subscale: Govern	**.921**		.150
Temptation & Restraint - Subscale: Restrict	.727		.469
Temptation & Restraint - Subscale: Emotion	.650		.511
Temptation & Restraint - Subscale: Concern	.696		.486
Temptation & Restraint - Subscale: Cognitive preoccupation	**.871**		.236

Note. Applied rotation method is varimax

Based on this dimension reduction process, all variables despite both subscales of the *Experience of Compensation & Gratification* scale and the *Enjoyment*, *Self-enhancement* and *Overinvolvement* (*(Gambling) Expectancy*) subscales were put forth to linear regression analyses to identify the main predictors of the outcome measures (*ICB-Checklist*, *Harm Screen*, *QUIP-rs*) for the OCD subgroup.

4.4.2 Linear Regression Analysis 3.1: Predictors of *ICB-Checklist* (OCD subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 8 as composed of the most appropriate predictor of the *ICB-Checklist* within the OCD subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 1.74 ($p = .434$). Furthermore, the assumption of multicollinearity was not violated, given that the resulting model consisted of 1 predictor (Variance Inflation Score = 1, Tolerance = 1).

The resulting model (see Table 12) was significant ($F(1, 30) = 24.98$, $p < .001$) and explained 43.6% of the variance in the *ICB-Checklist* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 7.07, suggestive of a rather inaccurate prediction of the observed data. However, relative to the scoring range of the *ICB-Checklist* ([34, 136]), the 7-unit deviation demonstrates that the models range of error inflates the models prediction by only 5.4%.

Table 12

Main Predictors of ICB-Checklist (for the OCD subgroup)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Compulsions	+0.998	0.20	+0.67	4.50	<.001***

* p < .05, ** p < .01, *** p < .001

The *Compulsions (Obsessive Compulsive (Drinking))* subscale significantly predicted scores on the *ICB-Checklist* within the OCD subgroup. Individuals experiencing compulsions to engage in the OCD behaviour and face interferences due to it, were more likely to indicate that behaviour as more frequently problematic.

4.4.2 Linear Regression Analysis 3.2: Predictors of *SGHS-18 Harm Screen* (OCD subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 7 as composed of the most appropriate predictors of the *SGHS-18 Harm Screen* within the OCD subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 1.41 (p = .082). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [1.07, 1.37], Tolerance [0.73, 0.94]).

The resulting model (see Table 13) was significant ($F_{(3, 28)}$ = 8.08, p < 0.001) and explained 40.7% of the variance in the *SGHS-18 Harm Screen* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 3.11, indicative of a possibly inaccurate prediction of the observed data. However, relative to the scoring range of the *SGHS-18 Harm Screen* ([18, 72]), the 3.11-unit deviation demonstrates that the models range of error inflates the models prediction by only 5.8%.

Table 13

Main Predictors of SGHS-18 Harm Screen (for the OCD subgroup)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Obsessions	+0.47	0.18	+0.42	2.60	.015*
(Gambling) Expectancy - Subscale: Overinvolvement	-0.26	0.11	-0.32	-2.24	.033*
Temptation & Restraint - Subscale: Concern	+0.77	0.33	+0.37	+2.33	.027*

* p < .05, ** p < .01, *** p < .001

The *Obsessions (Obsessive Compulsive (Drinking))* subscale, as well as the *Overinvolvement ((Gambling) Expectancy)* and *Concern (Temptation & Restraint)* subscales all significantly predicted scores on the *SGHS-18 Harm Screen* within the OCD subgroup. Besides a significant negative effect by the *Overinvolvement* subscale, all the other scales had a significant positive main effect on how often harmful consequences were experienced as a result of the OCD behaviour.

4.4.2 Linear Regression Analysis 3.3: Predictors of *QUIP-rs* (OCD subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 8 as composed of the most appropriate predictors of the *QUIP-rs* within the OCD subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 1.35 ($p = .053$). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score = 1.21, Tolerance = 0.83).

The resulting model (see Table 14) was significant ($F(2, 29) = 46.73$, $p < 0.001$) and explained 74.7% of the variance in the *QUIP-rs* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 1.82, indicative of a possibly imprecise prediction of the observed data. However, relative to the scoring range of the *QUIP-rs* ([4, 20]), the 1.82-unit deviation demonstrates that the models range of error inflates the models prediction by 11.4%.

Table 14

Main Predictors of QUIP-rs (for the OCD subgroup)

Variables	b	SE	ß	t	p
Temptation & Restraint - Subscale: Concern	+0.44	0.18	+0.24	2.41	.022*
Temptation & Restraint - Subscale: Cognitive preoccupation	+0.89	0.12	+0.75	7.51	<.001**

* p < .05, ** p < .01, *** p < .001

The *Concern* and the *Cognitive preoccupation* (*Temptation & Restraint*) subscales predicted scores on the *QUIP-rs* within the OCD subgroup. Both scales had a significant positive main effect on the severity of symptoms of the OCD behaviour.

4.4.2 PCA 4: Substance-use behaviours (Substance-use)

The first Principal Component Analysis (PCA) with an oblique rotation method (oblimin), revealed one principal component (PC1) based on the data of the Substance-use subgroup. Although a significant Chi-Square test (X^2 (104, $n = 16$) = 283.59, $p < .001$) indicated a poor model fit, the Eigenvalue of 6.7 for PC1 suggested a high amount of data variability captured by the model (see Figure 7). Therefore, the findings were worth exploring, with the constraint of investigating at a preliminary stage. The revealed one-dimensionality was manually entered into a PCA using an orthogonal rotation (varimax) and resulted in PC1 explaining 41.9% of the variance in the Substance-use subgroup data (see Figure 7 & Table 15). Therefore, PC1 included components that captured the most amount of variability across participants scoring on the constructs operationalised based on the addictive process (I-PACE) and that indicated a substance-use behaviour as most problematic.
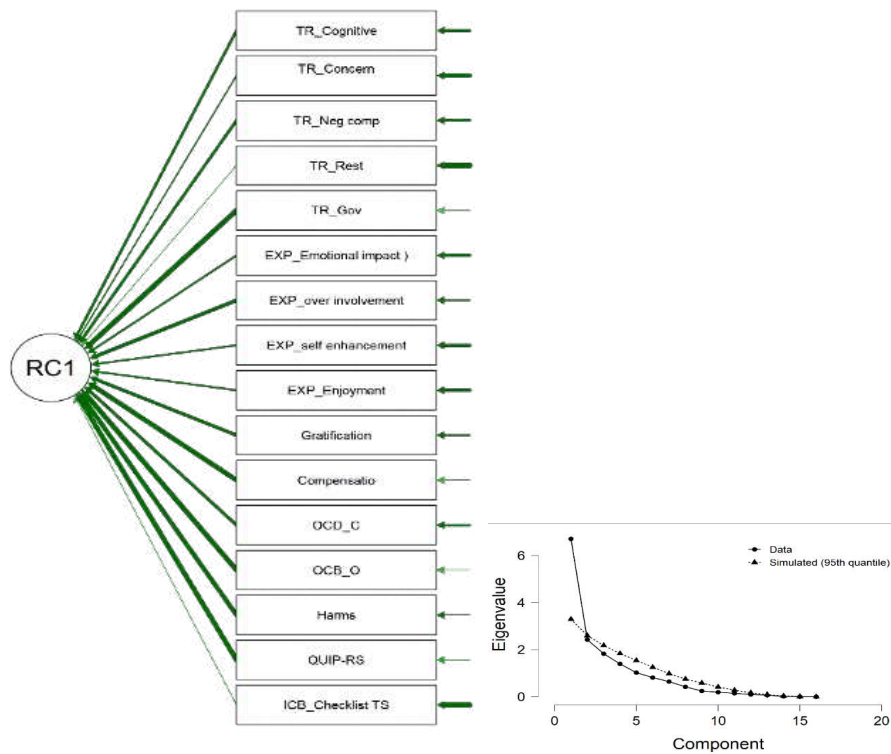
Figure 7

Path Diagram with main Principal Component for Substance-use subgroup (& Scree plot with Eigenvalues)

Table 15

Principal Component Analysis 4 (Substance-use - subgroup)

PCA 4 (Substance-use subgroup)	PC1	Uniqueness
ICB-Checklist		.886
SGHS-18 Harm Screen	.764	.417
QUIP-rs	.796	.366
Obsessive Compulsive (Drinking) Scale: Obsessions	**.816**	.334
Obsessive Compulsive (Drinking) Scale: Compulsions	.651	.577
Experience of Compensation & Gratification - Compensation	**.819**	.329
Experience of Compensation & Gratification - Gratification	.686	.529
(Gambling) Expectancy - Subscale: Enjoyment	.537	.711
(Gambling) Expectancy - Subscale: Self-enhancement	.534	.715
(Gambling) Expectancy - Subscale: Overinvolvement	.720	.482
(Gambling) Expectancy - Subscale: Emotional impact	.543	.705
Temptation & Restraint - Subscale: Govern	**.833**	.307
Temptation & Restraint - Subscale: Restrict		.892
Temptation & Restraint - Subscale: Emotion	.620	.615
Temptation & Restraint - Subscale: Concern	.461	.787
Temptation & Restraint - Subscale: Cognitive preoccupation	.595	.646

Note. Applied rotation method is varimax

Based on this dimension reduction process, all variables despite the *ICB-Checklist* and *Restrict* subscale (*Temptation & Restraint*) were put forth to linear regression analyses to identify the main predictors of the outcome measures (*ICB-Checklist, Harm Screen, QUIP-rs*) for the Substance-use subgroup. Noteworthy is that for the Substance-use subgroup, the *ICB-Checklist* did not load onto the same dimension as the other variables. It could be hypothesised, that the frequency of experiencing a substance-use behaviour as problematic and the attempts to restrict alcohol use and smoking, reflect a different underlying dimension than the behaviour's obsessive-compulsive nature and the expectancy for and experience with the behaviour.

4.4.2 Linear Regression Analysis 4.1: Predictors of *ICB-Checklist*

(Substance-use subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 8 as composed of the most appropriate predictors of the *ICB-Checklist* within the Substance-use subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 2.32 (p = .799). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [1.42, 3.18], Tolerance [0.31, 0.70]).

The resulting model (see Table 16) was significant ($F(6, 9)$ = 16.21, p < .001) and explained 85.9% of the variance in the *ICB-Checklist* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 2.54, indicative of a possibly inaccurate prediction of the observed data. However, relative to the scoring range of the *ICB-Checklist* ([34, 136]), the 2.54-unit deviation demonstrates that the models range of error inflates the models prediction by only 2.5%.

Table 16

Main Predictors of ICB-Checklist (for the Substance-use subgroup)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Obsessions	-1.07	0.39	-0.48	-2.77	.022*
Obsessive Compulsive (Drinking) Scale: Compulsions	+1.16	0.17	+1.02	7.03	<.001***
Temptation & Restraint - Subscale: Govern	-1.07	0.34	-0.48	-3.10	.013*
Temptation & Restraint - Subscale: Cognitive preoccupation	+2.53	0.50	+0.70	5.11	<.001***
Experience of Compensation & Gratification - Gratification	-0.29	0.09	-0.49	-3.36	.008**
(Gambling) Expectancy - Subscale: Self-enhancement	+0.95	0.16	+0.69	5.95	<.001***

* p < .05, ** p < .01, *** p < .001

The *Compulsions (Obsessive Compulsive (Drinking)), Cognitive preoccupation (Temptation & Restraint)* and *Self-enhancement ((Gambling) Expectancy)* subscales had a significant positive main effect on the *ICB-Checklist* within the Substance-use subgroup. Whereas the *Obsessions (Obsessive Compulsive (Drinking))* subscale, as well as the *Govern (Temptation & Restraint)* and *Gratification* subscales had a significant negative effect on on the *ICB-Checklist* within the Substance-use subgroup.

4.4.2 Linear Regression Analysis 4.2: Predictors of *SGHS-18 Harm Screen*

(Substance-use subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 7 as composed of the most appropriate predictors of the *SGHS-18 Harm Screen* within the Substance-use subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 2.54 (p = .342). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score [1.13, 1.50], Tolerance [0.67, 0.88]).

The resulting model (see Table 17) was significant ($F(3, 12)$ = 8.96, p = 0.002) and explained 61.4% of the variance in the *SGHS-18 Harm Screen* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 3.98, indicative of a possibly inaccurate prediction of the observed data. However, relative to the scoring range of the *SGHS-18 Harm Screen* ([18, 72]), the 3.98-unit deviation demonstrates that the models range of error inflates the models prediction by only 7.4%.

Table 17

Main Predictors of SGHS-18 Harm Screen (for the Substance-use subgroup)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Compulsions	+0.76	0.18	+0.71	4.14	.001***
Temptation & Restraint - Subscale: Concern	+2.28	0.56	+0.78	4.05	.002**
Temptation & Restraint - Subscale: Cognitive preoccupation	-1.31	0.67	-0.39	-1.96	.074

* p < .05, ** p < .01, *** p < .001

The *Compulsions (Obsessive Compulsive (Drinking))* subscale, as well as the *Concern* and *Cognitive preoccupation (Temptation & Restraint)* subscales all significantly predicted scores on the *SGHS-18 Harm Screen* within the Substance-use subgroup. Besides a significant negative effect by the *Cognitive preoccupation* subscale, both the other scales had a significant positive main effect on how often harmful consequences were experienced as a result of the Substance-use behaviour.

4.4.2 Linear Regression Analysis 4.3: Predictors of *QUIP-rs*

(Substance-use subgroup)

The stepwise (Backward entry) linear regression analysis revealed Model 7 as composed of the most appropriate predictors of the *QUIP-rs* within the Substance-use subgroup. This model did not indicate any confounding serial correlations, as the Durbin-Watson score was 2.14 (p = .897). Furthermore, the predictors did not violate the assumption of multicollinearity (Variance Inflation Score = 1.02, Tolerance = 0.98).

The resulting model (see Table 18) was significant (F(2, *13*) = 9.68, p = 0.003) and explained 53.6% of the variance in the *QUIP-rs* (R^2_{adj}). The model displayed a Root Mean Square Error (RMSE) of 1.66, indicative of a possibly imprecise prediction of the observed data. However, relative to the scoring range of the *QUIP-rs* ([4, 20]), the 1.66-unit deviation demonstrates that the models range of error inflates the models prediction by 10.4%.

Table 18

Main Predictors of QUIP-rs (for the Substance-use subgroup)

Variables	b	SE	ß	t	p
Obsessive Compulsive (Drinking) Scale: Compulsions	+0.26	0.07	+0.63	3.52	.004**
Temptation & Restraint - Subscale: Concern	+0.61	0.19	+0.56	3.14	.008**

* p < .05, ** p < .01, *** p < .001

The *Compulsions (Obsessive Compulsive (Drinking) Scale)* and the *Concern* (*Temptation & Restraint*) subscales significantly predicted scores on the *QUIP-rs* within the Substance-use subgroup. Both scales had a significant positive main effect on the severity of symptoms of the Substance-use behaviour.

Chapter 5 - Discussion and Conclusion

This study was driven by three hypotheses, which examined the breadth of ICBs (Hypothesis 1), the overlap between the severity of symptoms and ICB-related harm (Hypothesis 2), and explored the relevance of components in the addictive cycle based on the I-PACE model (Hypothesis 3). The latter was guided by three objectives, which were to reveal key dimensions of the development and maintenance of ICBs (1), their relative contribution across the subtypes of ICBs (ICD, OCD, Substance-use) (2), and examining the main predictors of the different outcome measures (3).

