THE CORE MOTIVATIONS OF OBSESSIVE-COMPULSIVE DISORDER

HARM AVOIDANCE AND INCOMPLETENESS: UNDERSTANDING THE CORE MOTIVATIONAL DIMENSIONS OF OBSESSIVE-COMPULSIVE DISORDER

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TITLE: Harm Avoidance and Incompleteness: Understanding the Core Motivational Dimensions of Obsessive-Compulsive Disorder

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LAY ABSTRACT

Obsessive-compulsive disorder (OCD) affects many people, yet the mechanisms underlying its symptoms are not fully understood. This dissertation examines the underlying motivations that drive OCD symptoms: harm avoidance (HA; the need to prevent harm) and incompleteness (INC; the feeling that things are not "just right"). Through three research studies, we investigated how these motivations are experienced, measured, and changed with treatment. The findings collectively provided support for the value of researching OCD from the perspective of the underlying motivations driving its symptoms. Overall, developing a deeper understanding of HA and INC in OCD can contribute to insights that could lead to future clinical advancements in the assessment and treatment of OCD.

ABSTRACT

Obsessive-compulsive disorder (OCD) affects millions worldwide, yet our understanding of its underlying mechanisms remains to be better understood. Traditionally, OCD has been examined through its overt symptom presentations, but there is growing evidence for a motivational perspective. The Core Dimensions Model posits harm avoidance (HA) and incompleteness (INC) as core motivations driving OCD. This dissertation aims to deepen our understanding of HA and INC in OCD across three studies, examining their phenomenology, measurement, and response to treatment. Chapter 2 utilized experience sampling methodology to capture the daily manifestations of HA and INC in a clinical OCD sample, identifying four distinct motivation profiles. Findings demonstrated that both HA and INC are relatively stable over time, though individual fluctuations suggest state-level variability. HA and INC showed unique relationships with the cognitive and behavioural responses to OCD experiences, providing insight into potential treatment targets. Chapter 3 concurrently evaluated the psychometric properties of two common measures, the Obsessive-Compulsive Core Dimensions Questionnaire (OC-CDQ) and the Not Just Right Experiences Questionnaire-Revised (NJRE-QR), to help inform their use. Results supported their reliability and validity, with the OC-CDQ proving effective for assessing trait-like motivations and the NJRE-QR capturing state-like not-just-right experiences. Both tools demonstrated sensitivity to change following group CBT, underscoring their utility for tracking core motivations across treatment. Chapter 4 investigated changes in HA and INC across group CBT for OCD, assessing their impact on treatment outcomes. While both motivations significantly decreased following treatment, pre-treatment HA and INC levels did not predict symptom severity post-treatment. However, reductions in HA and early decreases in INC were linked to better treatment outcomes, suggesting these motivations'

relevance for predicting therapeutic success. Together, these studies highlight the importance of understanding HA and INC in OCD, offering valuable insights for personalized assessment and intervention approaches that address the disorder's motivational underpinnings.

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LIST OF ABBREVIATIONS AND SYMBOLS

α	Cronbach's alpha
AIC	Akaike Information Criterion
ANCOVA	Analysis of covariance
ANX	Mixed anxiety disorders sample
APA	American Psychiatric Association
β	Beta coefficient
BINCS	Brown Incompleteness Scale
CBT	Cognitive-behavioural therapy
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CI	Confidence Interval
CLMMs	Cumulative link mixed-effects models
d	Cohen's d
DART	Diagnostic Assessment and Research Tool
DASS-21	Depression Anxiety Stress Scale 21
DF	Degrees of freedom
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
EFA	Exploratory factor analysis
EMM	Estimated marginal means
ERP	Exposure and response prevention
ESM	Experience sampling methodology

GAD	Generalized anxiety disorder
GLMM	Generalized linear mixed model
HA	Harm avoidance
INC	Incompleteness
KR-20	Kuder-Richardson Formula #20
LMMs	General linear mixed effects models
LRT	Likelihood ratio test
M	Mean
MBCT	Mindfulness-based cognitive therapy
η_p^2	Partial eta squared
NJRE-QR	Not Just Right Experiences Questionnaire- Revised
NJREs	"Not just right" experiences
OC-CDI	Obsessive-Compulsive Core Dimensions Interview
OC-CDQ	Obsessive-Compulsive Core Dimensions Questionnaire
OC-TCDQ	Obsessive-Compulsive Trait Core Dimensions Questionnaire
OCD	Obsessive-compulsive disorder
OCI	Obsessive Compulsive Inventory
OCI-R	Obsessive Compulsive Inventory Revised Version
OCRDs	Obsessive-Compulsive and Related Disorders
p	p value
r	Pearson correlation coefficient
RCT	Randomized control trial

REDCap	Research Electronic Data Capture
r^{it}	Pearson correlation coefficient, item-total
RMSEA	Root mean square error of approximation
SAD	Social anxiety disorder
SD	Standard deviation
SE	Standard error
SRMR	Standardized root mean square residual
SSRIs	Selective serotonin reuptake inhibitors
t	t-test statistic
TLI	Tucker-Lewis index
VIFs	Variance inflation factors
YBOCS	Yale-Brown Obsessive-Compulsive Scale
YBOCS-SR	Yale-Brown Obsessive-Compulsive Scale- Self Report
ω	McDonald's omega
χ^2	Chi-square statistic
ZI	Zero-inflated model

DECLARATION OF ACADEMIC ACHIEVEMENT

This dissertation contains 5 chapters. Chapter 1 is a general introduction to the dissertation topic and includes relevant background information. Chapters 2-4 are empirical studies where the author of this thesis (C. Puccinelli) is the first author of all 3 manuscripts. These studies were conducted under the supervision of Drs. Karen Rowa and Randi McCabe. Chapter 5 summarizes the conclusions, clinical implications, limitations, and future directions of this research. The contributions of each author in each study are outlined below.

The study presented in Chapter 2 is currently under review in a peer-reviewed scientific journal for publication. The study was conceived and designed by C. Puccinelli, and Drs. K. Rowa, L. Summerfeldt, and R. McCabe. C. Puccinelli served as the lead for data collection and curation, contributed to data analyses, and wrote the majority of the manuscript. Dr. A. Scott facilitated data curation, conducted data analyses, and contributed to writing sections of the methodology and results. All authors contributed to providing key revisions.

The study presented in Chapter 3 was accepted to be published in the *Journal of Obsessive-Compulsive and Related Disorders* and is currently in press. This study was conceived by all the authors (C. Puccinelli and Drs. K. Rowa, L. Summerfeldt, and R. McCabe). C. Puccinelli carried out data analyses and wrote the manuscript. Drs. K. Rowa, L. Summerfeldt, and R. McCabe provided key revisions.

The study presented in Chapter 4 was published in *Behavioural and Cognitive Psychotherapy.* This study was conceived and designed by all the authors (C. Puccinelli and Drs. K. Rowa, L. Summerfeldt, and R. McCabe). C. Puccinelli carried out data analyses and wrote the manuscript. Drs. K. Rowa, L. Summerfeldt, and R. McCabe provided key revisions

CHAPTER 1: GENERAL INTRODUCTION

Obsessive-compulsive disorder (OCD) affects millions worldwide yet much remains to be understood about this disorder. Although OCD's heterogeneity has typically been investigated and understood from a symptom-based lens, there has been significant support and value in investigating OCD from the lens of the underlying processes motivating and maintaining its symptoms. The Core Dimensions Model by Summerfeldt and colleagues (2004, 2014) states that harm avoidance (HA) and incompleteness (INC) are the two core motivational dimensions that drive OCD. This dissertation aims to develop a deeper understanding of these motivations in OCD from phenomenological, measurement, and treatment perspectives. By examining how HA and INC manifest and are experienced in the daily lives of those with OCD, how they are measured, and how they respond to treatment for OCD and impact treatment outcomes, this program of research aims to strengthen our understanding of OCD and its assessment and treatment. This chapter will introduce the theoretical background and supporting empirical literature that the body of work in this dissertation is built on. Additionally, it will highlight where there are gaps in this area of research that we aimed to contribute advancements to through a series of three studies. Finally, the overall aim of the dissertation and the three studies that comprise my program of research are introduced at the end of this chapter.

Obsessive-Compulsive Disorder

OCD is a heterogeneous and chronic mental health disorder that is defined by the presence of obsessions and/or compulsions that are time-consuming, distressing, or interfering. Obsessions are defined as repetitive and persistent intrusive thoughts, images, or urges that are experienced as unwanted, unacceptable or senseless (American Psychiatric Association [APA], 2013).

Individuals will attempt to ignore or suppress obsessions or neutralize them in some way. Compulsions are defined as repetitive behaviours or mental acts that an individual feels driven to perform in response to an obsession or according to rigid rules (APA, 2013). These behaviours and mental acts are completed to prevent or reduce distress or to prevent a feared situation despite not being connected in any realistic way or are clearly excessive.

The estimated lifetime prevalence of OCD is 2-3% (Kessler et al., 2012; Ruscio et al., 2010). OCD's age of onset has a bimodal distribution with one peak in childhood/early adolescence and the other in late adolescence/early adulthood (Taylor, 2011). Although the overall rate of OCD is approximately equal in males and females across the lifespan, early onset is more common in males, while females are more likely to have later onset (Geller, 2006). The onset of symptoms is typically gradual and when untreated, most individuals will experience a chronic course of symptoms, however, the severity of symptoms can wax and wane over time (APA, 2013; Mataix-Cols et al., 2002). Importantly, the World Health Organization (WHO) has classified OCD as one of the leading disabling disorders(WHO, 2008). This is due to the negative impact OCD can have on quality of life, functioning, and the resulting financial burden (Coluccia et al., 2016; Hollander et al., 1997; Macy et al., 2013). Given the impact OCD has not only on the individual but also their loved ones, community, and health systems it is important to develop an understanding of how this disorder presents, including what is driving and maintaining the core symptoms so that it can be better identified in assessment and effectively treated.

Understanding the Heterogeneity of OCD

One of the complexities with OCD is that although it is defined by the fundamental symptoms of obsessions and/or compulsions, OCD is a heterogeneous disorder with various manifestations and presentations. Given the considerable differences that can be observed across

individuals with OCD, there have been significant efforts to understand and categorize the heterogeneity (Lochner & Stein, 2003; McKay et al., 2004). Examining OCD's heterogeneity and its defining characteristics has been important for advancing our understanding of OCD. Through this line of research, we have developed insights into OCD's etiology, neurobiological underpinnings, prognosis, and treatment (Lochner & Stein, 2003; McKay et al., 2004). There have been several different approaches to understanding the heterogeneity observed in OCD including focusing on the course of development/age of onset (e.g., Taylor, 2011), levels of insight (e.g., Eisen et al., 2001; Jacob et al., 2014), neurobiological correlates (e.g., Pauls et al., 2014), comorbidities (e.g., Pallanti et al., 2011), cognitive processes (e.g., Hezel & McNally, 2016), and treatment response (e.g., Keeley et al., 2008).

Symptom-Based Approach

One of the most common and well-studied approaches to understanding OCD's heterogeneity is by examining and classifying overt symptom presentations (i.e., the content of obsessions and compulsions). Many studies have aimed to identify categories of OCD symptoms using approaches such as factor and cluster analyses of OCD symptom inventories, such as the symptom checklist of the Yale-Brown Obsessive-Compulsive Scale (YBOCS; Goodman et al., 1989). Most studies typically identify 3 to 5 symptom dimensions (Mataix-Cols et al., 2005; McKay et al., 2004). Commonly identified symptom categories of OCD include 1) contamination obsessions (e.g., concerns about contracting an illness) and decontamination compulsions (e.g., excessive handwashing), 2) doubting obsessions (e.g., concerns about the stove being left on) and checking compulsions (e.g., checking stove knobs and burners), 3) taboo/repugnant obsessions concerning sex, violence and religion (e.g., intrusive thoughts about harming others) and mental compulsions (e.g., cancelling out "bad" thoughts with "good

thoughts"), and 4) symmetry obsessions (e.g., concerns about objects not being lined up) and ordering/counting compulsions (e.g., repositioning objects until they are straight). However, symptom-based subgroups of OCD are not agreed upon in the literature (see McKay et al 2004 for an overview of the various subgroups identified in OCD studies) and symptoms often blend across the above-stated categories (e.g., an individual who experiences contamination obsessions may also engage in checking behaviours, such as checking for signs of illness, and mental compulsions such as replacing thoughts about illness with "good" thoughts). Therefore, although there is support for the symptom-based approach that has led to advancements in our understanding of the phenomenology of OCD there are also shortcomings (Clark, 2005; McKay et al., 2004). Importantly, categorizing by overt symptom presentation has not reliably advanced our understanding of which symptom subgroups respond poorly to treatment nor has this led to significant treatment improvements (Abramowitz et al., 2011; McKay et al., 2004). This may be because a symptom-based approach does not directly address the underlying cognitive and emotional processes driving symptoms.

Underlying Motivation Approach

Notably, similar OCD symptom presentations may be driven by different underlying motivations. When examining OCD at the level of *what* symptoms are being experienced it does not allow for an understanding of *why* those symptoms are occurring. Clinically, it has been observed that different overt symptom presentations can occur due to similar affective responses and/or motivations. For example, excessive cleaning and checking compulsions may both be performed to reduce anxiety caused by fears of potential harm, such as getting and transmitting a serious infectious illness in the case of cleaning or someone breaking into one's home in the case of checking. Therefore, although observationally these OCD symptoms appear to be distinct

based on their overt presentation, the core underlying driver is quite similar, to avoid or prevent potential future harm. Alternatively, OCD behaviours that overtly appear very similar may have different underlying motivations. For example, some individuals with excessive cleaning compulsions do so to get rid of germs so that they do not get sick, whereas others report cleaning to achieve a particular state of perfection with their belongings so that they feel a sense of completeness. With the common approach of symptom-based categorization, both forms of these behaviours would be categorized as a cleaning compulsion despite having very different underlying functions. Due to these observations, it has been suggested that a perhaps more helpful approach to understanding OCD from is the underlying motivational dimensions that appear to cut across symptom presentations and drive the maladaptive behaviours in OCD (Summerfeldt, 2004).

The Core Dimensions Model of OCD

The Core Dimensions Model of OCD by Summerfeldt and colleagues (2014) states that there are two core motivational dimensions, HA and INC, that in combination may underlie most presentations of OCD. This model represents a shift in understanding OCD from the perspective of *what* symptoms are being experienced to *why* those symptoms are occurring. HA is defined as the motivation to engage in compulsions to prevent a potential feared consequence or decrease the probability of a negative event and is often accompanied by emotions such as fear or anxiety (e.g., "I need to flick the light switch off and on 3 times to prevent my loved ones from getting hurt"). INC is defined as the motivation to engage in compulsions to counteract an internal sense of discomfort (i.e., a "not just right" feeling) and is often accompanied by emotions such as tension and feeling discontent or stuck (e.g., "I need to flick the light switch off and on 3 times or else it will feel incomplete/ not just right"). This model posits that these two motivations

underlying OCD are associated with different clinical features, vulnerabilities, and causal factors (Summerfeldt et al., 2014). Although there is a body of evidence to support this model, much work remains, especially in better understanding the INC motivation. Theory and research have tended to focus more strongly on the HA motivation.

Harm Avoidance

HA is characterized by anxious apprehension and a sensitivity to potential threats which motivates engagement in compulsions to prevent or decrease the probability of feared potential consequences or negative events (Summerfeldt et al., 2014). This motivation is similar to what is seen in anxiety disorders, where there is a cognitive appraisal of threat and subsequent engagement in behaviours (i.e., safety behaviours) or avoidance that ultimately maintains the fear due to preventing disconfirmation of fears (Barlow, 2000). For example, in social anxiety disorder, a fear of social judgment and being negatively evaluated by others can promote engaging in safety behaviours such as mentally rehearsing conversations or avoiding social situations (Wells et al., 1995). Or, in panic disorder where there is a fear that physical symptoms of anxiety are indications that one may be losing control or dying (e.g., from a heart attack), there are often changes in behaviours to try to prevent panic attacks and feared consequences through safety behaviours (e.g., carrying anxiety medication at all times) and avoidance of triggers of panic attacks (Salkovskis et al., 1999). In fact, prior to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; APA, 2013), OCD was classified as an anxiety disorder. This was because anxiety was originally considered to play a central role in OCD's symptoms (Tynes et al., 1990). Obsessions and their subsequent appraisals were thought to primarily cause anxiety while the compulsions were seen as efforts to reduce/neutralize the anxiety (Salkovskis, 1985). This temporary reduction in anxiety that

ultimately maintained obsessional fears and the related compulsions was aligned with mechanisms seen in other anxiety disorders (Barlow, 2000).

However, since the DSM-5, OCD is no longer categorized as an anxiety disorder and has been recategorized into a new category called Obsessive-Compulsive and Related Disorders (OCRDs; APA, 2013). OCD is now grouped with body dysmorphic disorder, hoarding disorder, trichotillomania, and excoriation disorder (APA, 2013). The decision to move OCD out of the anxiety disorders and into the new category of OCRDs was due to growing evidence that showed similarities amongst the OCRDs in their course of illness, comorbidity patterns, familiarity, genetics, and treatment response (particularly medication) which also distinguished them from anxiety disorders (Stein et al., 2010). Additionally, it was increasingly recognized that although fear/anxiety is a common feature in OCRDs, it can present more variably and is not the defining feature in these disorders' phenomenology (Mataix-Cols et al., 2007; Van Ameringen et al., 2014).

Incompleteness

It has long been recognized that there are individuals with OCD who do not describe anticipatory anxiety or wanting to avoid harm (i.e., HA) as a reason for their symptoms. For example, Foa et al. (1999) found that 40% of the OCD participants in their study did not endorse feared consequences as a significant driver of their compulsions. Instead, others report a hard to describe feeling of inner discomfort or dissatisfaction with their current state, like something is incomplete or "not just right" (Coles et al., 2003; Summerfeldt, 2004). It is posited that this subjective experience of incompleteness (INC) can drive compulsive behaviours to "correct" these feelings and alleviate the associated discomfort to reach a sense of completeness. It has been observed that this underlying sense of INC can manifest through any sensory modality

(Summerfeldt, 2004). Therefore, INC is another important motivation that is posited to drive symptoms in OCD, not due to fear or to prevent a feared consequence, but rather due to a need to correct or adjust to feel "just right".

Origins of the Motivational Approach to Understanding OCD

Despite our understanding of the INC motivation still lagging behind the HA motivation, the INC motivation of OCD has been gaining increased research and clinical attention within the last couple of decades due to the recognition of its role in the phenomenology of OCD. However, the first mention of INC as a motivator of compulsions can be traced back to the early 20th century in Janet's (1903) work *Les Obsessions et al Psychasthénie*. He described "*les sentiments d'incomplétude"* (which translates from French to "the feelings of incompleteness") where patients that we would now consider having OCD, "…feel that actions they perform are incompletely achieved or that they do not produce the sought-for satisfaction" (see Pitman, 1987, p.1, for a translated précis of Janet, 1903). He also described that after completing a compulsion the individual can experience a sense of perfection or accomplishment, although perhaps only briefly (Pitman, 1987). Then, it was not until Rasmussen and Eisen (1990, 1992) that greater attention to understanding the motivations underlying OCD symptoms were first incorporated into a categorical model and the term INC resurged. It was stated that three core features drive the urge to engage in compulsions: abnormal risk assessment, pathological doubt, and INC which was defined as "an inner drive to have things perfect, absolutely certain, or completely under control" (Rasmussen & Eisen, 1992). These core features were seen as relevant to various compulsions without a direct correlation between the form of the compulsion and the underlying driver (Rasmussen & Eisen, 1992). The Core Dimensions Model of OCD was generated by Summerfeldt and colleagues (2001, 2004, 2014) to address conceptual and methodological

limitations observed in the Rasmussen and Eisen (1992) model such as its implicit focus on categorical subtypes, rather than continuous dimensions. The subtypes proposed by Rasmussen and Eisen (1992) were based on behavioural, motivational, and emotional features, which are better understood as continuous variables that often blend in individuals (Summerfeldt et al., 2014). Additionally, although pathological doubt is an important feature of OCD, it was suggested that it may be more parsimoniously viewed as an intersection of the other dimensions (Rasmussen & Eisen, 1990; Summerfeldt et al., 2014). Therefore, Summerfeldt and colleagues' revised model, the Core Dimensions Model, proposed that HA and INC are orthogonal core dimensions that are content-independent (Summerfeldt et al., 2014). All combinations of levels of these core dimensions are possible and in OCD they can be thought of as forming a dimensional space where different symptom patterns may emerge (Summerfeldt et al., 2014). For example, in the case study of Summerfeldt (2004) the combination of high INC with typical harm avoidance was associated with symmetry obsessions, mental rituals, and re-reading, repeating, and ordering compulsions.

Constructs Related to Incompleteness (e.g., Not Just Right Experiences)

In the body of literature aiming to understand this phenomenon in OCD, there are several different constructs similar to INC that have been identified and characterized. This includes constructs such as just right perceptions (e.g., Leckman et al., 1994), sensory phenomena (Miguel et al., 2000), and "not just right" experiences (NJREs; Coles et al., 2003, 2005). NJREs refer to the uncomfortable inner experience of dissatisfaction that arises when an individual perceives that something is not aligned (i.e., "not just right") with their expectations of how things should feel, appear or be (Coles et al., 2003, 2005). NJREs can motivate an individual to engage in a compensatory behaviour/compulsion in attempt to achieve a "just right" feeling. While it has been

suggested that the constructs mentioned above may all reflect the same underlying phenomenon, subtle differences likely exist between them which remains to be further explored and defined (Coles & Ravid, 2016; Pallanti et al., 2017). This dissertation will largely focus on further understanding the INC construct as defined by the Core Dimensions Model of OCD by Summerfeldt and colleagues (2004, 2014), however, the construct of NJREs (as it relates to INC) will also be explored. Although this remains an area for future research and clarification, INC can be conceptualized as a trait-like construct (i.e., a psychological characteristic that is stable and persistent across situations) of general tendency to need experiences to feel "just right", whereas NJREs may represent fluctuating state expressions/momentary occurrences of INC (Belloch et al., 2016; Summerfeldt et al., 2014).

Support For and Key Findings from the Core Motivations of OCD

HA and INC as the underlying core motivations of OCD have received both indirect and direct empirical support over the years. This includes case studies (e.g., Rasmussen & Eisen, 1992; Summerfeldt, 2004; Tallis, 1996) where there have been descriptions of individuals with OCD who do not endorse fear of harm but rather a sense of INC or something being "not just right" as central to their OCD experience. Additionally, there has been support from research conducted in nonclinical samples with correlational (e.g., Ghisi et al., 2010; Pietrefesa & Coles, 2008) and behavioural paradigm (e.g., Cougle et al., 2013; Pietrefesa & Coles, 2009; Summers et al., 2014) methodologies, as well as earlier research conducted in clinical participants (e.g., Ecker & Gönner, 2008).

INC/NJREs are prevalent in non-clinical and analogue samples (e.g., Coles et al., 2003; Ghisi et al., 2010; Pietrefesa & Coles, 2008). Which may be analogous to the high prevalence of intrusive thoughts in the general population (Rachman & De Silva, 1978). INC/NJREs are also

highly prevalent in patients with OCD, with estimates of approximately 50-80% of individuals with OCD endorsing these constructs as a significant part of their OCD experience (Ferrão et al., 2012; Summerfeldt, 2007). Furthermore, Belloch et al. (2016) conceptualized INC and NJREs as vulnerability markers for OCD, as their frequency and intensity are significantly positively correlated with obsessional tendencies.

Ecker and Gönner (2008) examined the association between HA and INC and OCD symptom dimensions and demonstrated that these core motivations underlie and cross over overt symptoms in a large clinical sample of individuals with OCD. Although some symptoms such as symmetry and harm-related/taboo obsessional thoughts were uniquely predictive of only one motivational dimension, INC and HA respectively, other symptoms (i.e., checking) were predictive of both motivations, indicating symptoms can be motivationally heterogenous (Ecker & Gönner, 2008). Cervin et al. (2020) found that HA and INC showed differential relationships to OCD symptom dimensions. Specifically, HA was significantly associated with doubting/checking, obsessing, and washing whereas INC was significantly associated with doubting/checking, ordering, and neutralizing (Cervin et al., 2020).

INC and NJREs have continually demonstrated that they are important constructs to OCD. Notably, INC and the severity of NJREs are signficantly associated with greater OCD symptom severity (Ferrão et al., 2012; Sibrava et al., 2016). Additionally, in a nonclinical student sample, NJREs significantly explained obsessive-compulsive symptom variation over time even when general distress and maladaptive cognitive style were controlled for (Sica et al., 2012). Research has also examined the specificity of INC/NJREs to OCD. In early descriptions, INC was posited to be “unique to obsessive-compulsive phenomena” (Summerfeldt, 2004) while HA was known to be a part of anxiety disorders as previously described. Ghisi et al. (2010) found that the severity of

NJREs significantly discriminated those with OCD from those with anxiety disorders and depression even when OCD-related dysfunctional beliefs were controlled for. Ecker et al. (2014) compared the severity of INC and HA in those with OCD, anxiety disorders, depressive disorders, and non-clinical controls to investigate if 1) INC is specific to OCD and 2) if HA is common to both OCD and anxiety disorders. They found that INC levels were significantly higher in those with OCD compared to the other clinical and nonclinical groups. An OCD diagnosis also independently predicted INC severity but anxiety did not. Expectedly, those with OCD and those with anxiety did not significantly differ on HA levels, though both groups scored higher than those with depression and the control group (Ecker et al., 2014). Although INC/NJREs do not appear to be specific to OCD as they can be observed in other non-clinical and clinical populations, the intensity and severity of these experiences are notably elevated in OCD (Cervin et al., 2020; Chik et al., 2010; Coles & Ravid, 2016; Ecker et al., 2014; Ghisi et al., 2010; Sica et al., 2015).