5.1 Breadth of ICBs

The sample of older adults with a mean age of 69 years old, reported 23 different types of behaviours as problematic. Among them were the 7 phenotypes commonly screened for by the *QUIP-rs*, represented by individual items in the *ICB Checklist*: gambling (item 13 "Betting/ gambling"), sex (item 16 "Sexual activities/behaviours"), buying (item 6 "Shopping"), eating (item 34 added for this study), performing tasks or hobbies (item 10 "Idiosyncratic routines"), repeating simple activities (item 11 "Repeating actions"), and taking Parkinson medication (item 27 "Medication use"). However, older adults indicated an additional 13 types of ICBs within the *ICB Checklist* as most problematic for them, that the *QUIP-rs* is not sensitive to. Additionally, three variations of worrying were reported, that are not assessed for in either the *QUIP-rs* or *ICB Checklist*. Noteworthy, is also that 6.4% of respondent indicated problematic online activities, suggestive of screen time and social media use becoming increasingly problematic among older adults.

Therefore, in line with Hypothesis 1, ICB phenotypes are more heterogeneous than currently assessed for, with the behaviours reported as most problematic reflecting difficulties with impulse-control, obsessive-compulsivity and substance-use. Therefore, ICBs appear to entail behaviours indicative of a phenotypical expression of Impulse-Control Disorders, Obsessive-Compulsive Disorders and Substance-Related Disorders. Consequently, when screening for behaviours that could be experienced as problematic and distressing for individuals, a larger range of diverse expressions and ICB phenotypes needs to be included.

Although the 7 ICD phenotypes assessed for currently by the *QUIP-rs* are very relevant, they have been based on the commonality of dopamine in reward-related behaviours (impulse-control) and Parkinson's disease. However, in line with the I-PACE model, reward-driven behaviours can also take on habitual characteristics (obsessive-compulsive). Therefore, additional behaviours should be assessed for beyond this narrow focus, especially with the items of the *QUIP-rs* regarding punding and hobbyism already indicating a compulsive aspect of possibly problematic behaviours, and the majority of behaviours reported in this sample classifying as obsessive-compulsive. Thus, solely focusing on ICDs has potentially underestimated the burden of problematic behaviours experienced by PwP. In line with RDoC, the heterogeneity of ICBs revealed in this general population study is expected to also present among Parkinson populations and need to be accounted for in assessment.

5.2 Severity of Symptoms & ICB-related Harm

The severity of symptoms (*QUIP-rs*) of ICBs was strongly associated with the harm they cause. Therefore, individuals that obsessively think about and have desires for the ICB, while having difficulties to control it and requiring activities to continue engaging in it, were also more likely to face negative consequences on their well-being due to their ICB (financial, work, health, emotional, relational, and social). It is expected, that including respondents experiencing ICBs to a pathological degree, could reveal a correlation to an even greater extent. Therefore, Hypothesis 2 underestimated the overlap between the outcome measures; assessing the severity of symptoms within the medical model remains relevant. Nevertheless, it could be beneficial to additionally screen for the consequences of the behaviour on the individuals well-being in terms of financial, social and health (psychology and physical) domains, to extend assessment to a psychosocial perspective. ICB affected individuals could be identified and supported, that experience consequences of the behaviour, despite their displayed symptoms not exceeding the cut-off of clinical relevance.

Moreover, in line with the authors' suggestion of administering the *QUIP-rs* in non-Parkinson populations (Weintaub et al., 2012), this general population study highlighted the four items of this measure to be strongly associated with the *Obsessive Compulsive (Drinking) Scale*

and *Temptation & Restraint Questionnaire* that operationalise similar constructs in non-Parkinson individuals. Moreover, both the *QUIP-rs* and *SGHS-18 Harm Screen* were associated with expecting negative outcomes by the behaviours, contrary to expecting positive outcomes. Therefore, individuals expecting to become overinvolved and to experience a negative emotional impact as a result of the behaviour, are more likely to face severe symptoms and harmful consequences of the behaviour. Although positive reward expectancies might reinforce the behaviour at early stages, individuals' behaviours exacerbating to causing problematic outcomes entails expecting the behaviour to result in negative outcomes.

5.3 Exploration of "Hypothesis 3"

5.3 Objective 1: Key dimensions in the addictive cycle of ICBs

When depicting the reduced central dimensions relevant in the development and maintenance of ICBs, it is noteworthy to view their interpretation within the problematic mismatch between a small sample size and the number of variables investigated. Consequently, significant Chi-Square tests indicated a poor model fit for all the dimension reduction approaches discussed next. Therefore, the following interpretations are purely speculative, but could propose relevant factors for ICBs based on a high variability accounted for by the dimensions. Based on the questionnaires proposed as reflective of components of the I-PACE model, two dimensions were revealed that accounted for 60% of the variance in the ICB dataset. With the primary component explaining 44% of the variance, it suggests that its components capture the most salient patterns within the data. The measures loading on this dimension, represent the nature and severity of the problem behaviour (obsessive/compulsive), as well as the awareness of being tempted to engage in it, being concerned about restricting it, and expecting the behaviour to cause feelings of guilt, shame and cravings for it. Within the I-PACE model it can be hypothesised that this dimension reflects the central component distinguishing early and later stages of the addictive process; the clinically relevant component. Early stages (A) have been characterised by the control over the specific problematic behaviour becoming challenging and the behaviour having positive but also negative consequences in daily life. It can be hypothesised, that the weaker component loading variables reflect the earlier stages of the problematic behaviour. The *Restrict*, *Emotion*, and *Concern* subscales (*Temptation & Restraint*) describe negative affect (i.e., feeling anxious, lonely and nervous) motivating the behaviour,

while attempting and planning to limit the behaviour, and worrying about losing control over it. These measures indicate awareness about the problematic behaviours, while still aiming to control and reduce it. Similarly the *Overinvolvement* and *Emotional impact* subscales (*(Gambling) Expectancy*) respectively instigate the motivation to engage in the behaviour ("I feel like", "I want to"), as well as experiencing some negative consequences (i.e., guilt and shame). On the contrary, later stages (B) are marked by the control over the behaviour diminishing, as well as only experiencing negative consequences in daily life. With the *Obsessive Compulsive (Drinking) Scale*, as well as the *Govern* and *Cognitive preoccupation* (*Temptation & Restraint*) subscales assessing the obsessive-compulsive nature of the behaviour becoming habitual, they might represent the later stages of the addictive behaviour. Therefore within the context of ICBs in the addictive cycle (I-PACE), most of the information can be captured by the degree that the behaviour consumes thoughts and instigates both urges and compulsions to execute it.

The second dimension is composed of measures possibly capturing another aspect of the data; the motivation for engaging in the behaviour, which could represent the non-clinically relevant component. Especially positive expectations about the behaviour, such as feeling pleasure and enhancement of oneself (feeling cooler, powerful, in control, more accepted), influenced this dimension (*Gratification*, *Self-enhancement* (*Gambling Expectancy*)). Additional loadings on this component, were relieving negative emotions by the behaviour (*Compensation*), as well as expecting for the behaviour to cause joy and excitement (*Enjoyment (Gambling Expectancy)*), and getting over involved with the behaviour (*Overinvolvement (Gambling Expectancy)*). Interestingly, the latter was the only component loading on both the primary and secondary dimension, emphasising the ambiguity of the items; reflecting both liking and wanting to engage in the behaviour (motivation), as well as loosing control over it (compulsion). Within the I-PACE model this dimension is hypothesised to reflect reward expectancies of earlier stages. The individual still expects and experiences positive outcomes from the behaviour, which reinforces engaging in it.

This PCA enables to understand the key components of the addictive cycle of ICBs, which are the severity of the problematic behaviour based on the level of control & consequences experienced, and the motivation to engage in the behaviour. It appears, that these factors might explained most of the variability in ICBs across participants and could be proposed as central components underlying the addictive cycle of ICBs.

5.3 Objective 2: Components across subtypes of ICBs

Due to the sample size of 71 participants, analysing and comparing the three subgroups identified among the sample was at the cost of a sufficient power that would have required an additional 88 participants based on a G* power analysis (F-test, one-way ANOVA with three groups) (Faul et al., 2009). Therefore, the following findings have to be viewed within that context and discuss purely speculative differences. Despite considering the results within a low power as a result of a small sample size, it is of interest to note valuable patterns and relationships that have been identified and can guide future research.

It was explored whether the I-PACE model could be used to investigate the etiology of the heterogenous types of ICB, by investigating if the factor solution was consistent across different types of ICBs. While a similar two-dimensional factor solution accounted for the majority of variability in obsessive-compulsive behaviours, individuals displaying difficulties with impulse-control and substance-use each revealed only one underlying key dimension. All questionnaires, but those operationalising the expectation of positive outcomes from the behaviour (*Enjoyment & Self-enhancement* (*(Gambling) Expectancy*), loaded onto the dimension accounting for most of the variability in impulse-control behaviours. Therefore, the E*xperience of Compensation & Gratification scale* loaded onto the same component, as the obsessional compulsive nature and the awareness about being tempted by the behaviour, while losing control over restricting it. Thus, it could be hypothesised, that the main dimension underlying the addictive cycle of problematic impulse-control behaviours, is the experience with it; especially regarding the extent that the behaviour occupies thoughts and results in difficulties controlling the behaviour. Interestingly, the attempts to limit the behaviour did seem to influence the key dimension accounting for substance-use behaviours. Instead, data in the substance use group seemed to be mainly accounted for by constructs representing thinking about the substance frequently and uncontrollably, struggling to control its administration, and using them in order to relieve negative symptoms. Although these aspects loaded onto the same dimension as the severity of symptoms and harmful consequences measured, the frequency of considering the substance-use as problematic was surprisingly not related.

For all types of behaviours, the operationalised components of the addictive cycle representing obsessional thoughts about the behaviour and difficulties controlling to engage in it appeared most influential in defining the dimension, by accounting for the majority of variability

in the data. While for obsessive-compulsive behaviours the motivation to engage in the behaviour loaded on a separate dimension, expecting negative outcomes loaded onto the primary factor for impulse-control problems. Variability in the data on substance-use behaviours, was mostly explained by the reward expected, pleasure and relief experienced, and obsessional compulsive nature of thinking about and administering the substance. These factors, possibly central to craving a substance, are irrespective of the attempt to limit its consumption and the frequency of considering it a problem. Possibly, individuals with substance-use problems cannot attempt to cut down their substance consumption, due to the physical dependence preventing from controlling and cutting back on it.

Comparing the groups on the individual measures, suggested that individuals with impulse-control problems and substance-use could expect more positive outcomes (i.e., joy and arousal) as a result of their behaviour, compared to those engaging in obsessive-compulsive behaviours. However, these phenotypical types of ICBs (ICD & Substance) also appeared to attempt to limit the behaviour more than individuals with obsessive-compulsive behaviours did. Furthermore, respondents indicating an impulse-control problem behaviour, also tended to expect more negative outcomes by their behaviour (i.e., over involvement and shame/guilt) and were more worried about controlling the behaviour, compared to individuals reporting an obsessive-compulsive behaviour. Therefore, within the context of an insufficient power attained, it could be suggested that impulses (e.g.: gambling, shopping) and substances (e.g.: alcohol, cigarettes) are anticipated to lead to more pleasure than OCD behaviours such as checking and cleaning excessively, but individuals experiencing impulses also worry more about losing control over it and the negative consequences they could face.

5.3 Objective 3: Predictors of outcome measures

Analyses on the predictors of the different outcome measures and investigating them across different types of ICBs, revealed some common patterns among the underpowered sample in predicting how frequently problematic, severe and harmful the ICB behaviours were.

5.3.1 Outcome: *ICB-Checklist*

How frequently any type of ICB behaviour was considered as problematic, was predicted by the degree of compulsions to engage in the behaviour. Therefore, experiencing a strong drive for the behaviour and having difficulties controlling it (resulting in frequently engaging in the

behaviour and it interfering with work and social functioning), predicted considering the behaviour as problematic more often. This predictive value of compulsions increasing how problematic the behaviour was experienced, was true for all types of ICBs (ICD, OCD, Substance-use) and represented the single predictor of how problematic obsessive-compulsive behaviours were perceived.

Additional predictors of the *ICB-Checklist* among all types of ICBs, were worrying about controlling the behaviour and expecting to feel guilt and shame when engaging in it. While the former factor influenced viewing the behaviour as more frequently problematic, the latter reduced experiencing it as such. However, with respect to the subgroups of ICBs, these factors only had a predictive value for impulse-control phenotypes. An impulse-control behaviour was more frequently experienced as problematic, if it relieved more negative symptoms, led to compulsions to engage in it and caused worrying about reducing/controlling it, while having little expectations to feel guilty and ashamed of this behaviour. On the contrary, the degree of considering an obsessive-compulsive behaviour as problematic was merely predicted by the compulsions to engage in it. For substance-use behaviours, various factors reflected a predictive value for higher scores on the *ICB-Checklist*; compulsions, cognitive preoccupation with the behaviour, and expecting an enhanced self (i.e., cool, powerful, social acceptance) by the substance-use behaviour. Other factors predictive of a less problematic substance-use behaviour were obsessions about it, difficulties controlling its use and feeling pleasure as a result of its administration. Possibly, individuals that have positive experiences with the substance and do not face interference by thoughts about it (obsession), have less awareness about losing control over the behaviour or it becoming problematic. However, this needs more exploration in future studies.

In conclusion, worrying about and the inability to resist an impulse (ICD), compulsion (OCD) or craving (Substance) commonly seemed to predict how frequently an ICB behaviour was experienced as problematic. However, other predictors varied depending on the specific type of behaviour, with problematic impulse-control behaviours being predicted by relieving negative symptoms (Compensation) and substance problems being predicted by experiencing less positive feelings as a result of its use (Gratification). Furthermore, how problematic an individuals viewed their use of a substance was uniquely predicted by the extent it preoccupied their thoughts. It could be hypothesised, that experiencing relief from negative symptoms and

encountering additional pleasure as a result of the behaviour cannot be distinguished as clearly. In line with this have been medium to large relationships between both subscales (Wegmann et al., 2022). Although compensation & gratification are of relevance for the development of addictive behaviours, their distinction is questionable for predicting the severity of a problematic behaviour.

5.3.2 Outcome: *Harm Screen*

The degree of facing harmful consequences as a result of an ICB, was predicted by how severely the thoughts about the behaviour interfered in daily life and how difficult it was for the individual to control both thoughts about and the behaviour itself. Those experiencing obsessions about an ICB behaviour, while worrying and having difficulties controlling it, displayed more consequences on various domains of well-being (financial, work, health, social). On the contrary, individuals thinking about the ICB behaviour and thus possibly reflecting on it, experienced less harm.

Interestingly, when investigating the predictors relevant for different types of ICB, obsessions predicted more harm for both impulse-control and obsessive-compulsive behaviours. The harm caused by problematic impulse-control behaviours was further predicted by more difficulties controlling the behaviour and feeling less emotionally impacted by the behaviour. Similarly, the harm caused by obsessive-compulsive behaviours was predicted by worrying more about controlling the behaviour or planning to reduce it, as well as having less expectations to become over-involved in the behaviour. The former factor also predicted harm caused by substance-use behaviours, while thinking about the behaviour predicted less harmful consequences.