The Phenomenology of Harm Avoidance and Incompleteness in OCD

The Cognitive-Behavioural Model of OCD

The most widely accepted and influential psychological models of OCD are the cognitive-behavioural models, which emphasize the role of fear and anxiety in the development and maintenance of symptoms and therefore may overidentify with a HA motivation (e.g., Rachman, 1997; Salkovskis, 1985, 1989). In these models, intrusive thoughts are characterized as repetitive and exaggerated fears/worries, which are catastrophically misinterpreted, this causes increased distress and therefore drives compulsions as a way to avoid or escape potential feared consequences (Abramowitz et al., 2009). The cognitive-behavioural model of OCD emphasizes the importance of how intrusive thoughts are appraised and the behaviours that individuals believe are required to reduce the associated distress and prevent feared outcomes (Rachman,

1997, 1998; Salkovskis, 1985, 1989). This is based on the well-established finding that intrusive thoughts are experienced by most people in the general population and the content of the intrusive thoughts is similar to those observed in OCD obsessions (Rachman, 1997; Rachman & De Silva, 1978). When people without OCD experience an intrusive thought they regard it as a perhaps unpleasant although meaningless thought, with no harm-related implications (Abramowitz et al., 2009). On the other hand, individuals with OCD are more likely to appraise intrusive thoughts as highly important or threatening (Rachman, 1997, 1998).

The Obsessive Compulsive Cognitions Working Group (1997) identified common themes of misappraisals that important in OCD: inflated responsibility (i.e., individuals believing they are personally responsible for causing or preventing harm/ negative outcomes even if they have little or no control over the situation), overestimation of threat (i.e., assuming that highly unlikely or minor threats are probable and catastrophic), over importance of thoughts (i.e., believing that the presence of a thought indicates that it is important), a need to control one's thoughts (i.e., believing that it is important and possible to have complete control over intrusive thoughts and not being able to is a sign that something is wrong with them), intolerance of uncertainty (i.e., believing that it is necessary to be certain because uncertainty is indicative of negative outcomes that will be challenging to cope with), and perfectionism (i.e., believing that things must be done flawlessly, and that this is possible, or else there will be negative consequences).

Research supports the assertion that these appraisals can escalate intrusive thoughts into obsessions and evoke increased distress in those with OCD (e.g., Julien et al., 2007). Compulsions develop in an attempt to reduce the distress from the obsessions and to prevent perceived negative outcomes (Abramowitz et al., 2009; Salkovskis, 1985). Cognitive-

behavioural models suggest that compulsions persist and become excessive because they are negatively reinforced by the immediate although short-term relief they provide from the distress. This ultimately reinforces both the obsessional fear (because it indirectly indicates the fear was valid and does not allow for disconfirmation of feared outcomes) and the compulsions (because the individual learns the behaviour is a potential way to get short-term relief). The cognitive-behavioural model of OCD can account for the diverse and individualized nature of obsessions and compulsions. However, because historically OCD was conceptualized as an anxiety disorder, the HA motivation has dominated our cognitive-behavioural understanding of OCD and its assessment and treatment. Therefore, the extent to which and how INC/NJREs fit into our existing cognitive-behavioural models remains a matter for future research.

How Do HA and INC Manifest in OCD?

As previously described, investigating OCD from the lens of the core motivations driving its symptoms has led to advancements in our understanding of OCD. However, there is still a lot to be learned about how HA and INC manifest in the OCD population. For example, we have a limited understanding of the relative prevalence of HA and INC in OCD patients and in what ways these motivations blend to produce the heterogeneity observed in OCD. Bragdon and Coles (2017) began to address this by identifying subgroups of individuals based on their underlying motivations in a clinical sample of patients with OCD and found four subgroups corresponding to individuals either high or low on both motivations, and groups with relative elevations on one motivation compared to the other. They also examined patterns of beliefs and obsessive-compulsive symptoms in the motivation subgroups they found. The results indicated that the INC group had low beliefs regarding inflated responsibility and overestimation of threat and high beliefs regarding perfectionism and intolerance of uncertainty, whereas the HA group had

increased beliefs regarding inflated responsibility and overestimation of threat and importance and control of thoughts (Bragdon & Coles, 2017). Regarding these subgroups' relationships to obsessive-compulsive symptoms, within the INC group there were significantly higher ordering symptoms than obsessing symptoms; whereas in the HA group, ordering symptoms were significantly lower than washing, checking, and obsessing symptoms (Bragdon & Coles, 2017). Overall, these results demonstrate support for a motivational model of OCD where various motivation profiles can exist and differences in the motivation profiles appear to be associated with different cognitions and behaviours (Bragdon & Coles, 2017).

Importantly, because the literature on the core motivational dimensions of OCD has largely been comprised of studies with cross-sectional correlational designs (e.g., Belloch et al., 2016; Bragdon & Coles, 2017; Ghisi et al., 2010; Pietrefesa & Coles, 2008) we do not know if and how the core motivations change across context and time, particularly outside of the context of treatment. Recognizing that OCD is complex and symptom experiences can fluctuate across time and context (Naftalovich et al., 2021; Nota et al., 2014), data from cross-sectional designs may limit the extent to which we can understand such dynamic experiences. Therefore, understanding how the core motivations present in the daily lives of those with OCD would provide a richer understanding of HA and INC and how they impact how OCD is experienced.

Assessing Harm Avoidance, Incompleteness, and Not Just Right Experiences

Researching the core motivational dimensions of OCD has been possible due to the development of measures to assess the important constructs of INC/NJREs, with two of the most commonly used self-report questionnaires being The Obsessive-Compulsive Core Dimensions Questionnaire (OC-CDQ; Summerfeldt et al., 2014) and the Not Just Right Experiences Questionnaire- Revised (NJRE-QR; Coles et al., 2003).

Of these two measures, the NJRE-QR was developed first to assess NJREs which according to this measure is defined as "…times when you have the subjective sense that something isn't just as it should be", specifically it measures their occurrence and severity (Coles et al., 2003). The NJRE-QR generates two scores, one is a Checklist score (range 0 to 10) that indicates how many of the 10 listed NJREs (e.g., "I have had the sensation after getting dressed that parts of my clothes didn't feel just right") the respondent has experienced over the past month. The other score is a Severity score (range 0 to 7) generated based on the respondent's average rating of their most recent NJRE on seven features such as its intensity, frequency, and distress. To date, research suggests that the NJRE-QR demonstrates good internal consistency, and good convergent and discriminant validity (Coles et al., 2003, 2005; Coles & Ravid, 2016).

Summerfeldt et al. (2014) developed the OC-CDQ to measure the two underlying core motivational dimensions in OCD, HA and INC. This self-report questionnaire contains 20 items that assess the degree to which HA (e.g., "Even if harm is very unlikely, I feel the need to prevent it at any cost") and INC (e.g., "I must do things in a certain way or I will not feel right") apply to how an individual typically thinks, feels, and acts. There are 10 items for each motivation, and each item is rated on a scale from 0 (never applies to me) to 4 (always applies to me), which generates HA and INC scale scores ranging from 0 to 40. When developing the OC-CDQ the authors ensured that the items did not reference any specific symptom content or behavioural indicators so that items could assess the constructs as intended, "…as motivational and affective precursors of symptoms" (Summerfeldt et al., 2014, p. 88). To date, research suggests that the OC-CDQ demonstrates high internal consistency, and good convergent validity with measures of obsessive-compulsive symptoms (Coles et al., 2005; Summerfeldt et al., 2014).

Additionally, confirmatory factor analyses (CFAs) have supported a two-factor structure for this measure (Pietrefesa & Coles, 2008; Summerfeldt et al., 2014).

Given the importance of the NJRE-QR and OC-CDQ to this area of research due to their function of measuring NJREs and HA and INC, respectively, further evaluation of the psychometric properties of these measures is warranted. Additional psychometric evaluation of these questionnaires can help ensure that they are a reliable and valid method to measure these constructs across different populations and settings. Importantly, although these questionnaires are conceptually and theoretically related, they have never been evaluated in the same clinical sample. This to date has limited our ability to make more direct comparisons that may help to inform researchers and clinicians about how these constructs have been operationalized and measured which can help guide decisions for how these measures are used in research, assessment, and treatment. Therefore, simultaneously examining the psychometric properties of the NJRE-QR and OC-CDQ in a large clinical OCD population can provide clearer insights into their use in research and practice.

Treatment for OCD and its Relationship to Harm Avoidance and Incompleteness

Treating OCD

As mentioned, OCD tends to be a chronic disorder particularly when untreated, with a waxing and waning course over an individual's life (APA, 2013). However, there are effective pharmacological (e.g., selective serotonin reuptake inhibitors [SSRIs] as such escitalopram, fluoxetine, sertraline and fluvoxamine) and psychological treatments that can be used to help manage its symptoms (Katzman et al., 2014). Cognitive-behavioural therapy (CBT) with exposure and response prevention (ERP) is the recommended first-line psychological intervention for OCD (National Institute for Health and Clinical Excellence, 2005). Studies have

found that CBT with ERP has equivalent or superior outcomes to pharmacotherapy for OCD (e.g., Belotto-Silva et al., 2012; Foa et al., 2005; Sousa et al., 2006). ERP involves a systematic exposure to triggers of obsessions (in vivo or imaginal) while refraining from engaging in compulsions or other safety behaviours such as avoidance. This process is effective for reducing symptoms of OCD because it directly addresses the negative reinforcement of compulsions (i.e., the temporary reduction in distress that ultimately maintains the disorder). Over time through repeated exposure this leads to habituation of fear/anxiety reactions, breaks the cycle of compulsions/avoidance, and can facilitate cognitive restructuring of dysfunctional cognitive beliefs and generate new learning when individuals experience that distress will diminish without rituals and that feared consequences are unlikely to come true (Foa & McLean, 2016).

Meta-analyses have demonstrated that CBT with ERP has large effect sizes compared to control conditions (Olatunji et al., 2013; Reid et al., 2021). Several studies have demonstrated its efficacy (e.g., McKay et al., 2015) and effectiveness (e.g., Ferrando & Selai, 2021). Although a majority of people who complete a course of treatment for OCD experience some symptom improvement, recovery and remission rates for adults who have completed CBT with ERP vary with estimates of about 40-60% of patients achieving significant symptom reduction, while approximately 25-50% achieve symptom remission (e.g., Farris et al., 2013; Foa et al., 2005; Simpson et al., 2006). Therefore, a significant proportion of patients who complete treatment are not experiencing adequate levels of symptom improvement. Due to OCD's prevalence, chronicity, and impact of the disorder on the individual and society improving our understanding of which patients are not being adequately treated and the factors that may moderate treatment outcomes is critical.

The Core Motivational Dimensions Relationship to OCD Treatment

As described above, HA had dominated our understanding of cognitive-behavioural models of OCD and its related treatment before INC was widely acknowledged as an important motivation underlying OCD. Therefore, there has been significant interest in investigating if INC is adequately addressed with our current CBT interventions. Early research indirectly suggested that INC may be more challenging to treat and less responsive to CBT than HA (e.g., Foa et al., 1999; Tallis, 1996). For example, a frequently cited study by Foa et al. (1999) found that those with OCD who did not report a feared consequence (and therefore indirectly suggesting that INC was underlying their symptoms), only experienced a 45% reduction in symptoms after ERP as compared to a 69% reduction in those with feared consequences. Additionally, it has been suggested that treatment may need to be specifically tailored to INC as traditional CBT for OCD emphasizes exposures to disconfirm feared outcomes and correct dysfunctional cognitive beliefs (e.g., inflated responsibility, overestimated threat, over importance of thoughts) which may be less relevant to INC (Summerfeldt, 2004). Summerfeldt (2004) highlighted that because INC appears to be primarily characterized by sensory-affective dysfunction, cognitive techniques may be less relevant, and it is unclear the extent to which the distress evoked by INC (i.e., often described as discomfort or tension) habituates during exposures like anxiety would with HA (Foa & Kozak, 1986).

Only more recently has there been an investigation into how INC and NJREs respond to existing CBT for OCD treatments in clinical samples. The findings of this research to date have a more hopeful outlook for INC OCD. For example, Coles and Ravid (2016) found that individuals with OCD who completed individual CBT for OCD (n = 19) experienced significant reductions in both core motivations, reported significantly fewer NJREs and experienced less distress from NJREs. Additionally, a meta-analysis by Schwartz (2018) revealed that INC improved

significantly but modestly over treatment and posited that tailoring treatments to INC is important. However, in this meta-analysis, there were only three studies (i.e., Coles & Ravid, 2016; Fitch, 2016; Gönner et al., 2016) that measured how both HA and INC changed over treatment and the studies had modest sample sizes. Additionally, examining how the core motivations change in group CBT for OCD treatment remains to be investigated. Therefore, further investigation of how the core motivations underlying OCD change across treatment (and specifically with group CBT for OCD) in large clinical OCD samples is warranted.

INC is an important motivational factor for many with OCD, and high/problematic levels of INC have been associated with more severe OCD symptoms, increased comorbidity, decreased functioning and quality of life, and higher rates of unemployment and disability compared to individuals with OCD with little/no INC (Belloch et al., 2016; Sibrava et al., 2016). Given this, further research examining if and how INC affects treatment outcomes is needed to help determine whether additional considerations should be made when trying to provide treatment to those with INC as part of their OCD presentation. Cervin and Perrin (2021) investigated this in children and found that higher baseline levels of INC, but not HA, predicted poorer treatment outcomes (Cervin & Perrin, 2021). However, it was only within the last year that Lundström et al. (2024) demonstrated that adults' INC scores at baseline predicted more modest treatment effects for internet-delivered CBT on OCD symptom severity with clinician-administered measures but this relationship was not found for self-rated measures. Investigating if changes in the underlying core motivations of OCD are associated with treatment outcomes would begin to answer whether the underlying motivations maintain OCD are significant mediators of CBT for OCD outcomes, which has yet to be investigated in an adult sample. Overall, research in this area is in its infancy and warrants further investigation and replication.

Overview of Dissertation

The overall aim of this dissertation research program was to expand our understanding of the two core motivations in OCD, HA and INC, to develop new insights about OCD that could contribute to our understanding of the motivational mechanisms underlying this disorder and help inform its assessment and treatment. As introduced above, further investigation of the core motivations is warranted particularly in clinical OCD samples to determine how HA and INC present and impact how OCD is experienced cognitively and behaviourally, how we currently commonly measure these motivations, and if they are significantly reduced in treatment and their relationship to treatment outcomes for OCD. Therefore, three studies were designed to investigate HA and INC in large clinical OCD samples from phenomenological, measurement, and treatment perspectives to address current gaps in the literature. Conducting the studies in clinical samples allowed us to increase the applicability of the findings to clinical advancements in the assessment and treatment of OCD.

Chapter 2 (Study 1: "Phenomenology of incompleteness and harm avoidance in obsessive-compulsive disorder: An experience sampling study") expanded our understanding of the phenomenology of HA and INC using data gathered from the daily lives of a clinical OCD sample using experience sampling methodology (ESM). This study aimed to provide a nuanced understanding of how the core motivations present in an OCD sample, including descriptive data on the core motivations such as whether clusters of underlying motivations can be identified and if the core motivations change across time and context. Further, given that a cognitive-behavioural model of understanding OCD is at the forefront of our psychological conceptualization of this disorder, we aimed to investigate how HA and INC relate to how OCD is experienced (i.e., trigger, interpretation, and OCD behaviours).

Chapter 3 (Study 2: "Measuring incompleteness and not just right experiences: A psychometric evaluation of two commonly used questionnaires in OCD and anxiety disorders samples) aimed to examine the psychometric properties of two of the most widely used self-report questionnaires, the OC-CDQ (Summerfeldt et al., 2014) and NJRE-QR (Coles et al., 2003) that measure the constructs of INC (and HA) and NJREs. In large clinical samples of individuals with OCD and anxiety disorders, we aimed to examine and compare the questionaries' psychometric properties including the factor structure, reliability (internal consistency and test-retest reliability), validity (convergent and discriminant, construct) and treatment sensitivity. Investigating their psychometrics simultaneously in the same clinical samples allowed for a closer comparison of these important measures which can help inform their use in research and clinical practice.

Chapter 4 (Study 3: "Changes in harm avoidance and incompleteness across group CBT for OCD and their relationship with symptom change") aimed to examine if the core motivations of OCD are being adequately addressed in our current psychological treatment for OCD by investigating if HA and INC significantly decreased across group CBT for OCD. Additionally, we aimed to explore the relationships between OCD symptom severity treatment outcomes and pre-treatment levels of HA and INC as well as changes in HA and INC throughout treatment. This study allowed us to have a better understanding of if and how the core motivational dimensions of OCD moderate treatment outcomes and provided insights into considerations and potential opportunities regarding tailoring treatment for OCD.

Finally, in Chapter 5 (General Discussion) an overview of the significance and strengths of the three studies is presented by highlighting their contributions to the literature and clinical

implications. Additionally, the limitations of the research as well as areas for future research are discussed.

CHAPTER 2

STUDY 1: PHENOMENOLOGY OF INCOMPLETENESS AND HARM AVOIDANCE IN OBSESSIVE-COMPULSIVE DISORDER: AN EXPERIENCE SAMPLING STUDY

Puccinelli, C., Rowa, K., Scott, A. M, Summerfeldt, L. J., & McCabe, R. E. Phenomenology of incompleteness and harm avoidance in obsessive-compulsive disorder: An experience sampling study. [*Manuscript submitted for publication; Under review*].

Previous research has demonstrated that HA and INC are the core motivations of OCD that underlie and cut across overt symptom presentations. Although research has more recently begun to explore the relationships between the core motivations and how OCD is experienced this has yet to be examined in the naturalistic environments of individuals with OCD. This chapter used data gathered from the daily lives of those with OCD to investigate how the core motivations present, if they change across time, and how they differentially relate to how OCD is experienced such as what triggers the experience, how it is interpreted, and what behaviours are used to help manage the distress, with the goal of better understanding the phenomenology of HA and INC in OCD.

Phenomenology of incompleteness and harm avoidance in obsessive-compulsive disorder: An experience sampling study

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Abstract

This study used experience sampling methodology to explore the phenomenology of the core motivations in obsessive-compulsive disorder (OCD), harm avoidance (HA) and incompleteness (INC), and their influence on the experience of OCD. Fifty participants with a primary OCD diagnosis completed four questionnaires daily for five days about a recent obsessive-compulsive experience and its underlying motivations. A cluster analysis revealed four motivation profiles: high HA/INC, moderate HA/INC, high HA/low INC, and high INC/ low HA, with most individuals endorsing a blend of both motivations. At the sample level, HA and INC were stable trait-like constructs across time. However, there was notable individual variability in the motivations, suggesting potential state-level fluctuations. Both motivations were associated with the interpretation of long-lasting distress related to a particular obsessive-compulsive experience, HA predicted increased beliefs of future harm, and INC was associated with reduced beliefs that the experience meant something negative about themselves. Behaviourally, HA was associated with avoidance, reassurance seeking, and thought suppression, whereas INC was associated with compulsions and reduced likelihood of doing nothing. HA and INC both contribute to how OCD is experienced, although they appear to do so through distinct cognitive and behavioural pathways, offering potential targets for tailored interventions.

Keywords: Obsessive-compulsive disorder, harm avoidance, incompleteness, not just right experiences, experience sampling, ecological momentary assessment, cognitive-behavioural

Introduction

Obsessive-compulsive disorder (OCD) is a heterogeneous disorder with an estimated lifetime prevalence of 2.3% (Kessler et al., 2012). Given its chronic and disabling course which can significantly impact quality of life, there has been considerable effort to better understand the heterogeneity of OCD to make improvements in assessment and treatment (Macy et al., 2013). There have been various approaches to help understand and categorize the OCD experience such as overt symptom presentation, dysfunctional cognitive beliefs, neuropsychological deficits, and neuropsychiatric correlates (McKay et al., 2004).

Although each of these approaches has led to advances in our understanding of OCD, an alternative approach to understanding the heterogeneity in OCD is the core dimensions model of OCD (Summerfeldt, 2004). This model posits there are two core motivational dimensions that are underlying mechanisms driving the OCD experience: harm avoidance (HA) and incompleteness (INC). HA is the motivation to engage in compulsions due to anxious apprehension and an attempt to avoid potential harm. INC is the motivation to engage in compulsions to counteract internal perceptions and feelings of discomfort that something is "not just right" or imperfect. These core motivations cut across overt symptom presentations and it is believed that in combination, to varying degrees, underlie most expressions of OCD (Summerfeldt, 2004). The construct validity of these underlying core motivations in OCD has received empirical support in both analogue and clinical samples (e.g., Bragdon & Coles, 2017; Ecker & Gönner, 2008; Pietrefesa & Coles, 2008; Sibrava et al., 2016; Summerfeldt et al., 2014; Taylor et al., 2014). However, there is still much to be learned about the phenomenology of these core motivations such as their relative prevalence in the OCD population and their impact on how OCD is experienced.

The cognitive-behavioural model of OCD conceptualizes how OCD is developed and maintained through the interactions between thoughts, emotions, and behaviours (Salkovskis, 1985; Taylor et al., 2007). An OCD experience typically begins with a trigger, which can be external (e.g., something someone saw, heard, touched, etc.) or internal (e.g., a psychological or mental event; a sensory event, etc.). These triggers lead to an obsession which is defined as an intrusive thought, image, or impulse that repeatedly enters the individual's mind and feels out of their control (American Psychiatric Association [APA], 2013). The intrusive thought is often misinterpreted in some way that makes it personally significant, revealing, threatening, or catastrophic (Taylor et al., 2007). This appraisal causes an increase in distress (e.g., anxiety, discomfort, tension, etc.). In an attempt to reduce the distress that arises from obsessions, individuals with OCD often engage in repetitive or rule-based behaviours (APA, 2013). This can include various physical or mental acts such as compulsions, avoidance, thought suppression, and seeking reassurance. However, these behaviours ultimately only provide temporary relief and can reinforce the OCD cycle.

Historically much of the theory, research, and understanding of OCD has been through the lens of a HA conceptualization. Early cognitive-behavioural models of OCD emphasized the role of anxiety in OCD with compulsions being a way to reduce anxiety or prevent feared outcomes (e.g., Rachman, 1997; Salkovskis, 1985, 1989). This is perhaps because of the more easily observable nature of some HA behaviours and their clear link to fears of harm (e.g., excessive handwashing due to fears of contamination, excessive checking due to fears of leaving the stove on). The early focus on HA is also evidenced by the fact that OCD was originally classified as an anxiety disorder and was only recently moved to a new section called obsessive-compulsive and related disorders in the fifth edition of the Diagnostic and Statistical Manual of

Mental Disorders (DSM-5; APA, 2013). There were several factors involved in this recategorization, including a recognition that although anxiety is a common feature in OCD it is not a defining characteristic (Hollander et al., 2008). Compulsions can be performed to alleviate forms of distress other than anxiety such as tension brought on by a sense of INC. Given that the HA conceptualization has predominated our cognitive-behavioural understanding of OCD and related treatment approaches, how and how well the cognitive-behavioural model fits with INC is a matter for research. Further, understanding the relationships between HA and INC and key components of the cognitive-behavioural model may provide insights into other treatment foci.

To date, the literature investigating the core motivations of OCD consists primarily of studies with cross-sectional, correlational designs (e.g., Belloch et al., 2016; Ghisi et al., 2010; Pietrefesa & Coles, 2008). Given that people's OCD experiences can fluctuate across time and context, data from cross-sectional designs are limited in describing such dynamic experiences. Experience sampling methodology (ESM) is a research design that involves collecting multiple, real-time assessments of participants' experiences in a single day and across several days (Csikszentmihalyi & Larson, 1987), offering data with greater accuracy and reliability and less recall bias. This methodology can provide a more nuanced understanding of the core motivations underlying OCD and their relationship to the OCD experience.

The purpose of this study was to use ESM to explore the phenomenology of the core motivations (HA and INC) of OCD and understand their relationship with other aspects of the OCD experience in a clinical sample. We aimed to: 1) conduct a descriptive analysis of the core motivations including determining if there are distinct clusters that can be identified, 2) explore if the core motivations change over time, across and within individuals, and 3) understand the relationship between the core motivations of OCD and other aspects of the OCD experience (i.e.,

the trigger of the OCD experience, interpretations, and OCD behaviours). This study was exploratory and, therefore, no hypotheses were generated a priori.

Methods

Participants

Participants were 50 adults recruited from a Canadian specialty anxiety and related disorders clinic located in a large academic health sciences centre. Prior to entering the study, participants had received a diagnostic assessment as part of regular clinic procedures from a mental health professional (i.e., psychologist, psychiatrist, etc.) or doctoral-level clinical psychology student under supervision. Assessments were conducted using the Diagnostic Assessment and Research Tool (DART; McCabe et al., 2017; Schneider et al., 2022) or a psychiatric assessment. Individuals who had a diagnosis of OCD and consented to be contacted for research were identified for recruitment.

Inclusion criteria were 1) a principal diagnosis of OCD, 2) an adult (i.e., age 18+), 3) not currently receiving psychological treatment for OCD or if currently enrolled in group CBT for OCD, study completion needed to occur before the fourth session (i.e., when active ERP begins) of our 12-session protocol, 4) access to a smartphone with a data plan to complete daily experience sampling questionnaires. See Table 1 for a summary of the study sample demographics.

Procedure

Before enrolling in the study, interested participants were screened for the inclusion criteria over the telephone by a research assistant. If eligible and interested, participants were then scheduled for a virtual baseline appointment. During this appointment, participants

completed informed consent procedures, a demographics questionnaire, and were prepared for the experience sampling portion of the study. Given that participants may have had varying levels of understanding of OCD, participants watched a brief informational video about OCD created for this study so that they could have common terminology about obsessions, compulsions, other OCD behaviours (i.e., avoidance, thought suppression, reassurance seeking), learn about the CBT for OCD model, and learn about the core motivations HA and INC. The research assistant then explained the experience sampling procedure. The experience sampling period began the day after the baseline appointment and continued for five consecutive days. During this period, participants were prompted to answer a brief questionnaire four times per day regarding a recent, distressing obsessive-compulsive episode. Therefore, a total of 20 prompts were sent to each participant. The prompts were sent at random intervals (i.e., signal-contingent data collection) during a 12-hour interval of the participant's choosing. The minimum distance between each signal was set to 60 minutes. The link to the questionnaire hosted on Research Electronic Data Capture (REDCap; Harris et al., 2009) was sent to participants' smartphones via text message using SurveySignal (Hofmann & Patel, 2015), a web-based application that automated the sending of the questionnaires.

Participants were asked to keep their phones near them during the study period, with the volume on to minimize missing prompts. They were instructed to answer the questionnaire as soon as possible when it was received. Participants were told that we were interested in capturing their experiences as they occurred in normal daily life and that there were no right or wrong answers.

At the end of the baseline appointment participants received a practice prompt to help address any technical difficulties and review the questions asked. Participants were encouraged

to contact the research assistant throughout the study period if they had any questions or technological difficulties. After the experience sampling period was complete, participants were debriefed and received a $20 gift card for participation. The collection and use of this data were approved by the institution's local research ethics board, and all participants provided informed consent.