It appears, that developing less control over an ICB behaviour and thoughts about it interfering with daily life, could predict more financial, social and occupational losses, as well as poorer psychological and physical health. Whereas, individuals expecting less negative outcomes and frequently thinking about the behaviour reported less harmful outcomes by their ICB. Possible explanations could be a confirmation bias, or being more aware of the risks of the behaviour and thus attempting to protect oneself from facing such negative consequences of the behaviour. It appears, that while obsessing about the behaviour is maladaptive, frequently thinking about the behaviour could be advantageous and needs further exploration.

5.3.3 Outcome: *QUIP-rs*

Lastly, factors influencing the severity of ICB symptoms were reviewed. Based on the resulting model for overall ICBs, individuals frequently thinking about the behaviour (and feeling shame/guilt about it), feeling compulsions to engage in it, and that have difficulties controlling the ICB behaviour, displayed higher scores on the *QUIP-rs*. Given that these components respectively reflect the items of the outcome measure, the model explained 75% of the variability in the *QUIP-rs*. Only individuals expecting to become over-involved (i.e., getting hooked and liking/wanting to engage in the behaviour) with the ICB behaviour, were predicted to experience less severe symptoms.

In the context of the individual subgroups of ICB, frequently thinking about the behaviour predicted more severe symptoms for both impulse-control and obsessive-compulsive behaviours. Furthermore, whereas expecting guilt and shame as a result of impulse-control behaviours heightened their severity, worrying about controlling obsessive-compulsive behaviours predicted more severe symptoms in the OCD subgroup. Lastly, increasingly severe thoughts, urges and exacerbating control for the Substance-use group was mainly predicted by worrying about losing control over the use of substances and actually experiencing compulsions to administer them.

Overall, it appears that the frequency of perceiving a behaviour as problematic (*ICB-Checklist*) is predicted by compulsions, whereas the harmful consequences of that behaviour are rather predicted by obsessions *(Harm Screen)*. It could be hypothesised, that lacking control over increasingly engaging in the behaviour leads to considering it as frequently problematic, whereas the behaviour uncontrollably occupying thoughts predicts harmful consequences on various domains of well-being. Although, compromised control over ICB related thoughts or behaviours both interfere with social and occupational functioning, it appears that behavioural urges (compulsions) to execute the behaviour possibly tend to predict how problematic and severe the behaviour is (*ICB-Checklist* & *QUIP-rs*), and intrusive thoughts about the behaviour possibly lead to rumination that could decline ones well-being. For example, uncontrollably thinking about the behaviour, could reduce performance at work or studies, minimise the amount of sleep, increase tobacco use or depressive symptoms, or socially isolate.

Therefore, both obsessions and compulsions predicted more maladaptive outcomes of ICBs, but differed slightly in what aspect they predicted. A risk factors highlighted for all outcome measures, was the *Concern* subscale (*Temptation & Restraint*). Worrying about controlling the behaviour or having plans to reduce it could be a universal risk for ICBs; predictive of the behaviour being more frequently problematic (for all ICBs & ICDs), causing harmful consequences (for all ICBs, OCDs, and Substance-use) and heightening the severity of symptoms (for OCD and Substance-use subgroups). Interestingly, this subscale (*Concern*, *Temptation & Restraint*) is composed of individual items strongly indicating experiences with cue-reactivity (i.e. by "seeing other people", "commercials, advertisements, pop-ups etc related to the behaviour"). Thus, within the context of the I-PACE model, this predictor could reflect the cognitive responses to triggers and challenged control over the behaviour in early stages (problematic behaviour). And the cue-reactivity and diminished control over the behaviour in later stages (addictive behaviour).

Other variables displayed mixed predictive values depending on the outcome measures, ICB subgroup type, or conceptual nature of the scale. Noteworthy, is the possibly distinctive predictive value between obsessions and cognitive preoccupation. While obsessional thoughts tended to predict worse outcomes, being occupied by thoughts on the behaviour had mixed predictions. Cognitive preoccupation with the behaviour increased the severity of symptoms associated with the ICB, but it also seemed to predict less harmful consequences caused by the ICB (especially for substance-use). Similarly, having difficulties controlling the behaviour predicted more severe symptoms and harmful consequences, but also predicted viewing a substance-use behaviour as less frequently problematic. Further mixed results were revealed for expecting the behaviour to have an emotional impact. Whereas expecting guilt and shame due to the behaviour was possibly protective for how problematic overall ICBs and ICDs were experienced, it also predicted a higher severity of the associated ICB symptoms in this sample. It could be proposed, that this highlights the limitations of self-reporting experiences with behavioural addictions, that are often viewed as shameful, and could consequently lead to denying how frequently problematic the behaviour is despite the behaviour increasing in its symptom severity. Furthermore, the discussed mixed results emphasise that some predictors varied depending on the outcome measure examined and the type of ICBs inspected, and will need further exploration within larger samples.

5.4 Limitations & Future Directions

Besides the small sample size leading to a significant Chi-Square goodness of fit test and underpowered group comparisons, this study was limited by using self-report questionnaires with item adaptations. Although, modifying the individual wording of items allowed for exploring various types of ICBs, it could have been at cost of the confirmed adequate psychometric properties of the original questionnaires. Furthermore, respondents self-reporting their experiences regarding a behaviour they consider as "problematic", is rather subjective and does not ensure transparency; especially with ICBs being commonly underreported (Phu et al., 2014) possibly due to shame and social stigmatisation. In line with this, only using self-report measures led to operationalising only a limited number of components of the I-PACE. Predispositional factors and inhibitory control impact the addictive cycle as well, and their influence needs to be investigated additionally. Moreover, although respondents indicated experiencing the behaviours as problematic, it was not examined whether some exceeded the clinical cut-off for the behaviour being pathologically relevant. Therefore, the problematic behaviours reported (Index behaviours) do not necessarily interfere significantly with respondents life, and might only explore specific problematic behaviours and not additive behaviours. Furthermore, recruiting participants via an online platform that offered monetary compensation for participation has possibly biased the sample.

Therefore, it is suggested for future studies to recruit a larger and broader sample, that extends to clinical populations (behavioural addictions & Parkinson's disease). Although this study revealed patterns of ICBs among the general population, it further proposes a framework to investigate the breadth and risk factors for ICB among PwP (RDoC). Furthermore, the influence of inhibitory control on the components of the addictive cycle within the I-PACE model needs to be explored. It is suggested, for future studies to include a measure of inhibitory control by using an online experimental software such as "Gorilla". Lastly, possible differences for the subtypes of ICBs within the I-PACE model need to be examined and mixed findings highlighted in this study understood. More specifically, it should be considered whether the awareness over the behaviour indexed by worrying about it, is lost in later stages due to the behaviour engaged in becoming increasingly compulsive. Additionally, future research needs to inspect whether expecting guilt and shame by a problematic behaviour is protective for that individual or whether

it could put them at risk for the behaviour exacerbating to an addiction. Furthermore, the distinctive prediction between having intrusive 'obsessive' thoughts about the behaviour and having ones thoughts 'occupied' by the behaviour needs to be investigated.

5.5 Conclusions

Despite the shortcomings of this study, it can be concluded that screening for ICBs needs to be reflective of the breath of their heterogeneous expressions; the current types included (ICD) need to be extended to assess both the inability to resist an urge/impulse (impulse-control) and the difficulties to resist a compulsion (obsessive-compulsive) to behave in a particular way (ICBs). Furthermore, individuals experiencing severe symptoms associated with their ICB, are also more likely to face ICB-related harm on their well-being (e.g.: financial, social, health). Therefore, assessing the outcomes of ICBs within the medical model needs to be extended to viewing additional consequences from a bio psychosocial perspective. Lastly, it is suggested, that the severity of (obsessions and compulsions) and motivation for the behaviour (expectation and experience) appear central to the development of addictive behaviours. More specifically, compulsions to engage in the behaviour could possibly influence how problematic the ICB becomes, and obsessions about the behaviour could decline the individuals well-being. Additionally, worrying about the loss of control over the behaviour by reacting to cues associated to the ICB, might reflect the exacerbation from early stages of the problematic behaviour to later stages of an addictive behaviour. This study proposes a framework to further investigate the aforementioned speculative conclusions in Parkinson populations and replicate them among larger sample sizes.

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Appendix

Appendix A

Descriptive statistics of operationalised constructs

Variables	M	SD	Ra
ICB Checklist	54.8	8.48	[44.00, 83.00]
QUIP-rs	8.4	3.44	[4.00, 18.00]
Short (Gambling) Harm Screen (SGHS-18)	23.3	5.56	[18.00, 43.00]
Obsessive Compulsive (Drinking) Scale - Total score	23.8	7.09	[13.00, 43.00]
Obsessive Compulsive (Drinking) Scale - Subscale: Obsessions	11.7	4.00	[6.00, 22.00]
Obsessive Compulsive (Drinking) Scale - Subscale: Compulsions	23.9	6.51	[10.00, 39.00]
Experience of Compensation & Gratification - Subscale: Compensation	43.7	22.38	[26.00, 116.00]
Experience of Compensation & Gratification - Subscale: Gratification	51.1	21.11	[27.00, 115.00]
(Gambling) Expectancy - Total score	63.1	20.47	[21.00, 106.00]
(Gambling) Expectancy - Positive Outcome Expectancies Scales	41.0	15.44	[12.00, 72.00]
(Gambling) Expectancy - Subscale: Enjoyment	29.8	11.95	[8.00, 53.00]
(Gambling) Expectancy - Subscale: Self-enhancement	11.2	5.31	[4.00, 23.00]
(Gambling) Expectancy - Negative Outcome Expectancies Scales	22.1	9.54	[8.00, 42.00]
(Gambling) Expectancy - Subscale: Overinvolvement	13.5	6.27	[5.00, 30.00]
(Gambling) Expectancy - Subscale: Emotional impact	8.5	5.27	[3.00, 19.00]
Temptation & Restraint - Total score	33.1	12.02	[15.00, 60.00]
Temptation & Restraint - Subscale: Govern	7.5	3.55	[3.00, 15.00]
Temptation & Restraint - Subscale: Restrict	6.8	2.92	[3.00, 12.00]
Temptation & Restraint - Subscale: Emotion	7.3	2.90	[3.00, 15.00]
Temptation & Restraint - Subscale: Concern	5.4	2.73	[3.00, 11.00]
Temptation & Restraint - Subscale: Cognitive preoccupation	6.0	2.94	[3.00, 14.00]

Note. M = Mean, SD = Standard deviation, Ra = Range

Appendix A. The descriptive statistics of the entire sample scoring on the individual questionnaires.

Pearson's r Heatmap of all the Questionnaires

	ICB_Checklist TS	QUIP-RS	Harms	Compensatio	Gratification	EXP_Enjoyment	EXP_self enhancement	EXP_over involvement	EXP_Emotional impact)	Expectancy TS	Exp_Pos_OC	Exp_Neg_OC	OCB_O	OCD_C	OC(D)TS	TR_Gov	TR_Rest	TR_Neg comp	TR_Concern	TR_Cognitive	T&R_TS
ICB_Checklist TS		0.334**	0.28*	0.302*	0.165	-0.123	0.053	0.225	0.113	0.04	-0.077	0.211	0.326**	0.49***	0.445***	0.371**	0.104	0.344**	0.315**	0.325**	0.369**
QUIP-RS	0.334**		0.622***	0.323**	0.067	0.055	-0.122	0.38**	0.682***	0.292*	0	0.627***	0.684***	0.699***	0.753***	0.815***	0.589***	0.518***	0.519***	0.781***	0.818***
Harms	0.28*	0.622***		0.495***	0.222	0.069	0.122	0.238*	0.473***	0.267*	0.095	0.418***	0.612***	0.581***	0.629***	0.6***	0.374**	0.418***	0.448***	0.444***	0.579***
Compensatio	0.302*	0.323**	0.495***		0.687***	0.354**	0.365**	0.372**	0.153	0.455***	0.399***	0.329**	0.39**	0.432***	0.429***	0.406***	0.184	0.408***	0.234*	0.287*	0.386***
Gratification	0.165	0.067	0.222	0.687***		0.561***	0.647***	0.534***	0.055	0.673***	0.657***	0.381***	0.243*	0.294*	0.29*	0.187	0.056	0.3*	0.151	0.224	0.23
EXP_Enjoyment	-0.123	0.055	0.069	0.354**	0.561***		0.529***	0.412***	0.079	0.868***	0.956***	0.314**	-0.059	0.078	0.018	0.078	0.239*	0.16	0.185	-0.003	0.161
EXP_self enhancement	0.053	-0.122	0.122	0.365**	0.647***	0.529***		0.332**	-0.075	0.651***	0.754***	0.177	0.005	-0.042	-0.004	-0.026	-0.088	0.032	-0.017	0.018	-0.021
EXP_over involvement	0.225	0.38**	0.238*	0.372**	0.534***	0.412***	0.332**		0.361**	0.726***	0.433***	0.857***	0.488***	0.537***	0.559***	0.502***	0.397***	0.465***	0.275*	0.519***	0.546***
EXP_Emotional impact)	0.113	0.682***	0.473***	0.153	0.055	0.079	-0.075	0.361**		0.395***	0.035	0.79***	0.48***	0.451***	0.523***	0.723***	0.603***	0.402***	0.608***	0.639***	0.752***
Expectancy TS	0.04	0.292*	0.267*	0.455***	0.673***	0.868***	0.651***	0.726***	0.395***		0.896***	0.696***	0.24*	0.315**	0.315**	0.379**	0.394***	0.348**	0.344**	0.326**	0.45***
Exp_Pos_OC	-0.077	0	0.095	0.399***	0.657***	0.956***	0.754***	0.433***	0.035	0.896***		0.304**	-0.044	0.046	0.013	0.052	0.155	0.135	0.138	0.004	0.117
Exp_Neg_OC	0.211	0.627***	0.418***	0.329**	0.381**	0.314**	0.177	0.857***	0.79***	0.696***	0.304**		0.586***	0.602***	0.656***	0.73***	0.594***	0.528***	0.516***	0.694***	0.775***
OCB_O	0.326**	0.684***	0.612***	0.39**	0.243*	-0.059	0.005	0.488***	0.48***	0.24*	-0.044	0.586***		0.699***	0.919***	0.651***	0.345**	0.575***	0.387***	0.731***	0.682***
OCD_C	0.49***	0.699***	0.581***	0.432***	0.294*	0.078	-0.042	0.537***	0.451***	0.315**	0.046	0.602***	0.699***		0.909***	0.715***	0.362**	0.634***	0.323**	0.62***	0.677***
OC(D)TS	0.445***	0.753***	0.629***	0.429***	0.29*	0.018	-0.004	0.559***	0.523***	0.315**	0.013	0.656***	0.919***	0.909***		0.756***	0.375**	0.646***	0.405***	0.741***	0.744***
TR_Gov	0.371**	0.815***	0.6***	0.406***	0.187	0.078	-0.026	0.502***	0.723***	0.379**	0.052	0.73***	0.651***	0.715***	0.756***		0.687***	0.57***	0.524***	0.786***	0.911***
TR_Rest	0.104	0.589***	0.374**	0.184	0.056	0.239*	-0.088	0.397***	0.603***	0.394***	0.155	0.594***	0.345**	0.362**	0.375**	0.687***		0.394***	0.522***	0.554***	0.795***
TR_Neg comp	0.344**	0.518***	0.418***	0.408***	0.3*	0.16	0.032	0.465***	0.402***	0.348**	0.135	0.528***	0.575***	0.634***	0.646***	0.57***	0.394***		0.343**	0.512***	0.709***
TR_Concern	0.315**	0.519***	0.448***	0.234*	0.151	0.185	-0.017	0.275*	0.608***	0.344**	0.138	0.516***	0.387***	0.323**	0.405***	0.524***	0.522***	0.343**		0.473***	0.707***
TR_Cognitive	0.325**	0.781***	0.444***	0.287*	0.224	-0.003	0.018	0.519***	0.639***	0.326**	0.004	0.694***	0.731***	0.62***	0.741***	0.786***	0.554***	0.512***	0.473***		0.843***
T&R_TS	0.369**	0.818***	0.579***	0.386***	0.23	0.161	-0.021	0.546***	0.752***	0.45***	0.117	0.775***	0.682***	0.677***	0.744***	0.911***	0.795***	0.709***	0.707***	0.843***	

Note * $p < .05$, ** $p < .01$, *** $p < .001$

Appendix B. Correlational matrix of all the questionnaires, with darker colours indicating a stronger Pearson's r correlation value.

Appendix C

Descriptives of subgroup demographics

Demographic	X^2	p	Variables	ICD subgroup	OCD subgroup	Substance-use subgroup
Gender	3.61	.462	Females	11	15	5
			Males	11	17	11
			Non-binary	1	0	0
Nationality	2.51	.643	British	23	30	16
			Irish	0	1	0
			Hungarian	0	1	0
Religion	1.40	.966	Atheist	11	15	8
			Agnostic	1	2	1
			Christian	11	14	7
			Muslim	0	1	0
Relationship status	0.70	.706	Single	5	10	5
			Partnership	18	22	11
Highest educational qualification	7.50	.678	Less than high school	2	1	0
			High school	8	9	4
			Training/ apprenticeship	4	6	2
			Bachelor's degree	5	11	5
			Master's degree	2	5	3
			Doctoral of professional degree	2	0	2
Employment status	2.76	.838	Retired	16	24	10
			Unemployed	0	1	0
			Employed part-time	4	5	4
			Employed full-time	3	2	2

Appendix C. Chi-square test of independence results, demonstrating that the demographics did not significantly differ depending on the subgroups (ICD, OCD, Substance-use). Additionally, the number of participants within each subgroup and of a certain demographic group were displayed.

Appendix D

Descriptive statistics of operationalised constructs per subgroup

Variables	Subgroups	*M*	*SD*	*Ra*
ICB Checklist	Group 1: ICD	54.61	8.45	[44, 83]
	Group 2: OCD	55.5	9.41	[45, 79]
	Group 3: Substance	53.81	6.75	[47, 73]
QUIP-rs	Group 1: ICD	9.13	3.67	[4, 15]
	Group 2: OCD	7.56	3.61	[4, 18]
	Group 3: Substance	8.94	2.44	[5, 13]
Short (Gambling) Harm Screen (SGHS-18)	Group 1: ICD	24.39	6.49	[18, 43]
	Group 2: OCD	21.84	4.03	[18, 33]
	Group 3: Substance	24.44	6.41	[18, 42]
Obsessive Compulsive (Drinking) Scale - Total score	Group 1: ICD	25.44	8.41	[13, 39]
	Group 2: OCD	22.94	6.67	[13, 43]
	Group 3: Substance	23.25	5.71	[14, 34]
Obsessive Compulsive (Drinking) Scale - Subscale: Obsessions	Group 1: ICD	12.70	4.81	[6, 21]
	Group 2: OCD	11.69	3.65	[6, 22]
	Group 3: Substance	10.13	3.03	[6, 17]
Obsessive Compulsive (Drinking) Scale - Subscale: Compulsions	Group 1: ICD	25.09	6.78	[12, 36]
	Group 2: OCD	22.22	6.36	[10, 39]
	Group 3: Substance	25.69	5.95	[18, 37]
Experience of Compensation & Gratification - Subscale: Compensation	Group 1: ICD	43.30	22.07	[26, 97]
	Group 2: OCD	43.13	23.62	[26, 116]
	Group 3: Substance	45.31	21.59	[28, 106]
Experience of Compensation & Gratification - Subscale: Gratification	Group 1: ICD	55.30	24.96	[27, 111]
	Group 2: OCD	49.44	21.94	[27, 115]
	Group 3: Substance	48.25	11.39	[30, 72]
(Gambling) Expectancy - Total score	Group 1: ICD	71.57	20.97	[29, 106]
	Group 2: OCD	53.34	18.84	[21, 101]
	Group 3: Substance	70.50	14.33	[45, 93]

(Gambling) Expectancy Positive Outcome Expectancies Scales	Group 1: ICD	45.35	14.79	[13, 72]
	Group 2: OCD	34.81	16.62	[12, 69]
	Group 3: Substance	47.25	8.22	[28, 59]
- Subscale: Enjoyment	Group 1: ICD	33.74	10.89	[9, 53]
	Group 2: OCD	23.31	11.85	[8, 46]
	Group 3: Substance	37.06	5.72	[24, 45]
- Subscale: Self-enhancement	Group 1: ICD	11.61	5.50	[4, 21]
	Group 2: OCD	11.50	5.45	[4, 23]
	Group 3: Substance	10.19	4.92	[4, 17]
(Gambling) Expectancy Negative Outcome Expectancies Scales	Group 1: ICD	26.22	10.92	[8, 42]
	Group 2: OCD	18.53	7.98	[8, 32]
	Group 3: Substance	23.25	7.98	[11, 35]
- Subscale: Overinvolvement	Group 1: ICD	15.91	7.57	[5, 30]
	Group 2: OCD	11.66	5.07	[5, 23]
	Group 3: Substance	13.94	5.48	[5, 22]
- Subscale: Emotional impact	Group 1: ICD	10.30	6.07	[3, 19]
	Group 2: OCD	6.88	4.72	[3, 18]
	Group 3: Substance	9.31	4.29	[3, 16]
Temptation & Restraint - Total score	Group 1: ICD	37.65	12.98	[17, 58]
	Group 2: OCD	28.78	11.64	[15, 60]
	Group 3: Substance	35.25	8.42	[19, 49]
Temptation & Restraint - Subscale: Govern	Group 1: ICD	8.30	3.65	[3, 15]
	Group 2: OCD	6.63	3.62	[3, 15]
	Group 3: Substance	8.25	3.02	[3, 13]
Temptation & Restraint - Subscale: Restrict	Group 1: ICD	8.09	2.66	[3, 12]
	Group 2: OCD	5.25	2.60	[3, 12]
	Group 3: Substance	8.13	2.42	[3, 12]
Temptation & Restraint - Subscale: Emotion	Group 1: ICD	7.39	2.98	[3, 14]
	Group 2: OCD	6.97	3.01	[3, 15]
	Group 3: Substance	8.00	2.58	[4, 13]
Temptation & Restraint - Subscale: Concern	Group 1: ICD	6.74	3.28	[3, 11]

- Subscale: Concern	Group 2: OCD	4.19	1.96	[3, 11]
	Group 3: Substance	5.81	2.23	[3, 10]
Temptation & Restraint - Subscale: Cognitive preoccupation	Group 1: ICD	7.13	3.20	[3, 14]
	Group 2: OCD	5.75	3.03	[3, 14]
	Group 3: Substance	5.06	1.88	[3, 9]

Note. *M* = Mean, *SD* = Standard deviation, *Ra* = Range

Appendix D. Scoring of the individual subgroups (ICD, OCD, Substance-use) on all the questionnaires.

Appendix E

Post Hoc Comparisons of significant Between-group ANOVAs

(Gambling) Expectancy Positive Outcome Expectancies Scale
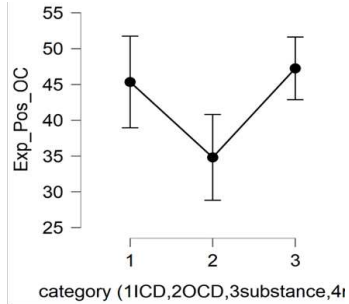
(Gambling) Expectancy - Subscale: Enjoyment
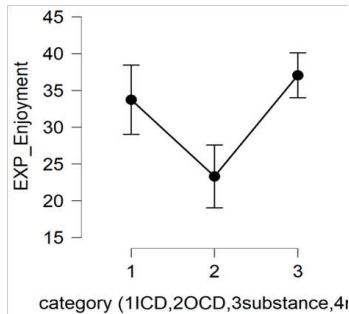
(Gambling) Expectancy Negative Outcome Expectancies Scales
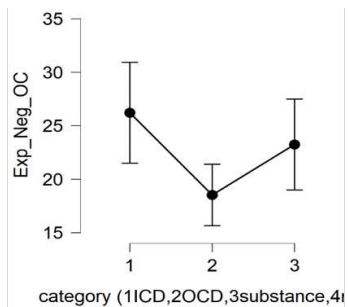
(Gambling) Expectancy - Subscale: Overinvolvement
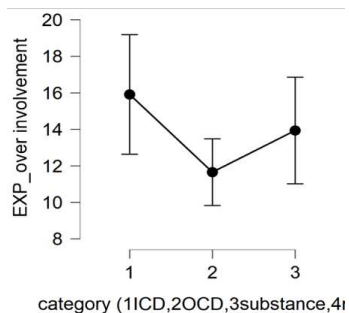
(Gambling) Expectancy - Subscale: Emotional impact
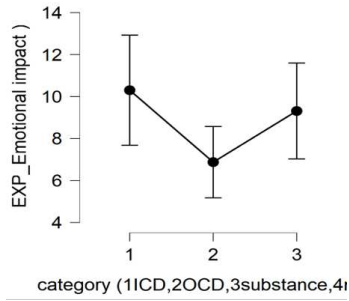
Temptation & Restraint - Total score
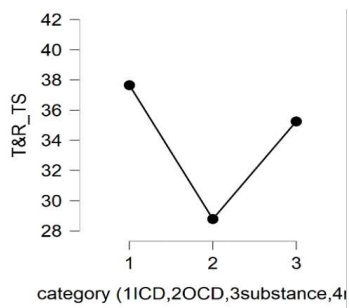
Temptation & Restraint - Subscale: Concern
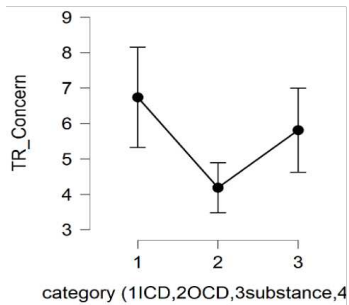
Temptation & Restraint - Subscale: Restrict
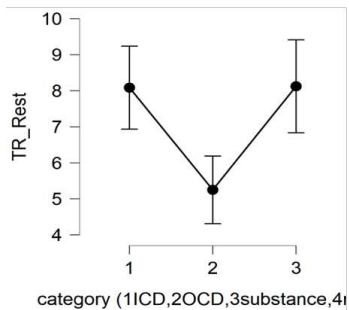
Appendix E. Post Hoc Comparisons of the significant Between-group ANOVAs. The graphs visualise the group difference patterns described in Table 6.

Appendix F

Complete Survey

Including:

Information sheet & Consent form

Demographic & optional medical questions

Part 1 questionnaires (discussed in this study)

Impulsive Compulsive Behaviours Checklist

QUIP-rs (*adapted)

Short (Gambling) Harm Screen (*adapted)

Obsessive Compulsive Drinking Scale (*adapted)

The Experience of Compensation & Gratification

(Gambling) Expectancy Questionnaire (*adapted)

Temptation and Restraint Inventory (*adapted)

Part 2 questionnaires (not discussed in this study)

The Self-Regulation Scale

Difficulties in Emotion Regulation Scale

Brief-COPE

Apathy Motivation Index

Urgency, Perseverance, Premeditation and Sensation Seeking Scale (UPPS-S)

The Yale-Brown Obsessive Compulsive Scale - II (Part A & B & C)

Consideration of Future Consequences Scale

Information sheet

Impulsive Compulsive Behaviour-related Harm in Older Adults: Rethinking Our Approach to Assessment

Thank you for taking the time to find out about this study. Before deciding to participate, it is vital to understand the purpose of the research and what your involvement will entail. Kindly review the information below attentively, and feel free to discuss it with others. Ask us if anything needs clarification or if you would like more information.

Meet the Team
We are an international, culturally diverse team of researchers.
Professor Nicky Edelstyn is leading the study from the United Kingdom. She is Professor of Cognitive Neuropsychology at Keele University, Department of Psychology. Prof. Dr. Andrea Kühn is a Professor of Neurology and head of the movement disorders and neuromodulation in the Dept. of Neurology at the Charité – Universitätsmedizin, Berlin, Germany. Dr Maris Thomas and Georgios Klados are the chief and first attendant of the Neurology Department of the Venizeleio Hospital in Crete, Greece. We also have students assisting with data collection. Ms Lina Nickmann is on clinical placement in the Dept. of Neurology at the Charité – Universitätsmedizin, Ms Ioanna Stefanidou Chronaki is on clinical placement in the Neurology Department of the Venizeleio Hospital, and Ana Maria De Freitas França Nogueira Da Rocha is on clinical placement in the Department of Neuropsychiatry at the Champalimaud Foundation. Ms Deniz Berber will collect data from a general population sample. The students are undertaking a Masters in Cognitive Neuroscience and Clinical Neuropsychology in the Department of General Psychology, Padua University, under the direct supervision of Prof Nicky Edelstyn.

What is the study about?
We are interested in why impulsive-compulsive behaviours affect some individuals more than others.

What are impulsive-compulsive behaviours?
People who experience impulsive-compulsive behaviours become overwhelmed by the impulse or urge to carry out an activity that may have once been rewarding or pleasurable. Typical forms of Impulsive-compulsive behaviours include but are not limited to being unable to control one's appetite, buying things one cannot afford, difficulty controlling one's sexual behaviours and gambling. This study aims to understand this experience

better and explore how the role of psychological factors and mental health may act to increase or decrease risk. Predicting who is at the most significant risk of impulsive-compulsive behaviours would help clinicians and researchers be aware and develop better and more appropriate care and management tailored to individual needs and coping strategies. A proactive approach to management will improve the lives of everyone affected by impulsive-compulsive behaviours - and here, we include family members as well as the individual.

What will happen if I take part?
Participation involves an online survey that is accessed from your home computer. The survey will require approximately 45-60 minutes of your time. Following some demographic and optional medical questions, you will go through the 15 questionnaires that are numbered accordingly. The survey comprises 425 questions, which have been taken from questionnaires that clinicians and researchers use to examine impulsive and compulsive behaviours. The questions ask about psychological factors such as how we cope with challenges, how well we control our emotions, how we express feelings, and reasons for engaging in pleasurable behaviours.

How long is the survey and how much will I be paid?
We have estimated that the survey will take around 45-60 minutes to complete and we are reimbursing you for your time at an hourly rate of £10.00. Which will be rounded up to the 15 min/quarterly intervals. You will have a total of 75 minutes to complete the survey, after which time the survey will 'time-out' and your response will be recorded as-is.

Disclaimer: There are between 15-20 attention check items embedded within the survey. If you fail 2 consecutive attention checks in a row, or a total of 3 attention checks overall, your data will not be used in our study, and you will NOT be paid. This is because we can't guarantee the quality of your responses and it would be 'bad science' to include what may be unreliable data in our analyses.