Measures

Demographics

Participants were asked for their age, gender, relationship status, education level, and ethnicity.

Experience Sampling Questionnaire

Participants were asked various questions about their most recent, distressing obsessive-compulsive episode. The questions were developed by the authors to address the research objectives and were based on the cognitive-behavioural model of OCD. Participants were asked about what triggered the obsession, how much their OCD experience was related to the INC and HA motivations using wording and scoring adapted from the Obsessive-Compulsive Core Dimensions Interview (OC-CDI; Summerfeldt et al., 2014), the interpretation of their obsessions, and the OCD behaviours (i.e., compulsions, avoidance, thought suppression, seeking reassurance) they engaged in. The survey was designed with branching logic; if they had not experienced an obsessive-compulsive episode since the last text prompt, they were not asked any additional questions. See Supplementary Material Table S1 for a list of the questions and response options participants were asked to complete throughout the experience sampling period.

Statistical Methods

All analyses were conducted in R (v4.3.0; R Core Team, 2021). Of a maximum of 1000 observations (50 individuals with 20 prompts each), 792 (79.2%) were answered (by individual: minimum = 40%, maximum =100%, *SD* = 16.2%). Of these, we filtered the data to look only at cases where individuals responded to a prompt confirming that an OCD episode was present (545 prompts with an episode present, 247 prompts without an episode). By individual, on average 54.5% of prompts given were responded to with an episode present (minimum = 15%, maximum = 95%, *SD* = 22.9%). Our main method of analysis, linear mixed effects modelling, is robust to missing data and unequal sample sizes among groups (Pinheiro, 2014).

Descriptive Analysis of the Core Motivations Underlying OCD

To identify patterns among individuals in their relative combinations of HA and INC, we used a k-means clustering analysis. First, to identify the ideal number of clusters, we inspected the scree and silhouette plots produced from the k-means cluster analysis with 1 to 10 clusters (Figure S2), which both supported 4 clusters. We used the base R k-means function which used the Hartigan and Wong (1979) algorithm with 4 centers, up to 50 iterations per run, and with 25 replicates (25 random sets chosen to be initial centers, with the best centers returned in the final output). We calculated descriptive statistics on the resulting 4 clusters, and used the within-cluster sums of squares and total between-cluster sums of squares to calculate the variation in HA and INC explained by the clustering.

Do the Core Motivations Change Over Time?

To analyze how the core motivations of OCD change over time we used mixed effects (hierarchical) modelling as this statistical method can handle data collected repeatedly from the same individuals. This method allowed us to investigate how HA and INC changed over time across the whole sample and how this varied among individuals. The time of the prompt

(measured as hours since the initial prompt, with prompt 1= 0), and the time of the day the prompt was received (modelled as a categorical variable with three levels: morning, afternoon, evening[1]) were included in the model as fixed effects. Individuals were modelled with a random intercept (i.e., to account for differences between individuals' levels of HA and INC at the start of the experience sampling period) and a random slope (i.e., to account for differences in how each person's HA and INC scores change over time). We first constructed these models with demographic covariates (age, gender, relationship status, and educational attainment) to test for their significance (Table S2), and subsequently dropped non-significant demographic covariates from the models used for the main results tables.

We initially analyzed the data using general linear mixed effects models (LMMs). However, because the HA and INC data had a bimodal distribution (Figure S1) with many scores clustered at 0 and 100 (i.e., the boundaries of the continuous sliding scale used to measure HA and INC), there were violations of several model assumptions including the normality of residuals, homoscedasticity, and normality of random effects (see diagnostic plots in Figure S2).

Therefore, to better handle this unique data we transformed the HA and INC data to a 0-1 scale and used a more advanced statistical model called a zero-inflated (ZI) generalized linear mixed model (GLMM) with a beta distribution using the glmmTMB package/function (Brooks et al., 2017), which models the data in two steps. First, it looks at the likelihood of a score being zero (i.e., indicates HA/INC was not endorsed) or nonzero (i.e., indicates some level of HA/INC was endorsed), which is the ZI model. It then models the nonzero data according to a beta distribution (to account for the skew in those data; Ferrari & Cribari-Neto, 2004) to analyze how

[1] morning (03:00:00 to 11:59:59, n = 93), afternoon (12:00:00 to 17:59:59, n = 266), and evening (18:00:00 to 02:59:59, n = 186)

strongly HA/INC was endorsed, which is the conditional model. The diagnostics for the GLMM improved (particularly in the assumption of homoscedasticity and normality of random effects) as compared to the LMM, although the Q–Q plot of the residuals still showed deviation from normality, though less severe than the LMM (Figure S3). We also did not detect any significant outliers in the residuals of the GLMM.

Given the residuals from the GLMM showed deviation from normality, we employed an additional conservative model specification by modelling the data as an ordinal logistic regression by categorizing the HA and INC scores into quantile-based groups and used cumulative link mixed-effects models (CLMMs). These models fulfilled the proportional odds assumption for ordinal logistic regressions (Table S3). However, this model loses important information present in the HA and INC data due to the arbitrary quantile binning process.

We tested for autocorrelation in the residuals of the HA and INC scores and no significant autocorrelation was observed for either HA or INC (Figure S4). Additionally, no multicollinearity was detected in any models (all VIFs <2). The significance of model terms was assessed using likelihood ratio tests (LRTs) by comparing nested models using the base R anova and drop1 functions. The results for the 3 types of models (LMM, GLMM, CLMM) aligned, supporting the reliability of our findings. Therefore, we chose to present the GLMM in the main results (see Table 4 in the Results section) as it best balanced using all available data while accounting for the specific distribution characteristics. The results of the other models (LMM and CLMM) are presented in the supplementary material (Table S4).

What Effects do the Underlying Motivations (HA, INC) Have on Other Aspects of the OCD Experience?

To analyze the effects of HA and INC on several measures of OCD experience, we constructed GLMMs similar to the models constructed for the analysis of HA and INC variation over time, with the same set of fixed and random effects. The significance of model terms was tested using LRTs, and model assumptions and the presence of autocorrelation were assessed by inspecting residuals as before. No major deviations from model assumptions or evidence of multicollinearity, significant outliers, or autocorrelation were observed for these models.

As with the HA and INC temporal analysis, models including demographics covariates were constructed first and assessed (see Table S5 – S7), with significant covariates remaining in the main models.

For the trigger, only 20 of 545 observations involving an OCD episode were classified as having "no trigger", so the analysis was constrained to just external vs. internal triggers (n = 258, n = 267 respectively). Trigger (external/internal), the 4 interpretations (endorsed/not) and 5 OCD behaviours (present/absent), were all modelled with logistic GLMMs with a binomial distribution and logit link function using glmmTMB.

Results

Descriptive Analysis of the Motivations Underlying OCD

Individual HA and INC scores (means across up to 20 prompts) were not significantly correlated (Table 2). The highest supported 4-center solution for the k-means clustering analysis (see Figure S5 for scree and silhouette plots) produced 4 clusters generally corresponding to "high HA, high INC", "high HA, low INC", "low HA, high INC", and "moderate HA, moderate INC" which accounted for 74.1% of the variation present in the measures (Table 3 & Figure 1). This analysis highlighted the presence of a majority of individuals (32/50, 64%, clusters 1 and 4) with a substantial and relatively even endorsement of HA and INC motivations. In addition,

individuals with low endorsement for one of the motivations tended to have substantial endorsement in the other (clusters 2 and 3), and there were no individuals with minimal endorsement of both motivations (i.e., no cluster corresponds to low HA, low INC).

Do the Motivations Underlying OCD Change Across Time?

Figures of individuals' change in HA and INC over time (prompts) are shown in Figure. S6.

In general, there was no significant overall (across all individuals) change in the likelihood of HA or INC to be not endorsed/endorsed over time, nor a change in score magnitude over time (see fixed effects in Table 4). There was also no significant effect of the time of day (morning/afternoon/evening) a prompt was received on HA or INC scores.

There was evidence of significant variation among individuals in their probability of not endorsing/endorsing HA and INC and the degree to which the core motivations were endorsed at the beginning of the study (prompt = 0, see random intercept in Table 4). Additionally, there was evidence of significant variation among individuals in their change in the degree to which HA and INC were endorsed over time, and in the change of the probability of HA to be not endorsed/endorsed over time (see random slope of time, Table 4).

Participant age had a significant effect on the probability of HA being not endorsed/endorsed: older individuals tended to be more likely to endorse HA. There was no effect of any demographic category on the degree to which the core motivations were endorsed (Table S2, Zero-inflated Beta GLMM). Participant gender, age, relationship status, and educational attainment all had a significant effect on the probability of INC scores being not endorsed/endorsed: females, older individuals, single individuals, and individuals with lower educational attainment were more likely to endorse INC. Gender and education also affected the

degree to which INC was endorsed: Females and non-binary individuals (compared to males) and individuals with lower educational attainment were more likely to score higher on the INC scale.

What Effects do the Underlying Motivations (HA, INC) Have on Other Aspects of the OCD Experience?

Trigger (Table 5)

Neither HA nor INC had a significant effect on the probability of an OCD trigger being described as external or internal. None of the demographic covariates had a significant effect on this probability (Table S5).

Interpretations (Table 6)

Higher HA scores were significantly associated with a higher probability of interpreting an OCD episode as "This means something bad can/has/will happen", and a lower probability of interpreting it as "This means that I will have an intolerable/uncomfortable feeling", with this latter interpretation also more likely to be endorsed in later prompts. Higher INC scores were associated with a lower probability of interpreting an OCD episode as "This means something awful about me as a person", which was also less likely to be endorsed later in the day (afternoon/evening) compared to the morning. Both higher HA and INC scores were significantly associated with a higher probability of endorsing the interpretation "this means that I will have an intolerable/uncomfortable feeling that will be long lasting", though there was a significant negative interaction between HA and INC, indicating the effects of each were reduced at higher values of the other predictor. None of the demographic covariates had a significant effect on the probability of endorsing any of these interpretations (Table S6).

Behaviours (Table 7)

For the five OCD behaviours assessed, higher INC scores were significantly associated with a higher probability of engaging in compulsions, and a lower probability of not engaging in any OCD behaviour. Higher HA scores were significantly associated with a higher probability of engaging in avoidance, thought suppression, and seeking reassurance. Other predictors (prompt, time of day) and demographic covariates (see Table S7) had no significant effect on the probability of engaging in any of the OCD behaviours.

Discussion

This study aimed to explore the phenomenology of the core motivations in OCD, HA and INC, and their relationship to other aspects of the OCD experience in a clinical sample of individuals with OCD using ESM.

Understanding How HA and INC Present in OCD

Individual HA and INC scores were not significantly correlated, which is consistent with early descriptions of these constructs as orthogonal (Summerfeldt, 2004). However, studies that have used the Obsessive-Compulsive Core Dimensions Questionnaire (OC-CDQ; Summerfeldt et al., 2014), one of the most used questionnaires to measure HA and INC, have generally found that the core motivations are significantly correlated although the strength of the correlation has varied (e.g., Pietrefesa & Coles, 2008; Summerfeldt et al., 2014; Taylor et al., 2014). Despite HA and INC scores being correlated in these previous studies, factor analytic studies have supported a 2-factor structure (Pietrefesa & Coles, 2008; Summerfeldt et al., 2014). The factors have been significantly positively correlated when using the OC-CDQ, but were significantly negatively correlated when using the clinician-administered Obsessive-Compulsive Core Dimensions Interview (OC-CDI; Summerfeldt et al., 2014). Therefore, the difference in the core motivations

being correlated (positively or negatively) or not may have to do with differences in how they are measured. To measure HA and INC in this current study, we created a single item for each core motivation that was developed from the wording of the OC-CDI (Summerfeldt et al., 2014) that was rated on a sliding scale from 0 - 100, whereas the OC-CDQ creates HA and INC scores by summing the ratings across 10 items each. Additionally, the more frequent sampling in our study may reveal fluctuations in the core motivations that are not captured when measured at a single time point using the OC-CDQ in a lab or clinical setting.

Cluster analysis provided further support for multiple iterations of the core motivations model of OCD. The clusters corresponded with groups who were high on both motivations, high on one motivation and low on the other, and moderate on both motivations. This is similar to previous work that found a 4-cluster solution when using the OC-CDQ to determine subgroups (Bragdon & Coles, 2017). Notably, we did not identify a group with low endorsement of both motivations. This indicates that individuals with OCD in our sample identified with at least one of the two core motivations that are posited to underlie the OCD experience. A majority of the sample indicated relatively even endorsement of both motivations (i.e., high or moderate on both HA and INC). This finding supports that both motivations are important in understanding the heterogeneity of OCD. Recognizing that many individuals with OCD experience both motivations may help clinicians in their conceptualization of the client's OCD which could help assist in assessment and treatment. Importantly though, there were also groups that highly endorsed one motivation and not the other. The percentage of people who were high on HA and low on INC as compared to those who were low on HA and high on INC were equivalent in our sample. Therefore, despite the fact that the HA conceptualization previously dominated our understanding of the OCD experience, this finding further demonstrates that it is equally

important to understand the role of INC as some individuals with OCD experience INC as the main and primary motivation underlying their symptoms. An individual case conceptualization that incorporates which motivation(s) are contributing to an individual's OCD experience is essential in personalizing intervention for OCD.