Are there any restrictions to participate?
You have to be a minimum of 60 years old to participate.

Do I have to take part?
Participating in this survey study is entirely voluntary, and the decision is yours to make. If you need assistance with completing the survey, or if you have any inquiries about the

study, you can get in touch with us. You are free to withdraw at any point during the survey completion without giving a reason.

What are the risks of taking part?

We understand that specific questions about mental health can be challenging to answer and may cause emotional distress. Therefore, it's okay to decline to answer these questions.

However, for reference, here are some example questions from the survey:

1. Do you have difficulty making sense of your feelings?
2. Have you been turning to work or other activities to take my mind off things?
3. Do you feel sad or upset when I hear bad news?
4. Do you have a hard time setting goals for yourself?
5. How often do you neglect household chores to spend more time online?
6. Do you think you have problems with cleaning too much?

Anonymity, Data Protection and Privacy

We will inquire about some personal information, such as your age, race, ethnicity, gender, marital status, income, and education, and medical questions, such as whether you are diagnosed with Parkinson's or another condition. Access to this background information will help us better understand the broader context in which impulsive and compulsive behaviours may arise. You do not need to complete all these questions to progress to the main part of the survey. We will not request your name or any other identifying information, such as medical number or email, that could link your identity to your data. The survey is hosted by Qualtrics on an online platform. Qualtrics 'policy on data protection complies with General Data Protection Regulation (GDPR).

Please use the following links to find out about the Qualtrics data and privacy policy and your rights about data protection under GDPR; please copy and paste the following links (respectively) into your web browser,

https://edps.europa.eu/sites/edp/files/publication/16-03-21_guidance_isrm_en.pdf
https://www.qualtrics.com/support/survey-platform/getting-started/data-protection-privacy/

If you would like to exercise your rights about data for which Qualtrics acts as data controller, please contact privacy@qualtrics.com

What will happen to the results of the study?

The anonymised study results will be analysed and summarised by Prof Nicky Edelstyn. The findings on impulsive-compulsive behaviours will be shared with clinicians and scientists through conferences and journals.

Data handling and Confidentiality

Keele University is the sponsor and data controller of the study, and we will adhere to their policy on research data management. Your data will be handled in compliance with the United Kingdom Data Protection Act (2018), which aligns with GDPR safeguards.

How will my data be stored, and who will have access to my data?

Once we have downloaded your data from Qualtrics, it will be kept secure on password-encrypted computers at Keele University. Members of the research team will have access to the complete data. The only other people in Keele University who will have access to this data will be people who need to audit the data collection process from Keele University in the case of needing to perform an audit. Keele University requires research data to be kept for at least ten years following project completion. The anonymised data will be stored indefinitely online in a professional repository (the Open Science Framework; https://osf.io/p8aqj/). This data is shared online so that other researchers can access our data to check the accuracy of published analyses independently, thus ensuring our work is reproducible and verifiable.

Who has reviewed the study?

This study has been reviewed by the Keele University Central Research Ethics Committee.

Whom should I contact for further information?

If you have any questions about this study or would like to speak to someone about how you are feeling, please get in touch with the Prof. Nicky Edelstyn.

First Contact Detail:
Name: Prof. Nicky Edelstyn
Site: https://www.keele.ac.uk/psychology/people/nicolaedelstyn/
Contact Email: n.edelstyn@keele.ac.uk
Phone number: +44 (0) 1782 734318
Address: Dorothy Hodgkin Building 1.94

Consent form

To indicate your consent and willingness to participate in this study, please click on each statement listed below.

- ☐ 1. I confirm that I have read and understand the study information.
- ☐ 2. I understand that I am free to withdraw my participation at any time before the end of the survey.
- ☐ 3. I understand that my anonymised data will be permanently available on a publicly accessible professional online repository.
- ☐ 4. I understand that my anonymised data will be used in scientific research publications and conferences.
- ☐ 5. I agree with my data being used in other research studies.
- ☐ 6. I give my consent to take part in this study.

1. Demographic and clinical characteristics

1. Thank you for taking part in this study. As state before, the survey will begin with a mandatory section of sociodemographic questions (from question 1.1 to 1.7) followed by an optional segment of questions about your health, (question 1.8 to 1.15).

What is your unique Prolific ID?

[   ]

1.1) What is your age? (only 60 or above; in numbers, e.g.: 65)

[   ]

1.2) How would you describe your nationality? (eg.: German, Turkish, Greek, Portuguese)

[   ]

1.3) How would you describe your gender?

- ○ Female
- ○ Male

○ Non-binary

○ Prefer to self-describe

○ Prefer not to say

1.4) What is your religion?

○ No religion/Atheist

○ Agnostic

○ Christian

○ Muslim

○ Buddhist

○ Hindu

○ Jewish

○ Sikh

○ [   ] Any other religion, please describe

○ Prefer not to say

1.5) How would you describe your family status?

○ single (no relationship, separated, divorced, widowed, etc.)

○ domestic partnership (relationship, married, etc.)

1.6) What is the highest level of educational or professional qualification you have received?

○ Less than a high-school

○ High-school

○ Training or apprenticeship

○ Bachelor's degree

○ Master's degree

○ Doctoral of professional degree

1.7) What is your employment status?

○ Unable to work

- O Retired
- O A student
- O A homemaker
- O Unemployed
- O Employed part time or casually for wages
- O Employed full time for wages

1.8) Have you received the diagnosis of Parkinson's disease by a neurologist?
(Note, if you have not received a diagnosis of Parkinson's disease, please proceed to the question 1.14).

- O No
- O Yes

1.9) If yes, when did you receive this diagnosis? (month/year) (eg.: March 2020 is 03/2020)
(Optional question)

[   ]

1.10) If yes, are you currently taking any Parkinson's medication?
(Optional question)

- O Yes
- O No

1.11) If yes, what type of Parkinson's medication (brand/name) are you taking?
(Optional question)

[   ]

1.12) What is the daily dosage you are administering?
(eg.: 3 times a day with dosage of 50mg -> 3x50)
(Optional question)

[   ]

1.13) Do you have a deep brain stimulation implantation?
(Optional question)

○ Yes
○ No

1.14) Have you ever received an additional neurological or psychiatric diagnosis by a clinician?
(Optional question)

○ [   ] yes, please list
○ no

1.15) If yes, are you taking any medication for it and if so which one?
(Optional question)

[   ]

2. Impulsive Compulsive Behaviours Checklist

2. This list consists of several behaviours that we all engage in from time to time. It can be challenging to be honest about your level of involvement in these behaviours and therefore we emphasize that all information here will be confidential. You will not be judged in any way based on your answers and we encourage you to fill this list honestly and accurately. When considering your responses, please do not include issues that are caused by medical conditions (e.g. diabetes, erectile dysfunction). Please answer the questions below for every behaviour on the list by selecting the appropriate response on the scale ranging from 'Never' to 'Always'.
Please answer each question as it applies to you over the last 12 months.
Make sure take your time to read all the questions carefully.

Do YOU and/or OTHERS think you have an issue/ problem with any of the following behaviours?

	Never	Sometimes	Often	Always

2.1. Washing	○	○	○	○
2.2. Smoking	○	○	○	○
2.3. Feeling compelled to collect free things (books, journals, sample items when shopping) saving something you know you will never use	○	○	○	○
2.4. Being overly cautious with money	○	○	○	○
2.5. Repetitive pointless motor behaviours for long periods of time at the expense of all other activities	○	○	○	○
2.6. Shopping	○	○	○	○
2.7. List making	○	○	○	○
2.8. Counting (e.g. money, tiles)	○	○	○	○
2.9. Grooming	○	○	○	○
2.10. Idiosyncratic routines (performing a very personalised sequence of actions)	○	○	○	○
2.11. Repeating actions (performing actions over and over again)	○	○	○	○
2.12. Exercising	○	○	○	○
2.13. Betting/gambling	○	○	○	○
2.14. Hair pulling	○	○	○	○
2.15. Lying	○	○	○	○
2.16. Sexual activities/behaviours	○	○	○	○
2.17. Alcohol consumption	○	○	○	○
2.18. This is an attention check. Please select the answer option 'Sometimes'.	○	○	○	○

2.19. Planning (e.g. over-organising)	○	○	○	○
2.20. Illicit drug use	○	○	○	○
2.21. Cleaning too much	○	○	○	○
2.22. Verbal aggression	○	○	○	○
2.23. Violence towards objects/properties	○	○	○	○
2.24. Swearing	○	○	○	○
2.25. Checking (e.g. locks, light switches)	○	○	○	○
2.26. Checking (e.g. yourself in the mirror)	○	○	○	○
2.27. Speed driving	○	○	○	○
2.28. Use medication in excess of prescribed regime.	○	○	○	○
2.29. Physical aggression	○	○	○	○
2.30. Social networking (e.g. Facebook, twitter, Google +, Myspace)	○	○	○	○
2.31. Applying rules	○	○	○	○
2.32. Purposeful self-injury (Le. not accidental	○	○	○	○
2.33. Re-writing/re-reading	○	○	○	○
2.34. Tattooing	○	○	○	○
2.35. Eating	○	○	○	○
2.36. Other:	○	○	○	○

3. QUIP-rs

Kindly review the list of behaviors and select the one you scored the highest on in the previous list of 33 behaviours. In the case of more than one behaviour scoring equally highly, then please choose the behavior that causes you the most trouble and write it in

the textbox below. If you have a problem with a behaviour that isn't listed, then please enter that in the text book and this will be your index behaviour. We will call this your INDEX behaviour, and it is this behaviour that we will be referring to in subsequent sections of the survey. So please make a mental note of your index behaviour so you don't forget it!

3. In the following set of questions, please keep in mind the index behavior that is either the most frequent or problematic and answer accordingly. **Please answer the following questions with your index behavior in mind.** Please make sure to take your time and read all the questions and instructions carefully.

	Never	Rarely	Sometimes	Often	Always
3.1. How much do you think about the index behaviour (such as having trouble keeping thoughts out of your mind or feeling guilty)?	○	○	○	○	○
3.2. Do you have urges or desires for the following index behaviour that you feel are excessive or cause you distress (including becoming restless or irritable when unable to participate in them)?	○	○	○	○	○
3.3. Do you have difficulty controlling the index behaviour (such as increasing them over time, or having trouble cutting down or stopping it)?	○	○	○	○	○

3.4. Do you engage in activities specifically to continue the index behaviour (such as hiding what you are doing, lying, hoarding things, borrowing from others, accumulating debt, stealing, or being involved in illegal acts)?

○ ○ ○ ○ ○

4. Short (Gambling) Harm Screen

Please refer back to the index behavior you were asked about earlier. Please enter it in the textbox below and answer the following questions in regards to this index behaviour.

[   ]

4. The following questions explore possible problems that may emerge as consequences of the index behavior. Have you experienced any of these issues as a result of your index behaviour?
Please make sure to take your time and read all the questions and instructions carefully.

	Never	Sometimes	Often	Always
4.1. Reduction of my savings	○	○	○	○
4.2. Reduction of my available spending money	○	○	○	○
4.3. Less spending on recreational expenses such as eating out movies or other entertainment.	○	○	○	○
4.4. Spent less time with people I care about	○	○	○	○
4.5. Spent less time attending social events	○	○	○	○

4.6. Experienced greater tension in my relationships (suspicion, lying, resentment, etc)	○	○	○	○
4.7. Felt ashamed because of engaging in this index behaviour	○	○	○	○
4.8. Felt like a failure	○	○	○	○
4.9. Had regrets that made me feel sorry because of engaging in this index behaviour	○	○	○	○
4.10. If you are paying attention, please choose 'Never' as your answer. This is an attention check.	○	○	○	○
4.11. Loss of sleep due to spending time doing this index behaviour	○	○	○	○
4.12. Increased my use of tobacco	○	○	○	○
4.13. Increased experience of depression	○	○	○	○
4.14. Reduced performance at work or study (i.e. due to tiredness or distraction)	○	○	○	○
4.15. Used my work or study time to engage in this index behaviour	○	○	○	○
4.16. Used my work or study resources to engage in this index behaviour	○	○	○	○
4.17. Promised to pay back money without genuinely intending to do so	○	○	○	○

| 4.18. Reduced my contribution to religious or cultural practices | ○ | ○ | ○ | ○ |
| 4.19. Outcast from religious or cultural community due to involvement with engaging in this index behaviour | ○ | ○ | ○ | ○ |

5. Obsessive Compulsive Drinking Scale

Please refer back to the index behavior you were asked about earlier. Please enter it in the textbox below and answer the following questions in regards to this index behaviour.

[   ]

5. The upcoming questions aim to explore the extent to which your index behavior plays a role in your thoughts, emotions, and actions.
Please make sure to take your time and read all the following questions.

5.1. How much of your time when you're not engaged in the index behaviour is occupied by ideas, thoughts, impulses or images related to it?

○ (0) Never
○ (1) Rarely
○ (2) Sometimes
○ (3) Often
○ (4) Always

5.2. How frequently do these thoughts occur?

○ (0) Never
○ (1) Rarely
○ (2) Sometimes
○ (3) Often
○ (4) Always

5.3. How much do these ideas, thoughts, impulses or images related to the index behaviour interfere with your social or work (or role) functioning? Is there anything you don't or can't do because of them? (If you are not currently working, how much of your performance would be affected if you were working?)

- ○ (0) Thoughts of the index behaviour never interfere – I can function normally.
- ○ (1) Thoughts of the index behaviour slightly interfere with my social or occupational activities, but my overall performance is not impaired
- ○ (2) Thoughts of the index behaviour definitely interfere with my social or occupational performance, but I can still manage.
- ○ (3) Thoughts of the index behaviour cause substantial impairment in my social or occupational performance.
- ○ (4) Thoughts of the index behaviour interfere completely with my social or work performance.

5.4. How much distress or disturbance do these ideas, thoughts, impulses, or images related to the index behaviour cause you when you're not engaged in the index behaviour?

- ○ (0) None
- ○ (1) Mild, infrequent and not too disturbing
- ○ (2) Moderate, frequent and disturbing, but still manageable
- ○ (3) Severe, very frequent and very disturbing
- ○ (4) Extreme, nearly constant, and disabling distress

5.5. How much of an effort do you make to resist these thoughts or try to disregard or turn your attention away from these thoughts as they enter your mind when you're not engaging in the index behaviour (Rate your effort made to resist these thoughts, not your success or failure in actually controlling them.)

- ○ (0) My thoughts are so minimal, I don't need to actively resist. If I have thoughts, I make an effort to always resist.
- ○ (1) I try to resist most of the time.
- ○ (2) I make some effort to resist.
- ○ (3) I give in to all such thoughts without attempting to control them, but I do so with some reluctance.
- ○ (4) I completely and willingly give in to all such thoughts.

5.6. How successful are you in stopping or diverting these thoughts when you're not

engaging in the index behaviour?

○ (0) I am completely successful in stopping or diverting such thoughts.
○ (1) I am usually able to stop or divert such thoughts with some effort and concentration.
○ (2) I am sometimes able to stop or divert such thoughts.
○ (3) I am rarely successful in stopping such thoughts and can only divert such thoughts with difficulty.
○ (4) I am rarely able to divert such thoughts even momentarily.