Relationship Between the Core Motivations and Time

When examined across individuals, HA and INC did not significantly change over time and appeared to be stable trait-like constructs whose expression may be differentially influenced by situational factors. For example, time of day did not significantly impact HA scores, but INC scores tended to be lower in the evening as compared to the morning. This may suggest that the INC motivation is more sensitive to certain factors such as fluctuations in mood or energy levels over the day. Additionally, within individuals, there was significant variability and change in the degree to which they endorsed the HA and INC motivations over time. This is perhaps another indicator of the heterogeneity in the OCD experience. In general, there was significant variation in how individuals rated their core motivations across their various OCD experiences which may be suggestive of state-level fluctuations in core motivations depending on the context of the OCD experience.

Relationship Between the Core Motivations and Demographics

We also explored the relationships between demographic variables and the core motivations. For HA, the only significant finding that emerged was that older individuals were more likely to endorse HA than not, however, age did not significantly impact the degree to which HA was endorsed. For INC, being female, older, single, and having lower educational attainment were significantly related to being more likely to endorse INC than not across particular obsessive-compulsive experiences. Furthermore, females and non-binary individuals

as well as those with lower educational attainment were more likely to score higher on INC. To date, studies have generally not found significant relationships between demographic variables and the core motivations, although the differences in findings may be at least partially explained by the differences in how the core motivations were measured (e.g., Bragdon & Coles, 2017; Sibrava et al., 2016). Another potential explanation for the gender difference observed for levels of INC may be due to differences in interoceptive awareness between genders. Females as compared to men have been found to notice bodily sensations more often, connect them to emotions, and experience more worry about body senses (Grabauskaitė et al., 2017). Therefore, our finding may reflect differences in awareness of one's body and the uncomfortable internal sensations associated with INC. The reasons underlying the relationships between demographic variables and INC and HA warrant further exploration. However, these findings may help clinicians be more attuned to the various ways the core motivations can manifest across a diverse population.

Relationship Between the Core Motivations and Other Aspects of the OCD Experience

When investigating the relationship between the core motivations and whether participants reported an external or internal trigger that precipitated the OCD experience there were no significant relationships. Therefore, this suggests that the type of trigger is likely not influenced by whether a person's OCD experience is motivated by HA or INC and various types of triggers can activate the underlying core motivations. This is consistent with Summerfeldt's (2004) description that INC can be manifested through various sensory modalities (i.e., visual, auditory, tactile, proprioceptive) as well as cognition. Therefore, clinically when generating potential exposure items, it can be valuable to explore with the client both external and internal triggers regardless of their core motivational experience.

Examining the relationships between the core motivations and interpretations of obsessions revealed interesting insights. Higher HA scores were associated with a higher probability of the interpretation "this means something bad can/has/will happen" and a decreased probability of the interpretation "this means I will have an intolerable/uncomfortable feeling" which is aligned with the definition of HA. The INC motivation was associated with a lower probability of the interpretation "this means something awful about me as a person". Therefore, the INC motivation appears to be less likely to be related to beliefs that the OCD experience means something negative and personally relevant about them. Higher scores on both motivations were associated with the interpretation that there would be an intolerable/uncomfortable feeling that would be long-lasting. Therefore, HA and INC are associated with the belief that there would be intolerable distress (i.e., perhaps anxiety in the case of HA and discomfort/ "not just right" feeling in the case of INC) that is invoked by obsessions thus prompting engagement in OCD behaviours in an attempt to reduce this distress. Bragdon and Coles (2017) used the Obsessive Beliefs Questionnaire-44 (Obsessive Compulsive Cognitions Working Group, 2005) to examine the patterns of beliefs associated with the motivation subgroups they identified, and also found that certain beliefs tend to be more relevant for certain motivation profiles. Specifically, the high INC group had low beliefs related to inflated responsibility and overestimation of threat and higher beliefs regarding perfectionism and intolerance of uncertainty (Bragdon & Coles, 2017) whereas the high HA group had elevations in beliefs related to inflated responsibility/overestimation of threat and importance and control of thoughts. Understanding which interpretations are relevant to each of the core motivations can be helpful for treatment planning. It can facilitate decisions regarding which cognitive techniques will be most relevant to an individual's OCD experience and thus help

promote the most change. For example, given that higher HA, but not INC, was associated with increased beliefs about bad things happening, the cumulative probabilities technique which can be used to help individuals more realistically assess the likelihood that a feared event will occur will likely be more relevant to those who are highly endorsing HA as compared to those who are highly endorsing INC.

Investigating OCD behaviours revealed that INC was significantly and positively associated with an increased probability of engaging in compulsions and a reduced probability of not engaging in an OCD behaviour. This finding provides support that the INC is an important driver of compulsions in OCD. Avoidance, thought suppression, and seeking reassurance were the OCD behaviours significantly associated with higher HA scores. Knowing which OCD behaviours tend to be associated with which motivations can help us better understand what is driving the unique behaviours in OCD and can provide insight into what behaviours to target in ERP. For example, for individuals with higher HA scores, clinicians should assess what the client is avoiding and help tailor exposures to approach triggers that would invoke intrusive thoughts while also encouraging the client to reduce thought suppression and reassurance-seeking behaviours. Additionally, these findings suggest that the greater extent to which INC is involved in a particular obsessive-compulsive experience, the more likely they are to be doing something, often compulsions, to reduce the distress. Therefore, it will be important to assess each individual's idiosyncratic compulsions to help them know what to work on reducing for ERP to allow for opportunities to practice tolerating the distress of INC/ "not just right" feelings. Individuals may be using multiple compulsions/OCD behaviours to manage obsessions. Therefore, clinicians should aim to be aware of all the compulsions/OCD behaviours an individual is employing to manage the distress of an obsessive-compulsive experience to

effectively support them in ERP. Additionally, given that higher levels of INC were associated with reduced probability of not engaging in an OCD behaviour, in future research it would be interesting to explore if there are other strategies that the INC motivation prompts beyond the typical OCD behaviours explored in this current study.

Limitations

This study should be interpreted with the following limitations in mind, particularly given the preliminary nature of these findings. While the use of ESM allowed us to gather a rich, real-time perspective on OCD experiences, to reduce participant burden of answering multiple surveys per day and to promote survey completion and honest responding we had to limit the number of survey questions asked. Given that there are no validated measures for momentary assessment of HA and INC we adapted wording from the OC-CDI, which was designed to assess symptom-specific motivations at one time point rather than at closely-spaced repeated intervals. The validity of this method warrants further research. Additionally, a sliding scale with a button slider was used to allow for a continuous measure of the HA and INC motivations, however, the mechanics of this scale may have unintentionally contributed to complexities (i.e., a bimodal distribution) in our data that required us to transform the data and can complicate data interpretation. A benefit of ESM is that real-time data collection limits recall bias, however, due to compatibility challenges with SurveySignal and REDCap, we were not able to have the survey link expire. Instead, participants were instructed to respond to the survey as soon as possible to a recent obsessive-compulsive experience. Our research questions and survey items were not dependent on in-the-moment responses, therefore, this limitation is likely less impactful on our findings. Finally, we chose to focus on the two core motivations as proposed by Summerfeldt (2004), however, it is important to acknowledge that other motivations, particularly disgust, have

been increasingly recognized as important to the OCD experience (e.g., Knowles et al., 2018). Therefore, the role of disgust in the daily experience of OCD remains to be investigated.

Conclusions

Using data gathered from the daily lives of individuals with OCD, this study provides valuable insights into the phenomenology of the core motivations of OCD, emphasizing the roles that HA and INC play in shaping the OCD experience. These findings further our understanding of the heterogeneity of OCD from the lens of the core motivations and demonstrate that HA and INC appear to contribute to differences in how OCD is experienced, cognitively and behaviourally. Given that both HA and INC are relevant to many individuals with OCD, this research supports the importance of considering both motivations during the assessment and treatment of OCD.

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Table 1

Demographics

		N	%
Gender	Female	30	60
	Male	16	32
	Non-binary/transgender	4	8
Relationship Status	Single	23	46
	In a relationship	16	32
	Married	7	14
	Co-habiting	3	6
	Separated	1	2
Education Level	Some high school	3	6
	Completed high school	4	8
	Some college/university	11	22
	Completed college/university	22	44
	Some graduate school	4	8
	Completed graduate school	6	12
Ethnicity	Indigenous (First Nation, Metis, Inuit)	1	2
	Black/Afro-Caribbean/African	1	2
	White/European	40	80
	Asian (South, East, Southeast)	2	4
	Biracial	5	10
	Middle Eastern (Arab, Persian, West Asian)	1	2

Note. Age: Mean = 29.2 years, *SD* = 8.99, Max = 60, Min = 18

Table 2

Mean/SD of Raw HA and INC Scores and Correlation Among Individuals' Mean HA and INC Scores

Measure	Mean	*SD*	Pearson's r (95% CI)	*t*	*p*
HA	58.3	34.6			
			-0.15 (-0.41, 0.13)	-1.08	.28
INC	63.2	31.2			

Table 3

Descriptive Analysis of 4-Center Solution of K-Means Cluster Analysis

Cluster (interpretation)	Cluster size	Mean HA	Mean INC	Within-cluster SS	Total between-cluster SS	100%* $\frac{\text{Between}}{\text{Total SS}}$
1 (High HA, High INC)	15	78.7	79.9	3055	48576	74.1%
2 (High HA, Low INC)	9	77.2	25.7	2898		
3 (Low HA, High INC)	9	10.6	73.8	6223		
4 (Moderate HA, Moderate INC)	17	52.2	59.2	4838		

Table 4

GLMM Analysis on HA and INC Change Over Time

Measure	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
HA	545 (50 IDs)	Intercept (ZI)	-5.01 (3.35)	.	.	-12.30, 1.31
		Intercept (Cond.)	0.57 (0.19)	.	.	0.19, 0.95
		Prompt (ZI)	-0.034 (0.04)	1.23 (1)	.27	-0.14, 0.03
		Prompt (Cond.)	0.001 (0.002)	0.31 (1)	.58	-0.003, 0.01
		Time of day (ZI)	Aft: 0.33 (0.86)	0.62 (2)	.73	-1.30, 2.15
			Eve: -0.19 (0.93)			-2.01, 1.71
		Time of day (Cond.)	Aft: -0.060 (0.14)	0.51 (2)	.78	-0.33, 0.21
			Eve: -0.10 (0.15)			-0.39, 0.18
		Random Effect	Std. Dev.	LRT χ^2 (df)	*p*	95% CI
		Slope (ZI)	0.07	9.17 (2)	.01	0.03, 0.18
		Slope (Cond.)	0.01	8.07 (2)	.02	0.004, 0.01
		Intercept (ZI)	6.15	131 (1)	< .001	2.97, 12.70
		Intercept (Cond.)	0.95	234 (1)	< .001	0.71, 1.27
Measure	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
INC	545 (50 IDs)	Intercept (ZI)	-0.78 (3.66)	.	.	-8.12, 7.59
		Intercept (Cond.)	0.62 (0.19)	.	.	0.25, 0.99
		Prompt (ZI)	0.0082 (0.024)	0.11 (1)	.73	-0.05, 0.06
		Prompt (Cond.)	0.001 (0.0016)	0.092 (1)	.76	-0.003, 0.004
		Time of day (ZI)	Aft: 0.53 (0.79)	0.93 (2)	.63	-0.95, 2.22
			Eve: 0.017 (0.85)			-1.66, 1.78
		Time of day (Cond.)	Aft: -0.17 (0.13)	5.52 (2)	.06	-0.43, 0.09
			Eve: -0.32 (0.14)			-0.59, -0.05
		Random Effect	Std. Dev.	LRT χ^2 (df)	*p*	95% CI
		Slope (ZI)	0.051	4.64 (2)	.10	0.02, 0.13
		Slope (Cond.)	0.0056	6.98 (2)	.03	0.003, 0.01
		Intercept (ZI)	5.26	70.6 (1)	< .001	2.26, 12.20
		Intercept (Cond.)	0.71	157 (1)	< .001	0.51, 0.99

Note. "Prompt" is in hours since prompt 1 (prompt 1 = 0). "Time of day" is a categorical predictor with "morning" as the reference level. In the random effects, "slope" is time (prompt) allowed to vary by individual ID, and "intercept" is the variation among individuals at the reference level and time (prompt) = 0. The likelihood ratio test (LRT) statistic follows a χ^2

distribution. LRT/*p* for (fixed) intercept not reported as it is not meaningful for our analysis. “ZI” refers to the zero-inflated model, which models the probability of observing a zero score as a logistic regression, where positive coefficients indicate a greater probability of obtaining a zero. The nonzero data are then modelled separately in the conditional model (“Cond.”) using a beta distribution.

Table 5

Results of Model of Trigger Type (External vs. Internal) Fit Using a Logistic GLMM with a Binomial Distribution.

OCD exp.	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
Trigger (external vs. internal)	525 (50 IDs) (258 int, 267 ext)	Intercept	0.29 (0.43)	.	.	-0.57, 1.16
		HA	0.19 (0.20)	0.75 (1)	.39	-0.19, 0.59
		INC	0.11 (0.18)	0.16 (1)	.69	-0.25, 0.47
		HA:INC	-0.17 (0.16)	1.19 (1)	.28	-0.49, 0.14
		Prompt	0.05 (0.16)	0.11 (1)	.74	-0.28, 0.39
		Time of day	Aft: -0.61 (0.36)	3.61 (2)	.16	-1.34, 0.08
			Eve: -0.69 (0.39)			-1.46, 0.06

Note. Twenty of 545 observations classified as "no trigger" and were removed from the analysis. Continuous predictors (HA, INC, prompt) centered and scaled due to scale differences.