5.7. How often do you engage in the the index behaviour each day?

○ (0) Never
○ (1) Rarely
○ (2) Sometimes
○ (3) Often
○ (5) Always

5.8. This is an attention check. Please select the answer option 'Disagree'.

○ (1) Strongly disagree
○ (2) Disagree
○ (3) Neutral
○ (4) Agree
○ (5) Strongly agree

5.9. How many days each week do you engage in the the index behaviour

○ (0) None
○ (1) No more than 1 day per week
○ (2) 2-3 days per week
○ (3) 4-5 days per week
○ (4) 6-7 days per week

5.10. How much does your index behaviour interfere with your work functioning? Is there anything that you don't or can't do because of your index behaviour? (If you are not currently working, how much of your performance would be affected if you were working?)

○ (0) The index behaviour never interferes – I can function normally

○ (1) The index behaviour slightly interferes with my occupational activities, but my overall performance is not impaired.

○ (2) The index behaviour definitely interferes with my occupational activities, but I can still manage.

○ (3) The index behaviour causes substantial impairment in my occupational performance.

○ (4) The index behaviour problems interfere completely with my work performance.

5.11. How much does your index behaviour interfere with your social functioning? Is there anything that you don't or can't do because of your index behaviour]?

○ (0) The index behaviour never interferes – I can function normally.

○ (1) The index behaviour slightly interferes with my social activities, but my overall performance is not impaired.

○ (2) The index behaviour definitely interferes with my social performance.

○ (3) The index behaviour causes substantial impairment in my social performance.

○ (4) The index behaviour problems interfere completely with my social performance .

5.12. If you were prevented from engaging in the index behaviour when you desire to, how anxious or upset would you become?

○ (0) I would not experience any anxiety or irritation.

○ (1) I would become only slightly anxious or irritated.

○ (2) The anxiety or irritation would mount but remain manageable.

○ (3) I would experience a prominent and very disturbing increase in anxiety or irritation.

○ (4) I would experience incapacitating anxiety or irritation.

5.13. How much of an effort do you make to resist engaging in your index behaviour? (Only rate your effort to resist, not your success or failure in actually controlling the [named behaviour]).

○ (0) My index behaviour is so minimal, I don't need to actively resist. I make an effort to always resist.

○ (1) I try to resist most of the time.

○ (2) I make some effort to resist.

○ (3) I give in to almost all [named behaviour] without attempting to control it, but I do so with some reluctance.

○ (4) I completely and willingly give in to all [named behaviour].

5.14. How strong is the drive to engage in the index behaviour

○ (0) No drive
○ (1) Some pressure
○ (2) Strong pressure
○ (3) Very strong drive
○ (4) The drive is completely involuntary and overpowering.

5.15. How much control do you have over the index behaviour?

○ (0) I have complete control.
○ (1) I am usually able to exercise voluntary control over it.
○ (2) I can control it only with difficulty.
○ (3) I must engage in [index behaviour] and can only delay it with difficulty.
○ (4) I am rarely able to delay engaging in [index behaviour] even momentarily.

6. The Experience of Compensation Gratification

Please refer back to the index behavior you were asked about earlier. Please enter it in the textbox below and answer the following questions in regards to this index behavior.

[   ]

6. These questions will ask you about what you expect to happen when you engage in the behavior mentioned above. Please mark which of the answer options applies most to you. There are no right or wrong answers; the important thing is that you rate each statement as it applies most to you.
Please make sure to take your time and read all the questions and instructions carefully.

	Never	Sometimes	About half the time	Most of the time	Always
6.1. Feel less excluded	○	○	○	○	○
6.2. Feel less stressed	○	○	○	○	○

6.3. Feel less constricted	○	○	○	○	○
6.4. Feel less worthless	○	○	○	○	○
6.5. Feel less weak	○	○	○	○	○
6.6. Feel less worried	○	○	○	○	○
6.7. Feel less incompetent	○	○	○	○	○
6.8. Feel less inferior to others	○	○	○	○	○
6.9. Feel less lonely/alone	○	○	○	○	○
6.10. Feel less need of help	○	○	○	○	○
6.11. Feel less unsuccesful	○	○	○	○	○
6.12. Feel less bored	○	○	○	○	○
6.13. Feel less self-dependent	○	○	○	○	○
6.14 Please select the response option at the top of the page with the word 'Half' in it. This is an attention check.	○	○	○	○	○
6.15. Feel less like a loser	○	○	○	○	○
6.16. Feel less inner emptiness	○	○	○	○	○
6.17. Experience less conflicts	○	○	○	○	○
6.18. Feel less determined by other	○	○	○	○	○
6.19. Feel less useless	○	○	○	○	○
6.20. Feel less insecure	○	○	○	○	○
6.21. Feel less rejected	○	○	○	○	○

			About half the time	Most of the time	

6.22. Feel less unimportant ○ ○ ○ ○ ○

6.23. Feel less tense ○ ○ ○ ○ ○

6.24. Feel less powerless ○ ○ ○ ○ ○

6.25. Feel less isolated ○ ○ ○ ○ ○

6.26. Feel less dependent on others ○ ○ ○ ○ ○

6.27. Feel less concerned ○ ○ ○ ○ ○

These questions will ask you about what you expect to happen when you engage in the behavior mentioned above. Please mark which of the answer options applies most to you.

	Never	Sometimes	About half the time	Most of the time	Always
6.28. feel good	○	○	○	○	○
6.29. feel autonomous	○	○	○	○	○
6.30. experience fun	○	○	○	○	○
6.31. feel strong	○	○	○	○	○
6.32. feel close to others	○	○	○	○	○
6.33. feel acknowledged	○	○	○	○	○
6.34. feel pleasantly aroused	○	○	○	○	○
6.35. feel belonging to others	○	○	○	○	○
6.36. feel admired	○	○	○	○	○
6.37. feel succesful	○	○	○	○	○
6.38. feel useful	○	○	○	○	○
6.39. feel self-reliant	○	○	○	○	○

6.40. consider myself to be assertive	○	○	○	○	○
6.41. feel supported by others	○	○	○	○	○
6.42. This is an attention check. Please select the answer option at the top of the page with the word 'Most' in it.	○	○	○	○	○
6.43. feel satisfied	○	○	○	○	○
6.44. feel self-determined	○	○	○	○	○
6.45. experience myself as influential	○	○	○	○	○
6.46. experience myself as actively creating	○	○	○	○	○
6.47. feel accepted by others	○	○	○	○	○
6.48. feel powerful	○	○	○	○	○
6.49. feel comptetent	○	○	○	○	○
6.50. feel like intoxicated	○	○	○	○	○
6.51. feel independent	○	○	○	○	○
6.52. feel valuable	○	○	○	○	○
6.53. feel understood by others	○	○	○	○	○
6.54. experience pleasure	○	○	○	○	○
6.55. feel important	○	○	○	○	○

7. (Gambling) Expectancy Questionnaire

Please refer back to the index behavior you were asked about earlier. Please enter it in the textbox below and answer the following questions in regards to this index behaviour.

7. These questions will ask you about what you expect to happen when you engage in the index behavior mentioned above and previously. Make sure to take your time and read all the questions carefully.

	(1) No chance	(2) Very unlikely	(3) Unlikely	(4) Neither likely or unlikely	(5) Likely	(6) Very likely	(7) Certain to happen
7.1. I have fun	O	O	O	O	O	O	O
7.2. I feel more relaxed	O	O	O	O	O	O	O
7.3. I stop being bored	O	O	O	O	O	O	O
7.4. I feel excited	O	O	O	O	O	O	O
7.5. I spend time with people I like	O	O	O	O	O	O	O
7.6. This is an attention check. Please select the answer option number 5.	O	O	O	O	O	O	O
7.7. I feel a rush	O	O	O	O	O	O	O
7.8. I enjoy myself	O	O	O	O	O	O	O
7.9. I have a good time	O	O	O	O	O	O	O

	(1) No chance	(2) Very unlikely	(3) Unlikely	(4) Neither likely or unlikely	(5) Likely	(6) Very likely	(7) Certain to happen
7.10. My friends think I'm cool	O	O	O	O	O	O	O
7.11. I feel powerful	O	O	O	O	O	O	O
7.12. I feel in control	O	O	O	O	O	O	O

	(1) No chance	(2) Very unlikely	(3) Unlikely	(4) Neither likely or unlikely	(5) Likely	(6) Very likely	(7) Certain to happen
7.13. I am more accepted by people	○	○	○	○	○	○	○
7.14. I only want to spend time with people who enjoy the same/similar index behaviour as I do	○	○	○	○	○	○	○
7.15. If you are paying attention, please select the answer option you would choose if something would not apply to you at all.	○	○	○	○	○	○	○
7.16. I feel like engaging in the index behaviour all the time	○	○	○	○	○	○	○
7.17. I want to engage in the index behaviour more and more	○	○	○	○	○	○	○
7.18. I get hooked	○	○	○	○	○	○	○
7.19. I'm not able to stop	○	○	○	○	○	○	○

	(1) No chance	(2) Very unlikely	(3) Unlikely	(4) Neither likely or unlikely	(5) Likely	(6) Very likely	(7) Certain to happen
7.20. I feel guilty	○	○	○	○	○	○	○
7.21. I feel as if in over my head	○	○	○	○	○	○	○
7.22. I feel ashamed of myself	○	○	○	○	○	○	○

8. Temptation and Restraint Inventory:

Please refer back to the index behavior you were asked about earlier. Please enter it in the textbox below and answer the following questions in regards to this index behaviour.

[   ]

8. For each of these questions, you will choose one number from 1 to 5 to indicate how frequently the statement is true for you. Choose lower numbers if the question is never, or rarely true and choose higher numbers for questions that are more often true for you. Again, we kindly ask you to carefully read each item and pay attention to the available response options before answering.
Please make sure to take your time and read all the questions and instructions carefully.

	1 (Never)	2 (Rarely)	3 (Sometimes)	4 (Often)	5 (Always)
8.1. When you feel anxious, are you more likely to engage in the index behaviour?	O	O	O	O	O
8.2. When you feel lonely, are you more likely to engage in the index behaviour?	O	O	O	O	O
8.3. How often do you attempt to cut down the amount time you spend engaged in the index behaviour?	O	O	O	O	O
8.4. At times, do you find yourself unable to stop thinking about the index behaviour?	O	O	O	O	O
8.5. Does seeing other people engaging in the behaviour remind you of your efforts to control your index behaviour?	O	O	O	O	O

8.6. Do you ever feel so nervous that you really need to engage in the index behaviour?	○	○	○	○	○
8.7. Please select the answer option 'Always'. This is an attention check.	○	○	○	○	○
8.8. Do thoughts about the index behaviour intrude into your daily activities?	○	○	○	○	○
8.9. Does seeing commercials, advertisements, pop-ups etc related to the index behaviour, stimulate concerns about the need to limit your index behaviour?	○	○	○	○	○
8.10. Do you ever find that once you start the index behaviour it is difficult for you to stop?	○	○	○	○	○
8.11. Do feelings of guilt about the index behaviour too much help you to control the index behaviour	○	○	○	○	○
8.12. Is it hard to distract yourself from thinking about the index behaviour?	○	○	○	○	○
8.13. Does the sight of someone engaging in the index behaviour make you think about limiting your index behaviour?	○	○	○	○	○
8.14. How much difficulty do you have controlling your index behaviour?	○	○	○	○	○
	○	○	○	○	○

8.15. Do you ever cut back on your index behaviour to change your habits?

8.16. How much effort does it take for you to keep your index behaviour under control?

    O   O   O   O   O

9. The Self-Regulation Scale

Thank you for completing the first of two parts of the survey. The following questions will no longer concern the index behavior.

9. Please answer the following questions by choosing the response that best describes how you are. If you STRONGLY DISAGREE with a statement, select 1. If you DISAGREE select 2. If you are UNCERTAIN or UNSURE select 3. If you AGREE select 4, and if you STRONGLY AGREE select 5. There are no right or wrong answers. Work quickly and don't think too long about your answers.

Please make sure to take your time and read all the questions and instructions carefully.

	1 (Strongly Disagree)	2 (Disagree)	3 (Uncertain/Unsure)	4 (Agree)	5 (Strongly Agree)
9.1. I usually keep track of my progress toward my goals.	O	O	O	O	O
9.2. My behavior is not that different from other people's.	O	O	O	O	O
9.3. Others tell me that I keep on with things too long.	O	O	O	O	O
9.4. I doubt I could change even if I wanted to.	O	O	O	O	O
9.5. I have trouble making up my mind about things.	O	O	O	O	O
9.6. I get easily distracted from my plans.	O	O	O	O	O
9.7. I reward myself for progress toward my goals.	O	O	O	O	O

9.8. I don't notice the effects of my actions until it's too late.	O	O	O	O	O
9.9. My behavior is similar to that of my friends.	O	O	O	O	O
9.10. It's hard for me to see anything helpful about changing my ways.	O	O	O	O	O
9.11. I am able to accomplish goals I set for myself.	O	O	O	O	O
9.12. I put off making decisions.	O	O	O	O	O
9.13. I have so many plans that it's hard for me to focus on any one of them.	O	O	O	O	O
9.14. I change the way I do things when I see a problem with how things are going.	O	O	O	O	O
9.15. This is an attention check. Please click on Agree.	O	O	O	O	O
9.16. It's hard for me to notice when I've "had enough" (alcohol, food, sweets)	O	O	O	O	O
9.17. I think a lot about what other people think of me.	O	O	O	O	O
9.18. I am willing to consider other ways of doing things.	O	O	O	O	O
9.19. If I wanted to change, I am confident that I could do it.	O	O	O	O	O
9.20. When it comes to deciding about a change, I feel overwhelmed by the choices.	O	O	O	O	O
9.21. I have trouble following through with things once I've made up my mind to do something.	O	O	O	O	O
9.22. I don't seem to learn from my mistakes.	O	O	O	O	O
9.23. I'm usually careful not to overdo it when working, eating, drinking.	O	O	O	O	O
9.24. I tend to compare myself with other people.	O	O	O	O	O

9.25. I enjoy a routine, and like things to stay the same	○	○	○	○	○
9.26. I have sought out advice or information about changing.	○	○	○	○	○
9.27. I can come up with lots of ways to change, but it's hard for me to decide which one to use	○	○	○	○	○
9.28. I can stick to a plan that's working well.	○	○	○	○	○
9.29. I usually only have to make a mistake one time in order to learn from it	○	○	○	○	○
9.30. I don't learn well from punishment.	○	○	○	○	○
9.31. I have personal standards, and try to live up to them.	○	○	○	○	○
9.32. I am set in my ways	○	○	○	○	○
9.33. If you are paying attention please select the highest number as your answer. This is an attention check.	○	○	○	○	○
9.34. As soon as I see a problem or challenge, I start looking for possible solutions.	○	○	○	○	○
9.35. I have a hard time setting goals for myself.	○	○	○	○	○
9.36. I have a lot of willpower.	○	○	○	○	○
9.37. When I'm trying to change something, I pay a lot of attention to how I'm doing.	○	○	○	○	○
9.38. I usually judge what I'm doing by the consequences of my actions.	○	○	○	○	○
9.39. I don't care if I'm different from most people.	○	○	○	○	○
9.40. As soon as I see things aren't going right I want to do something about it.	○	○	○	○	○
9.41. There is usually more than one way to accomplish something.	○	○	○	○	○

9.42. I have trouble making plans to help me reach my goals.	○	○	○	○	○
9.43. I am able to resist temptation.	○	○	○	○	○
9.44. I set goals for myself and keep track of my progress.	○	○	○	○	○
9.45. Most of the time I don't pay attention to what I'm doing.	○	○	○	○	○
9.46. I try to be like people around me.	○	○	○	○	○
9.47. I tend to keep doing the same thing, even when it doesn't work.	○	○	○	○	○
9.48. I can usually find several different possibilities when I want to change something.	○	○	○	○	○
9.49. Once I have a goal, I can usually plan how to reach it.	○	○	○	○	○
9.50. I have rules that I stick by no matter what.	○	○	○	○	○
9.51. If I make a resolution to change something, I pay a lot of attention to how I'm doing.	○	○	○	○	○
9.52. Often I don't notice what I'm doing until someone calls it to my attention.	○	○	○	○	○
9.53. I think a lot about how I'm doing.	○	○	○	○	○
9.54. Usually I see the need to change before others do.	○	○	○	○	○
9.55. I'm good at finding different ways to get what I want.	○	○	○	○	○
9.56. Please select strongly disagree.	○	○	○	○	○
9.57. I usually think before I act.	○	○	○	○	○
9.58. Little problems or distractions throw me off course.	○	○	○	○	○
9.59. I feel bad when I don't meet my goals.	○	○	○	○	○
9.60. I learn from my mistakes.	○	○	○	○	○

9.61. I know how I want to be.	○	○	○	○	○
9.62. It bothers me when things aren't the way I want them.	○	○	○	○	○
9.63. I call in others for help when I need it.	○	○	○	○	○
9.64. Before making a decision, I consider what is likely to happen if I do one thing or another.	○	○	○	○	○
9.65. I give up quickly.	○	○	○	○	○
9.66. I usually decide to change and hope for the best.	○	○	○	○	○

10. Difficulties in Emotional Regulation Scale

10. Please indicate how often the following statements apply to you by selecting the appropriate number from the scale above (1-5) for each item.
Please make sure to take your time and read all the items and instructions carefully. We kindly ask you to pay close attention to the available response options before answering the questions.