Table 6

Results of Models of 4 OCD Interpretations (Endorsed/Not Endorsed) Fit Using Logistic GLMM with a Binomial Distribution.

OCD exp.	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
Interpretation 1 ("This means something bad can/has/will happen")	545 (50 IDs)	Intercept	0.080 (0.54)	.	.	-1.00, 1.18
		HA	3.01 (0.37)	149.7 (1)	< .001	2.35, 3.82
		INC	-0.39 (0.26)	2.23 (1)	.14	-0.91, 0.13
		HA:INC	0.068 (0.29)	0.053 (1)	.82	-0.54, 0.63
		Prompt	0.29 (0.22)	1.70 (1)	.19	-0.12, 0.74
		Time of day	Aft: -0.16 (0.50)	0.59 (2)	.74	1.16, 0.82
			Eve: 0.12 (0.54)			-0.95, 1.17
Interpretation 2 ("This means something awful about me as a person")	545 (50 IDs)	Intercept	-1.80 (0.57)	.	.	-3.12, -0.76
		HA	0.15 (0.23)	0.55 (1)	.46	-0.31, 0.61
		INC	-0.61 (0.22)	7.57 (1)	.01	-1.09, -0.20
		HA:INC	0.20 (0.20)	0.99 (1)	.32	-0.20, 0.62
		Prompt	-0.030 (0.30)	0.010 (1)	.92	-0.76, 0.55
		Time of day	Aft: -1.11 (0.43)	6.91 (2)	.03	-1.98, -0.27
			Eve: -0.97 (0.46)			-1.89, -0.073
Interpretation 3 ("This means that I will have an intolerable/uncomfortable feeling")	545 (50 IDs)	Intercept	1.59 (0.62)	.	.	0.45, 2.97
		HA	-1.06 (0.25)	22.9 (1)	< .001	-1.58, -0.60
		INC	0.17 (0.21)	0.61 (1)	.44	-0.26, 0.61
		HA:INC	-0.025 (0.21)	0.015 (1)	.90	-0.43, 0.39
		Prompt	0.60 (0.34)	4.24 (1)	.04	0.025, 1.43
		Time of day	Aft: 0.30 (0.42)	0.015 (2)	.40	-0.53, 1.11
						-1.00, 0.74

			Eve: -0.13 (0.44)			
Interpretation 4 (“This means that I will have an intolerable/uncomfortable feeling that will be long lasting”)	545 (50 IDs)	Intercept	-0.65 (0.44)	.	.	-1.53, 0.23
		HA	0.57 (0.21)	5.56 (1)	.02	0.17, 1.01
		INC	0.68 (0.20)	9.89 (1)	.01	0.30, 1.11
		HA:INC	-0.41 (0.20)	4.93 (1)	.03	-0.82, -0.05
		Prompt	0.070 (0.17)	0.17 (1)	.68	-0.29, 0.39
		Time of day	Aft: -0.50 (0.37)	1.83 (2)	.40	-1.23, 0.22
			Eve: -0.36 (0.39)			-1.14, 0.40

Note. Continuous predictors (HA, INC, prompt) centered and scaled due to scale differences.

Table 7

Results of Models of 5 OCD Behaviours (Present/Absent) Fit Using Logistic GLMM with a Binomial Distribution.

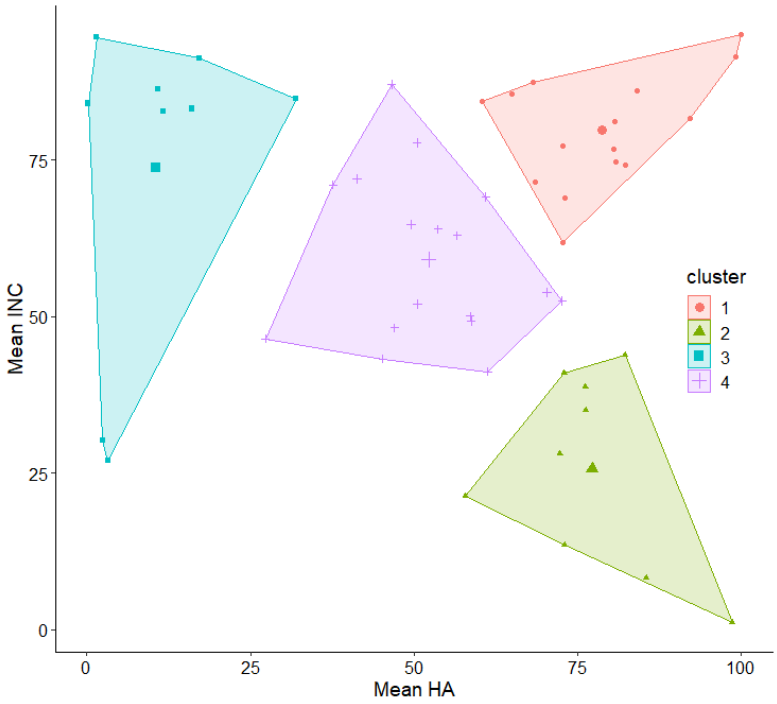
OCD exp.	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
Behaviour 1 (Compulsions)	545 (50 IDs)	Intercept	2.25 (0.52)	.	.	1.29, 3.37
		HA	-0.16 (0.23)	0.54 (1)	.46	-0.61, 0.30
		INC	1.22 (0.26)	32.1 (1)	< .001	0.76, 1.78
		HA:INC	-0.19 (0.19)	1.03 (1)	.31	-0.59, 0.18
		Prompt	0.13 (0.24)	0.30 (1)	.58	-0.35, 0.66
		Time of day	Aft: 0.23 (0.45)	0.26 (2)	.88	-0.67, 1.12
			Eve: 0.18 (0.48)			-0.78, 1.11
Behaviour 2 (Avoidance)	545 (50 IDs)	Intercept	-1.32 (0.46)	.	.	-2.29, 0.46
		HA	0.79 (0.23)	13.2 (1)	< .001	0.36, 1.26
		INC	-0.38 (0.21)	3.15 (1)	.08	-0.80, 0.04
		HA:INC	-0.042 (0.20)	0.044 (1)	.83	-0.45, 0.35
		Prompt	0.28 (0.24)	1.33 (1)	.25	-0.22, 0.76
		Time of day	Aft: -0.74 (0.38)	4.00 (2)	.14	-1.49, 0.011
			Eve: -0.71 (0.41)			-1.53, 0.092
Behaviour 3 (Thought suppression)	545 (50 IDs)	Intercept	-0.55 (0.44)	.	.	-1.45, 0.32
		HA	0.97 (0.20)	28.1 (1)	< .001	0.58, 1.38
		INC	-0.21 (0.17)	0.74 (1)	.39	-0.55, 0.12
		HA:INC	0.26 (0.16)	2.69 (1)	.10	-0.05, 0.58
		Prompt	0.053 (0.12)	0.19 (1)	.67	-0.19, 0.29
		Time of day	Aft: -0.12 (0.35)	0.55 (2)	.76	-0.82, 0.57
			Eve: -0.27 (0.38)			-1.01, 0.48
Behaviour 4 (Seeking reassurance)	545 (50 IDs)	Intercept	-2.50 (0.55)	.	.	-3.63, 1.56
		HA	0.47 (0.24)	4.07 (1)	.04	0.01, 0.97
		INC	-0.26 (0.21)	1.79 (1)	.18	-0.69, 0.17
		HA:INC	-0.022 (0.21)	0.011 (1)	.92	-0.45, 0.38

		Prompt	0.25 (0.24)	1.04 (1)	.31	-0.25, 0.78
		Time of day	Aft: -0.24 (0.43)	0.55 (2)	.76	-1.08, 0.62
			Eve: -0.027 (0.46)			-0.93, 0.89
Behaviour 5 (Did not engage in OCD behaviour)	545 (50 IDs)	Intercept	-8.43 (1.87)	.	.	-13.5, -5.26
		HA	0.09 (0.48)	0.01 (1)	.92	-0.85, 1.11
		INC	-1.05 (0.40)	6.88 (1)	.01	-1.94, -0.34
		HA:INC	0.48 (0.37)	1.96 (1)	.16	-0.18, 1.31
		Prompt	0.76 (1.12)	0.49 (1)	.48	-1.50, 3.66
		Time of day	Aft: -1.12 (0.86)	3.29 (2)	.19	-2.84, 0.57
			Eve: -0.09 (0.87)			-1.80, 1.67

Note. Continuous predictors (HA, INC, prompt) centered and scaled due to scale differences.

Figure 1

4-Center Solution of K-Means Cluster Analysis



CHAPTER 3

STUDY 2: MEASURING INCOMPLETENESS AND NOT JUST RIGHT EXPERIENCES: A PSYCHOMETRIC EVALUATION OF TWO COMMONLY USED QUESTIONNAIRES IN OCD AND ANXIETY DISORDERS SAMPLES

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The previous chapter's results suggest that both of the core motivations (HA and INC) of OCD are important for understanding the heterogeneity of the disorder and appear to differentially contribute to how OCD is experienced cognitively and behaviourally. Therefore, it is critical to understand and evaluate how the core motivations have been commonly assessed in this area of research and clinical practice. This chapter examined the psychometric properties of the OC-CDQ and NJRE-QR concurrently in large clinical OCD and anxiety disorders samples to evaluate their reliability and validity so that a comparison of these measures could be made to help inform their research and clinical use.

Measuring incompleteness and not just right experiences: A psychometric evaluation of two commonly used questionnaires in OCD and anxiety disorders samples

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Abstract

Extending previous research, this study examined the psychometric properties of two commonly used self-report measures of incompleteness (INC) and not-just-right experiences (NJREs), the Obsessive-Compulsive Trait Core Dimensions Questionnaire (OC-TCDQ; Summerfeldt et al., 2014) and the Not Just Right Experiences Questionnaire - Revised (NJRE-QR; Coles et al., 2003) in large samples of individuals with OCD and anxiety disorders. Factor analyses indicated adequate support for a two-factor solution for the OC-TCDQ and a one-factor solution for the NJRE-QR. Both measures demonstrated excellent internal consistency and good-to-excellent test-retest reliability. We found good convergent validity between the measures of interest and with an OCD symptom severity measure. Discriminant validity was evidenced by a significantly stronger correlation between INC and NJRE severity than the relatively modest correlations with theoretically distinct constructs (i.e., harm avoidance and general distress). Individuals with OCD had a similar number of NJREs as individuals with anxiety disorders but reported significantly greater NJRE distress and levels of INC. Finally, both measures were sensitive to change across group cognitive-behavioural therapy for OCD. These findings provide support for the reliability and validity of the OC-TCDQ and NJRE-QR to measure INC (trait) and NJRE (state) constructs that assist in understanding the phenomenology of OCD.

Keywords: incompleteness, not just right experiences, obsessive-compulsive disorder, psychometric properties, reliability, validity

Introduction

Obsessive-compulsive disorder (OCD) is a heterogeneous clinical condition with many symptom expressions (Lochner & Stein, 2003; McKay et al., 2004). To better understand OCD and its heterogeneity there has been an interest in identifying and understanding the underlying mechanisms of OCD. Several constructs and mechanisms (e.g., attentional biases, maladaptive beliefs/interpretations, perfectionism, safety behaviours and avoidance, etc.) have been identified as contributors to the development and maintenance of OCD (e.g., Chessell et al., 2021; Wilhelm et al., 2015). However, these mechanisms are not specific to OCD and are relevant to many clinical conditions such as various anxiety and mood disorders (e.g., Cisler & Koster, 2010; Im & Kahler, 2022; Kaplan et al., 2018). Thus, efforts have focused on the identification of maintaining factors specific to OCD, that may functionally link obsessions and compulsions.

A body of research has investigated the underlying motivations driving obsessive-compulsive symptoms. Cognitive-behavioural models of OCD have emphasized that symptoms are motivated by harm avoidance (HA) and the associated threat-related maladaptive beliefs (e.g., beliefs that a negative outcome is likely, that one is personally responsible for anticipating and preventing harm, that intrusive thoughts are dangerous, etc.; Frost & Steketee, 2002). HA is the motivation to engage in compulsions to prevent potential feared negative outcomes (Summerfeldt, 2004). This anxiety/fear-based conceptualization of OCD is also evident in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association [APA], 2013) where it is stated that individuals engage in compulsions to prevent or reduce anxiety or distress or prevent some dreaded event or situation. However, HA is not specific to OCD and can be seen in many other anxiety and mood disorders (e.g., Abrams et al., 2004; Markett et al., 2016; Wachleski et al., 2008). Additionally, HA is not sufficient in

explaining what motivates obsessive-compulsive symptoms (Rasmussen & Eisen, 1992; Summerfeldt, 2004). It is increasingly recognized that there are OCD presentations where the main motivation driving compulsions is not to prevent harm but instead to counteract internal perceptions and feelings of discomfort that something is not "just right" (Coles et al., 2003; Rasmussen & Eisen, 1992; Summerfeldt, 2004). This motivational factor has been termed incompleteness (INC) and has been defined as "the sense or feeling that one's actions, intentions, or experiences have not been properly achieved" (Taylor et al., 2014, p.2); which motivates engagement in compulsions to reduce this discomfort (Summerfeldt, 2004). INC is an important factor that can help explain the repetitive and rule-based nature of compulsive behaviours in OCD (Summerfeldt, 2004). The first mention of INC can be traced back to the early 20th century when Janet (1903) described '*sentiments d'incomplétude'* as a central feature of OCD. It was described as "an inner sense of imperfection" where individuals "…feel that actions that they perform are incompletely achieved, or that they do not produce the sought-for satisfaction…" (Pitman, 1987, p.1). However, it was not until the early 21st century that INC and its related constructs began to receive more attention in research (e.g., Coles et al., 2003, 2005; Summerfeldt, 2004).