	1 (Almost never)	2 (Sometimes)	3 (About half of the time)	4 (Most of the time)	5 (Almost always)
10.1. I have difficulty making sense out of my feelings.	○	○	○	○	○
10.2. I am confused about how I feel.	○	○	○	○	○
10.3. When I'm upset, I have difficulty getting work done.	○	○	○	○	○
10.4. When I'm upset, I become out of control.	○	○	○	○	○
10.5. When I'm upset, I believe that I will remain that way for a long time.	○	○	○	○	○

10.6. When I'm upset, I believe that I'll end up feeling very depressed.	○	○	○	○	○
10.7. When I'm upset, I have difficulty focusing on other things.	○	○	○	○	○
10.8. When I'm upset, I feel out of control.	○	○	○	○	○
10.9. Select the answer option with the word 'most' in it. This is an attention check.	○	○	○	○	○
10.10. When I'm upset, I feel ashamed with myself for feeling that way.	○	○	○	○	○
10.11. When I'm upset, I feel like I am weak.	○	○	○	○	○
10.12. When I'm upset, I have difficulty controlling my behaviors.	○	○	○	○	○
10.13. When I'm upset, I believe that there is nothing I can do to make myself feel better.	○	○	○	○	○
10.14. When I'm upset, I become irritated with myself for feeling that way.	○	○	○	○	○
10.15. When I'm upset, I start to feel very bad about myself.	○	○	○	○	○
10.16. When I'm upset, I have difficulty thinking about anything else.	○	○	○	○	○
10.17. When I'm upset, my emotions feel overwhelming.	○	○	○	○	○

11. Brief COPE

11. The following questions ask how you have sought to cope with a hardship in your life. Read the statements and indicate how much you have been using each coping style. Please make sure to take your time and read all the questions and instructions carefully.

	(1) I haven't been doing this at all	(2) A little bit	(3) A medium amount	(4) I've been doing this a lot
11.1. I've been turning to work or other activities to take my mind off things.	O	O	O	O
11.2. I've been concentrating my efforts on doing something about the situation I'm in.	O	O	O	O
11.3. I've been saying to myself "this isn't real".	O	O	O	O
11.4. I've been using alcohol or other drugs to make myself feel better.	O	O	O	O
11.5. I've been getting emotional support from others.	O	O	O	O
11.6. I've been giving up trying to deal with it.	O	O	O	O
11.7. I've been taking action to try to make the situation better.	O	O	O	O
11.8. I've been refusing to believe that it has happened.	O	O	O	O
11.9. I've been saying things to let my unpleasant feelings escape	O	O	O	O

11.10. I've been getting help and advice from ather people.	O	O	O	O
11.11. I've been using alcohol or other drugs to help me get through it.	O	O	O	O
11.12. I've been trying to see it in a different light, to make it seem more positive	O	O	O	O
11.13 This is an attention check. I work fourteen months in a year.	O	O	O	O
11.14. I've been criticizing myself.	O	O	O	O
11.15. I've been trying to come up with a strategy about what to do.	O	O	O	O
11.16. I've been getting comfort and understanding from someone.	O	O	O	O
11.17. I've been giving up the attempt to cope.	O	O	O	O
11.18. I've been looking for something good in what is happening.	O	O	O	O
11.19. I've been making jokes about it.	O	O	O	O
11.20. I've been doing something to think about it less, such as going to movies, wasching TV, reading, daydreaming, sleeping or shopping	O	O	O	O
11.21. I've been accepting the reality of the fact that it has happened.	O	O	O	O

11.22. I've been expressing my negative feelings.	○	○	○	○
11.23. I've been trying to find comfort in my religion or spiritual beliefs.	○	○	○	○
11.24. I've been trying to get advice or help from other people about what	○	○	○	○
11.25. I've been learning to live with it.	○	○	○	○
11.26. I've been thinking hard about what steps to take.	○	○	○	○
11.27. I've been blaming myself for things that happened	○	○	○	○
11.28. Please select 'A little bit'. This is an attention check.	○	○	○	○
11.29. I've been praying or meditating.	○	○	○	○
11.30. I've been making fun of the situation.	○	○	○	○

12. Apathy Motivation Index

12. Below are a number of statements. Each statement asks you to think about your life over the last 2 weeks. For each statement, select how appropriately it describes your life right now. Select "Completely true" if the statement describes you perfectly, "Completely untrue" if the statement does not describe you at all **over the last 2 weeks**, and use the answers in between accordingly.
Please, make sure take your time to read all the questions carefully.

	Completely untrue	Mostly untrue	Neither true nor untrue	Quite true	Completly true
12.1. I feel sad or upset when I hear bad news.	○	○	○	○	○

12.2. I start conversations with random people.

○   ○   ○   ○   ○

12.3. I enjoy doing things with people I have just met.

○   ○   ○   ○   ○

12.4. I suggest activities for me and my friends to do.

○   ○   ○   ○   ○

12.5. I make decisions firmly and without hesitation.

○   ○   ○   ○   ○

12.6. After making a decision, I will wonder if I have made the wrong choice.

○   ○   ○   ○   ○

12.7. Based on the last two weeks, I would say I care deeply about how my loved ones think of me.

○   ○   ○   ○   ○

12.8. I go out with friends on a weekly basis.

○   ○   ○   ○   ○

12.9. Please select the answer option if something would describe you perfectly. This is an attention check.

○   ○   ○   ○   ○

12.10. When I decide to do something, I am able to make an effort easily.

○   ○   ○   ○   ○

12.11. I don't like to laze around.

○   ○   ○   ○   ○

12.12. I get things done when they need to be done, without requiring reminders from others.

○   ○   ○   ○   ○

12.13. When I decide to do something, I am motivated to see it through to the end.

○   ○   ○   ○   ○

12.14. I feel awful if I say something insensitive.

○ ○ ○ ○ ○

12.15. I start conversations without being prompted.

○ ○ ○ ○ ○

12.16. When I have something I need to do, I do it straightaway so it is out of the way.

○ ○ ○ ○ ○

12.17. I feel bad when I hear an acquaintance has an accident or illness.

○ ○ ○ ○ ○

12.18. I enjoy choosing what to do from a range of activities.

○ ○ ○ ○ ○

12.19. If I realise I have been unpleasant to someone, I will feel terribly guilty afterwards.

○ ○ ○ ○ ○

13. Urgency, Perseverance, Premeditation and Sensation Seeking Scale (UPPS-S)

13. Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you Agree Strongly choose/select 1, if you Agree Somewhat choose/select 2, if you Disagree somewhat choose/select 3, and if you Disagree Strongly choose/select 4.
Be sure to indicate your agreement or disagreement for every statement below.
Please make sure to take your time and read all the items and instructions carefully. We kindly ask you to pay close attention to the available response options before answering the questions.

	1 (Agree Strongly)	2 (Agree Some)	3 (Disagree Some)	4 (Disagree Strongly)
13.1. I have a reserved and cautious attitude toward life.	○	○	○	○

13.2. I have trouble controlling my impulses. ○ ○ ○ ○

13.3. I generally seek new and exciting experiences and sensations. ○ ○ ○ ○

13.4. I generally like to see things through to the end. ○ ○ ○ ○

13.5. When I am very happy, I can't seem to stop myself from doing things that can have bad consequences. ○ ○ ○ ○

13.6. My thinking is usually careful and purposeful. ○ ○ ○ ○

13.7. I have trouble resisting my cravings (for food, cigarettes, etc.). ○ ○ ○ ○

13.8. I'll try anything once. ○ ○ ○ ○

13.9. I tend to give up easily. ○ ○ ○ ○

13.10. When I am in great mood, I tend to get into situations that could cause me problems. ○ ○ ○ ○

13.11. I am not one of those people who blurt out things without thinking. ○ ○ ○ ○

13.12. I often get involved in things I later wish I could get out of. ○ ○ ○ ○

13.13. I like sports and games in which you have to choose your next move very quickly. ○ ○ ○ ○

13.14. Unfinished tasks really bother me.

○　　　○　　　○　　　○

13.15. When I am very happy, I tend to do things that may cause problems in my life.

○　　　○　　　○　　　○

13.16. I like to stop and think things over before I do them.

○　　　○　　　○　　　○

13.17. When I feel bad, I will often do things I later regret in order to make myself feel better now.

○　　　○　　　○　　　○

13.18. If you are paying attention, please select 'Disagree some'.

○　　　○　　　○　　　○

13.19. I would enjoy water skiing.

○　　　○　　　○　　　○

13.20. Once I get going on something I hate to stop.

○　　　○　　　○　　　○

13.21. I tend to lose control when I am in a great mood.

○　　　○　　　○　　　○

13.22. I don't like to start a project until I know exactly how to proceed.

○　　　○　　　○　　　○

13.23. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse

○　　　○　　　○　　　○

13.24. I quite enjoy taking risks.

○　　　○　　　○　　　○

13.25. I concentrate easily.

○　　　○　　　○　　　○

13.26. When I am really ecstatic, I tend to get out of control.

○　　　○　　　○　　　○

13.27. I would enjoy parachute jumping.

○ ○ ○ ○

13.28. I finish what I start.

○ ○ ○ ○

13.29. I tend to value and follow a rational, "sensible" approach to things.

○ ○ ○ ○

13.30. When I am upset I often act without thinking.

○ ○ ○ ○

13.31. Others would say I make bad choices when I am extremely happy about something.

○ ○ ○ ○

13.32. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.

○ ○ ○ ○

13.33. I am able to pace myself so as to get things done on time.

○ ○ ○ ○

13.34. I usually make up my mind through careful reasoning.

○ ○ ○ ○

13.35. When I feel rejected, I will often say things that I later regret.

○ ○ ○ ○

13.36. Others are shocked or worried about the things I do when I am feeling very excited.

○ ○ ○ ○

13.37. This is an attention check. Please select the lowest number.

○ ○ ○ ○

13.38. I would like to learn to fly an airplane.

○ ○ ○ ○

13.39. I am a person who always gets the job done.

○　　　○　　　○　　　○

13.40. I am a cautious person.

○　　　○　　　○　　　○

13.41. It is hard for me to resist acting on my feelings.

○　　　○　　　○　　　○

13.42. When I get really happy about something, I tend to do things that can have bad consequences.

○　　　○　　　○　　　○

13.43. I sometimes like doing things that are a bit frightening.

○　　　○　　　○　　　○

13.44. I almost always finish projects that I start.

○　　　○　　　○　　　○

13.45. Before I get into a new situation I like to find out what to expect from it.

○　　　○　　　○　　　○

13.46. I often make matters worse because I act without thinking when I am upset.

○　　　○　　　○　　　○

13.47. When overjoyed, I feel like I can't stop myself from going overboard.

○　　　○　　　○　　　○

13.48. I would enjoy the sensation of skiing very fast down a high mountain slope.

○　　　○　　　○　　　○

13.49. Sometimes there are so many little things to be done that I just ignore them all.

○　　　○　　　○　　　○

13.50. I usually think carefully before doing anything.

○　　　○　　　○　　　○

13.51. When I am really excited, I tend not to think of the consequences of my actions.

○ ○ ○ ○

13.52. In the heat of an argument, I will often say things that I later regret.

○ ○ ○ ○

13.53. This is an attention check. A week has 7 days.

○ ○ ○ ○

13.54. I would like to go scuba diving.

○ ○ ○ ○

13.55. I tend to act without thinking when I am really excited.

○ ○ ○ ○

13.56. I always keep my feelings under control.

○ ○ ○ ○

13.57. When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.

○ ○ ○ ○

13.58. Before making up my mind, I consider all the advantages and disadvantages.

○ ○ ○ ○

13.59. I would enjoy fast driving.

○ ○ ○ ○

13.60. When I am very happy, I feel like it is ok to give in to cravings or overindulge.

○ ○ ○ ○

13.61. Sometimes I do compulsive things that later I regret.

○ ○ ○ ○

13.62. I am suprised at the things I do while in a great mood.

○ ○ ○ ○

14. The Yale-Brown Obsessive Compulsive Scale-II

14. PART A:
Many people sometimes experience distressing or unwanted thoughts, ideas, or urges, and can feel the need to perform certain physical or mental actions in order to get rid of or lessen the distress associated with these thoughts. While it is co regulation experience these thoughts, for some people these thoughts and actions can be upsetting or disruptive.

The questions below are designed to help health professionals evaluate some of these symptoms.

Please answer the below questions as accurately as you can, keeping in mind that there are no right or wrong answers. Answer you feel is most consistent with you and your own experience, as accurately as you can.

The following questions refer to repeated types of thoughts, images, sensations, or urges you may experience.

Please indicate whether you have experienced each of the following thoughts, images, or urges **during the last 30 days** by selecting "yes" (Y) or "no' (N).

Examples are provided for each type of thought for the sake of clarification, but please note that these are only representative examples--your own thoughts and experiences may be similar, but distinct from the examples given.

Please make sure to take your time and read all the questions and instructions carefully.

	Yes	No
14.1. Excessive concern with germs (e.g. excessive fear that you will contract an illness from door handles, other people, or objects.)	O	O
14.2. Excessive concern with contaminants or chemicals (e.g. excessive fear that you will be poisoned or contract cancer from household cleaners, asbestos, radiation, pesticides, or toxic waste).	O	O

14.3. Excessive concern that you will harm others by spreading germs or contaminants
(e.g. you are excessively concerned that you will make someone else sick because you transferred germs or chemical residue from yourself or an object you touch.).

○   ○

14.4. Excessive concern or disgust with bodily waste or fluids
(e.g. excessive fear or disgust for contact with urine, feces, saliva or blood).

○   ○

14.5. Excessive concern or disgust with sticky substances or residues
(e.g. you are excessively bothered by adhesive residue, chalk residues dust, or grease).

○   ○

14.6. Excessive concern with becoming pregnant or of making someone preganant
(e.g. you are afraid of becoming or making someone pregnant if you swim in a public pool).

○   ○

14.7. Concerned with having an illness or disease
(e.g. you are excessively concerned with the possibility of having HIV or cancer).

○   ○

14.8. Fear of eating certain foods, not concern with gaining weight.
(e.g. you are excessively fearful that certain foods will make you choke, or will alter your body chemistry).

○   ○

14.9. Fear of harming yourself or others because you are not careful enough
(e.g. when driving, you are afraid you might hit a pedestrian because of not paying enough attention.You are afraid a customer might get injured because you gave them the wrong materials or information).

○   ○

14.10. Fear of harming yourself or others on impulse
(e.g. you are afraid you might impulsively stab a loved one or drive your car into oncoming traffic for no reason).

○   ○

14.11. Fear of being responsible for terrible events.
(e.g. you are afraid that something terrible like a fire, natural disaster, or burglary was or will be your fault).

O   O

14.12. Fear of blurting out obscenities, insults, or something inappropriate
(e.g. you are afraid you might shout blasphemies in church, yell "fire!" in a movie theater, or write obscenities in a business email for no good reason).

O   O

14.13. Fear of doing something else embarrassing or inappropriate
(e.g. you are afraid you might walk out of a store with unpaid merchandise).

O   O

14.14. Please indicate if you are paying attention.
(eg. select Yes if you are paying attention).

O   O

14.15. Violent, horrific, or repulsive images
(e.g. disturbing images of car accidents, disfigured people, or corpses enter your thoughts for no apparent reason).

O   O

14.16. Excessive concern with right and wrong or scrupulosity
(e.g. you have unfounded worries that you might or might have lied or cheated, or prayed 'incorrectly).

O   O

14.17. Concern with sacrilege or blasphemy
(eg. you have unacceptable unwanted thoughts about God or religion; concern about degree of devotion to God).

O   O

14.18. Excessive fears of Satan, evil spirits or demonic possession
(eg. you are excessively concerned or preoccupied with the number *666, sports teams with the word 'devil' in them, or that you or others might be possessed).

O   O

14.19. Forbidden or improper sexual thoughts or impulses
(e.g. you have intrusive, unwanted sexual thoughts about family members or experience unwanted images of forbidden sexual acts).

○　　　　　○

14.20. Experiences unwanted sexual impulses
(e.g. you are concerned that you might 'snap' and commit a sexual violation).

○　　　　　○

14.21. Excessive concerns about sexual orientation or gender
(e.g. you repeatedly wonder if you are gay even though you identity have every reason to believe you are heterosexual).

○　　　　　○

14.22. I swim across the Atlantic Ocean to go to work
(eg. This is an attention check. Please select No).

○　　　　　○

14.23. Need for symmetry or exactness
(e.g. you are excessively concerned with certain things being touched or moved, or are excessively bothered when things are not lined up perfectly straight).

○　　　　　○

14.24. Perfection in appearance or grooming
(eg. you are excessively concerned with the appearance of clothing (such as wrinkles, loose threads, lint, clothes matching; You are excessively bothered if your hair is not parted exactly straight).

○　　　　　○

14.25. Fear of saying the wrong thing
(eg. you excessively think through every possible interpretation of what you are about to say before you answer a question).

○　　　　　○

14.26. Excessively bothered by things not sounding "just right."
(eg. you might read just the volume of your stereo until it sounds "just right." Or, you ask family members to say things in just the right way).

○　　　　　○

14.27. Need to know or remember
(eg. you feel the need to remember insignificant details like license plate numbers, names of actors, or advertising slogans).

○　　　　　○

14.28. Need to hoard or save things
(eg. you are afraid something valuable might be discarded with recycled newspapers even though all of your valuables are locked up elsewhere).

○   ○

14.29. Fear of losing objects, information, or a person
(eg. you are excessively worried you might lose your memories, soul, or essence, or something of value).

○   ○

14.30. Magical or superstitious fears
(e.g. certain numbers hold special meaning to you or are associated with good/bad events).

○   ○

14.31. Intrusive meaningless sounds, words, or music
(e.g words or music of no special significance play over and over in your mind like a broken record).

○   ○

PART B:

Please answer the following questions regarding the unwanted thoughts, images, or urges that you indicated experiencing in Part A by selecting the option that is most consistent with your experience _during the past 30 day_s, selecting the most appropriate number from 0 to 5. You may refer back to your responses to Part A if needed:

14.32. How much of your time is occupied by these thoughts?

○ (0) None
○ (1) Less than one hour
○ (2) 1 to 3 hours per day
○ (3) Between 3 and 8 hours per day
○ (4) Between 8 and 12 hours per day
○ (5) More than 12 hours per day, constant, or nearly constant

14.33. On average, what Is the longest continuous period or block of time during which you are free of these thoughts?

- ( ) (0) No obsessive thoughts
- ( ) (1) More than 8 consecutive hours per day
- ( ) (2) Between 3 and 8 consecutive hours per day
- ( ) (3) Between 1 and 3 consecutive hours per day
- ( ) (4) Between a few minutes and 1 hour
- ( ) (5) Constant or nearly constant

14.34. How much control do you feel you have over these thoughts?
How successfully can you stop or ignore them when they occur?

- ( ) (0) Complete control, can dismiss completely
- ( ) (1) Much control, usually able to stop or ignore
- ( ) (2) Moderate control, often able to stop or ignore, but may require some effort/concentration
- ( ) (3) Some control, sometimes able to stop or ignore thoughts with much effort/concentration
- ( ) (4) Little control, rarely able to stop or ignore thoughts, and even then only with much difficulty
- ( ) (5) No control. Rarely able to even let go of thoughts for a moment

14.35. How much distress, anxiety or upset do these thoughts cause you?

- ( ) (0) No distress
- ( ) (1) Slightly disturbing
- ( ) (2) Definitely disturbing but still manageable
- ( ) (3) Often highly disturbing and difficult to manage
- ( ) (4) Most or even all thoughts are highly disturbing and difficult to manage
- ( ) (5) All or nearly all thoughts are highly, overwhelming and disabling distress whenever a thought occurs

14.36. How much do these thoughts interfere with your social school, or work functioning?

- ( ) (0) No interference
- ( ) (1) Slight interference with social or work activities, but overall performance not impaired
- ( ) (2) Definite interferenc with social or work activities, but still manageable
- ( ) (3) Significant impairment in one or more (but not all) aspects of functioning
- ( ) (4) Significant impairment in ALL areas of functioning
- ( ) (5) Incapacitating

14.37. This is an attention check. When asked for your favourite drink, you need to select carrot juice.

Based on the text above, what is your favourite drink?

○ Wine
○ Beer
○ Carrot juice
○ Other

PART C:

The following questions refer to behaviors, strategies, or actions people may use to minimize, avoid, or neutralize some of the intrusive or unwanted thoughts portrayed in Part A. If the any of the thoughts described in Part A have caused you to engage in any of the minimizing, neutralizing, or avoiding actions or behaviors listed below **during the last 30 days**, please indicate so by circling "yes" (Y) or "no" (N). You may refer back to your answers for Part A if needed. Again, some examples are provided for each type of action/behavior for the sake of clarification, but please note that these are only representative examples-your own behaviors or experiences may be similar, but distinct from the examples given.

	Yes	No
14.38. Excessive or ritualized hygiene (e.g. excessive handwashing or cleaning rituals)	○	○
14.39. Cleaning of household items, inanimate objects, or pets (e.g. you vacuum your floors several times per day).	○	○
14.40. Checking locks, stove, appliances, emergency brake, faucets,etc. (e.g. you have to check several times that your doors are locked before leaving the house. You have returned home after leaving to make sure that you remembered to turn the stove off).	○	○

14.41. Checking that nothing terrible did or will happen
(e.g. you will circle back around the block to make sure you have not run over a pedestrian).

○ ○

14.42. Checking that you did not make a mistake
(e.g. you will excessively check over homework, writing, or answers on forms before turning them in).

○ ○

14.43. Checking tied to bodily concerns
(e.g. you spend excessive time scrutinizing your body for moles or signs of skin cancer).

○ ○

14.44. Need to repeat routine activities or boundary crossings
(e.g. you have to cross back and forth through a doorway multiple times when entering a room. You have to turn your car on and off several times before you feel comfortable).

○ ○

14.45. Need to make things even or balanced
(e.g. you need to adjust the lengths of your shoe laces so that they are exactly the same).

○ ○

14.46. Need to re-read or re-write
(e.g. you rewrite a sentence until the letters look perfect. You will doubt information that you just read unless you re-read a sentence or page several times).

○ ○

14.47. Choose 'No'.
This is an attention check.

○ ○

14.48. Counting compulsions
(e.g. you spend excessive time counting celling or floor tiles, books in a bookcase, or words in a sentence).

○ ○

14.49. Ritualized activity of daily living routines
(e.g. you feel the need to put clothes on in a certain order. You feel you can only brush your teeth after you have followed an elaborate series of steps beforehand).

○ ○

14.50. Excessive religious rituals
(e.g. you will repeat prayers or passages from a religious text an excessive number of times).

○ ○

14.51. Ordering or arranging compulsions
(e.g. you will repeatedly straighten piles of papers on your desktop or adjust books in a bookcase until they seem "right").

○   ○

14.52. Repeating what someone else has said
(e.g. you repeat words, phrases, or sounds someone else has just said).

○   ○

14.53. Asking for reassurance
(e.g. you repeatedly ask other people if you said something or performed a routine correctly).

○   ○

14.54. Rituallzed eating behaviors
(e.g. you arrange or eat food in a very particular way to avoid a feared consequence other than gaining weight).

○   ○

14.55. Saving or collecting useless items
(e.g. you pile up old newspapers or collect objects you do not have a use for, or that have no monetary value).

○   ○

14.56. Picking up objects that most people would pass by
(e.g. you might pick up and save shards of broken glass, nails, or pieces of paper with writing on them while walking down the sidewalk).

○   ○

14.57. Examining things that leave your possession
(e.g. you sift through your own garbage or will hesitate to throw away used items to ensure you don't accidentally throw away something of value).

○   ○

14.58. Buying many unneeded items
(e.g. you might buy 20 umbrellas or 50 boxes of tissues at a time, to the extent that you waste a lot of money, or fill closets full of unnecessary items).

○   ○

14.59. Need to tell, ask, or confess things
(e.g. you feel the need to confess or sins or wrongs that you did not commit. You feel you must describe every detail so that nothing is left out, or repeat the same question in different ways to make sure it was understood).

○   ○

14.60. Need to do something until it feels "just right"
(e.g. you adjust your car seat, straighten pictures, or arrange papers on a desk until you feel an internal

signal that it's OK or just right')**.**

○   ○

14.61. Need to touch, tap, or rub
(e.g. you have the urge to run your finger along surfaces or edges, or to lightly touch other people. You feel the need to tap objects a certain number

of times)**.**

○   ○

14.62. Paying attention to what I am reading right now.
This is an attention check. Please select 'yes' if you are paying attention.

○   ○

14.63. Staring or blinking rituals
(e.g. you feel the need to blink a certain number of times or stare at something for a certain length of time to avoid

something bad happening)**.**

○   ○

14.64. Superstitious behaviors
(e.g. you go out of your way to step over sidewalk cracks, or make sure sentences hever contain 13 words. You feel the need to make the sign of a cross before dialing a phone number

containing '666*)**.**

○   ○

14.65. Mental rituals (other than checking or counting)
(e.g. you might silently recite a prayer, song, or nonsense words to cancel out

an unwanted or negative thought)**.**

○   ○

14.66. Pervasive slowness
(e.g. it is excessively difficult for you to start, execute, or finish a wide range of routine tasks. You may be unable to complete, or become 'paralyzed' while

trying to finish a task)**.**

○   ○

14.67. Ritualized avoidance
(e.g. you plan a course on a map or GPS to stay at least 1 mile away from a

chemical factory or hospital)**.**

○   ○

○   ○

14.68. Actively taking measures to avoid contact with contaminants or other feared objects (e.g. you will refuse to shake hands with strangers, or will avoid going near someone who has a cut).

14.69. Avoiding doing things, going places, or being with someone because of intrusive, senseless, or unwanted thoughts.

○   ○

14.70. Avoiding contact with dirty or contaminated objects or people.

○   ○

14.71. Avoding handling sharp or dangerous objects, or operating vehicles or machinery, out of concern that you might harm others.

○   ○

14.72. Avoiding contact with people, children, or animals because of unwanted impulses.

○   ○

14.73. Avoiding talking to or writing to others for fear you will say or write the wrong thing.

○   ○

14.74. Avoiding watching TV, listening to radio, or reading the newspaper to shield yourself from disturbing information.

○   ○

14.75. Working fourteen months in a year. This is an attention check.

○   ○

14.76. Avoiding going shopping out of concern you will buy extra items that aren't needed.

○   ○

14.77. Avoiding doing things, going places, or being with someone that would trigger unwanted impulses or ritualized actions.

⃝   ⃝

14.78. Avoiding reading or writing because it may bring on the urge repeatedly re-read or re-write.

⃝   ⃝

15. Consideration of Future Consequences Scale

15. For each of the statements below, please indicate whether or not the statement is characteristic of you. If the statement is extremely uncharacteristic of you (not at all like you) please select "1"; if the statement is extremely characteristic of you (very much like you) please select a "5". Use the numbers in the middle if you fall between the endpoints. Please keep the following scale in mind as you rate each of the statements below. Please make sure to take your time and read all the items and instructions carefully. We kindly ask you to pay close attention to the available response options before answering the questions.

	1=extremely uncharacteristic	2=somewhat uncharacteristic	3=uncertain	4=somewhat characteristic	5=extremely characteristic
15.1. I consider how things might be in the future, and try to influence those things with my day to day behavior.	⃝	⃝	⃝	⃝	⃝
15.2. Often I engage in a particular behavior in order to achieve outcomes that may not result for many years.	⃝	⃝	⃝	⃝	⃝

15.3. I only act to satisfy immediate concerns, figuring the future will take care of itself.

○　　　　○　　　　○　　　　○　　　　○

15.4. My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions.

○　　　　○　　　　○　　　　○　　　　○

15.5. My convenience is a big factor in the decisions I make or the actions I take.

○　　　　○　　　　○　　　　○　　　　○

15.6. I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.

○　　　　○　　　　○　　　　○　　　　○

15.7. I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.

○　　　　○　　　　○　　　　○　　　　○

○　　　　○　　　　○　　　　○　　　　○

15.8. I think it is more important to perform a behavior with important distant consequences than a behavior with less-important immediate consequences.

15.9. I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.

○   ○   ○   ○   ○

15.10. I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.

○   ○   ○   ○   ○

15.11. I only act to satisfy immediate concerns, figuring that i will take care of future problems.

○   ○   ○   ○   ○

15.12. Since my day to day work has specific outcomes, it is more important to me than behavior that has distant outcomes.

○   ○   ○   ○   ○