Another commonly used term to describe this phenomenon in OCD is "not just right experiences" (NJREs; Coles et al., 2003). The constructs of INC and NJREs are highly related and the terms are often used interchangeably throughout this area of research (e.g., Coles & Ravid, 2016). Both INC and NJREs share underlying feelings of discomfort and tension which can motivate individuals to engage in compulsive behaviours. However, it has been stated that INC and NJRE may capture slightly different aspects of the same underlying construct (Belloch et al., 2016). INC has been thought of as a more stable trait-like construct (i.e., a characteristic

that tends to be persistent and generalizable across situations), whereas NJREs are seen to be the state (i.e., a momentary and fluctuating characteristic influenced by current context) expression of this phenomenon (Belloch et al., 2016; Summerfeldt et al., 2014). For example, a person with high trait INC may have a general tendency to need to do things in a certain way and have a persistent tendency to feel dissatisfied when things do not align with their internal standards, leading to generalized patterns of being meticulous and repetitive in tasks or actions to achieve a sense of completeness. Whereas NJREs as a state may occur in specific moments when something feels "off" (e.g., noticing an object is misaligned, or one's actions or words do not feel "just right") and result in accompanying increases of discomfort and urges to act to alleviate the tension. However, distinguishing between INC and NJREs remains a matter for research.

The importance of INC and NJREs to the understanding of OCD has been continually demonstrated in the literature. INC and NJREs have been conceptualized as vulnerability markers for OCD (Belloch et al., 2016). Although both INC and NJREs are experienced by non-clinical participants and non-OCD clinical participants, the frequency and intensity are significantly positively correlated with obsessional tendencies with large effects (Belloch et al., 2016). Furthermore, INC and NJRE levels have been found to be significantly higher in individuals diagnosed with OCD than in those diagnosed with other clinical conditions such as gambling, eating, anxiety and depressive disorders, (Cervin et al., 2020; Chik et al., 2010; Coles & Ravid, 2016; Ecker et al., 2014; Ghisi et al., 2010; Sica et al., 2015). INC has also been found to have a strong positive relationship with obsessive-compulsive symptoms and severity, even after controlling for variables such as general distress, HA, and obsessive-compulsive beliefs (Belloch et al., 2016; Ecker & Gönner, 2008; Pietrefesa & Coles, 2008; Taylor et al., 2014).

Given the importance of INC and NJREs to the understanding of OCD, it is important that the measures used to assess these constructs are reliable and valid.

Two of the most commonly used self-report questionnaires of INC and NJREs in the literature are the Obsessive-Compulsive Core Dimensions Questionnaire – Trait Version (OC-TCDQ; Summerfeldt et al., 2014) and the Not Just Right Experiences Questionnaire-Revised (NJRE-QR; Coles et al., 2003). The OC-TCDQ was developed by Summerfeldt and colleagues (2014) and measures two underlying core motivations in OCD – HA and INC. This 20-item questionnaire has items that assess the degree to which HA (e.g., "Even if harm is very unlikely, I feel the need to prevent it at any cost") and INC (e.g., "I must do things in a certain way or I will not feel right") apply to how an individual typically thinks, feels, and acts. Each item is rated on a five-point Likert scale from 0 (never applies to me) to 4 (always applies to me). The 10 items corresponding to each motivation are summed to create the HA and INC scale scores. The authors of this measure noted that when creating the items there was careful attention to avoid referring to specific OCD symptoms or behaviours because the core motivations are content-independent (Summerfeldt et al., 2014). This contributes to the OC-TCDQ's criterion validity as this measure was designed to assess the motivational precursors to symptoms regardless of the specific content of the obsessions and compulsions, and therefore more accurately captures the core dimensional traits of HA and INC without being confounded by symptom content. HA and INC are independent constructs and confirmatory factor analyses (CFA) in nonclinical and clinical samples have supported a two-factor structure with acceptable to excellent fit across various fit indices (Pietrefesa & Coles, 2008; Summerfeldt et al., 2014). Despite this, research has found that the HA and INC scales are significantly correlated but the strength of this correlation has varied substantially (i.e., from as low as .36 in a clinical sample to as high as .76

in a nonclinical sample) across research studies (Pietrefesa & Coles, 2008; Summerfeldt et al., 2014; Taylor et al., 2014). Potential reasons for the significant correlation between HA and INC (e.g., shared method variance) and for the observed differences in the strength of correlations between clinical and non-clinical samples (e.g., potential population-specific factors; in non-clinical samples these constructs may be less familiar to them and overlap with broader distress-related traits, whereas in clinical populations the correlation may suggest how these constructs co-exist in OCD, etc.) have been explored in Summerfeldt et al. (2014, p. 90). Previous studies that have reported on the psychometric properties of the OC-TCDQ have indicated high internal consistency (e.g., HA: α =.91 - .92, INC: α = .91 - .93; Coles et al., 2005; Summerfeldt et al., 2014) and good convergent validity with measures of obsessive-compulsive symptoms, such as the Obsessive Compulsive Inventory original (OCI; Foa et al., 1998), r = .47 - .54 (Bragdon & Coles, 2017), and revised version (OCI-R; Foa et al., 2002), HA: r = .48, p < .01, INC: r = .69, p < .01 (Ecker & Gönner, 2008), the Yale-Brown Obsessive-Compulsive Scale– Self Report (YBOCS-SR; Baer et al., 1993) HA: r = .41, p < .01, INC: r = .48, p < .01 (Ecker & Gönner, 2008).

The NJRE-QR was developed by Coles and colleagues (2003) and measures the occurrence and severity of experiences where an individual felt “not just right”. First, a Checklist score ranging from 0 to 10 is generated by asking respondents to indicate whether or not they have experienced 10 specific NJREs (e.g., “When talking to people I have had the sensation that my words did not sound just right”, “I have had the sensation after getting dressed that parts of my clothes didn’t feel just right”) over the past month. Then, respondents are asked to focus on the most recent NJRE they experienced and complete seven ratings on a scale from 1 (absence) to 7 (extreme). The average of these seven ratings generates the Severity score. An exploratory

factor analysis (EFA) found a 1-factor structure, that explained 65% of the total variance, for the 7 items (loading values > .65) that create the Severity score indicating that these items measure a unitary latent construct of NJREs (Ghisi et al., 2010). Previous studies that have reported on the psychometric properties of the NJRE-QR have found adequate to good internal consistency for the Checklist (KR-20 = .67 - 0.80) Severity score (α = .92) as well as good convergent validity, with significantly higher correlations between the NJRE-QR and obsessive-compulsive symptom measures such as the OCI (r = .51 - .53, p < .01) and YBOCS (r = .53, p < .05) compared to measures of other psychopathology domains such as general distress and depression (Coles et al., 2003, 2005; Coles & Ravid, 2016). The temporal stability of the NJRE-QR over one month was examined by Ghisi et al. (2010) in an undergraduate sample and was found to be good (r = .76) despite the long time frame. To our knowledge, the test-retest reliability has yet to be investigated in a clinical sample.

Studies to date that have reported on the psychometric properties of the OC-TCDQ and NJRE-QR provide evidence that these measures demonstrate good reliability and validity in both non-clinical and clinical samples (e.g., Coles et al., 2003; Summerfeldt et al., 2014). This study aims to extend and provide additional psychometric estimates of the OC-TCDQ and NJRE-QR in a large Canadian clinical OCD sample. Given that these questionnaires are conceptually and theoretically linked, by simultaneously investigating the psychometric properties, more direct comparisons can be made which may help to better inform researchers and clinicians about the differences in how these constructs are measured by the questionnaires and can guide decisions in how they could be used in research, assessment, and treatment. Additionally, beyond the initial papers that describe the development and psychometric properties of these measures (Coles et al., 2003; Summerfeldt et al., 2014), estimates of the reliability and validity of these

measures are dispersed across the literature in studies where evaluating the psychometric properties is not the intended purpose. Thus, focused examination and comparison of their psychometric properties, particularly in clinical OCD samples, is warranted.

The present study sought to examine and compare the psychometric properties of the OC-TCDQ and the NJRE-QR in large clinical samples of individuals with OCD and anxiety disorders. The psychometric properties were examined by exploring the factor structure, reliability (internal consistency and test-retest reliability), validity (convergent and discriminant, construct) and treatment sensitivity of these measures.

It was hypothesized that the OC-TCDQ would have a two-factor structure capturing the latent constructs of HA and INC and the NJRE-QR would have a one-factor structure capturing the latent construct of NJREs. We hypothesized these measures would have high internal consistency in our sample based on previous research that has demonstrated this in various samples (e.g., Belloch et al., 2016; Coles & Ravid, 2016; Summerfeldt et al., 2014). To our knowledge, the test-retest reliability of the OC-TCDQ has not been previously investigated. Given the trait-like nature of the OC-TCDQ items, we hypothesized that this measure would have high test-retest reliability. Given that the NJRE-QR measures the state-like construct of NJREs and the way the Severity scale is structured (i.e., participants rating their most recent NJRE on seven domains) we hypothesized that this measure would have moderate test-retest reliability. As state measures such as the NJRE-QR are meant to capture fluctuating experiences, the expectation is not for perfect stability but rather evaluating if the measure can reliably detect variations to help ensure that observed fluctuations are due to changes in the construct and not measurement error. In examining convergent and discriminant validity it was hypothesized that given the similarities in the underlying constructs, INC and NJRE measures would be

significantly correlated to each other and would also show good convergent validity with an OCD symptom severity measure but would have a significantly weaker association with HA and general measures of distress (i.e., depression, anxiety and stress). When examining the construct validity of these measures, given that INC and NJREs are particularly relevant constructs to OCD, we hypothesized that individuals with OCD would have higher INC and NJRE scores than individuals with anxiety disorders, whereas we expected that HA scores would be comparable across both samples. Finally, given emerging treatment outcome studies that have incorporated these measures (e.g., Cervin et al., 2020; Coles & Ravid, 2016; Schwartz, 2018), we hypothesized that the OC-TCDQ and the NJRE-QR would be sensitive to treatment changes across group CBT for OCD.

Methods

Participants

Participants were adults seeking mental health services for anxiety or related disorders (i.e., OCD) at a specialized outpatient clinic within a Canadian hospital. Two participant samples participated in the current study. The OCD sample (N = 193) included individuals who had a confirmed diagnosis of OCD, were referred to group CBT for OCD, and completed at least one of the questionnaires of interest[1]. The mixed anxiety disorders (ANX) sample (N = 143) included individuals who had a confirmed anxiety disorder diagnosis of generalized anxiety disorder (GAD), social anxiety disorder (SAD), panic disorder, or agoraphobia; who did not have a diagnosis of OCD; who were referred to anxiety disorder specific group CBT depending on the

[1] Individuals in the OCD sample were allowed to have a comorbid anxiety disorder diagnosis, 100 individuals (51.8%) had a comorbid anxiety disorder diagnosis while 93 individuals (48.2%) did not. This decision was made to reflect the high rates of comorbidity between OCD and anxiety disorders, thus providing a more clinically realistic sample for our main sample of interest.

primary concern at the time of assessment, and who completed at least one of the questionnaires of interest. See Table 1 for the demographics and a comparison of the OCD and ANX samples. The samples significantly differed by age, with the ANX sample being significantly older than the OCD sample, and education; however, the difference in education level did not remain significant in the post-hoc tests. Participants in the OCD and ANX samples had an average of 1.32 (*SD* = 1.24) and 1.29 (*SD* = 1.07) additional diagnoses respectively, both with a range of 0 to 6 additional diagnoses. There was no difference between the OCD and ANX samples in the number of additional diagnoses, $t(334) = .173$, $p = .863$.

Procedure

Individuals were referred to the clinic by a healthcare professional (e.g., primary care physician). Participants received a diagnostic assessment from a trained mental health professional (e.g., psychologist, psychiatrist, social worker, nurse, psychological associate, etc.) or graduate level clinical psychology student. Diagnoses were assigned based on the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013). In the OCD sample, 55.9% (*n* = 108) were assessed using the Diagnostic Assessment and Research Tool (DART; a semi-structured modular interview based on DSM-5 criteria; McCabe et al., 2017; Schneider et al., 2022), 42.5% (*n* = 82) were assessed during a psychiatric consult, and 1.6% (*n* = 3) were assessed by a specialized nurse. In the ANX sample, 30.8% (*n* = 44) were assessed using the DART, 62.9% (*n* = 90) were assessed during a psychiatric consult, and 6.3% (*n* = 9) were assessed by a specialized nurse. The assessment method was determined based on the referral request (e.g., psychiatric consults for medication recommendations or medical complications) and availability. Following the assessment, participants were then referred to a psychological treatment group most appropriate for their diagnosis of priority concern at the

time. All participants in the OCD sample were referred to group CBT for OCD. The ANX sample includes individuals who were referred to group CBT for GAD (n = 74), SAD (n = 42), and panic disorder/agoraphobia (n = 27). All participants were administered self-report questionnaires as part of regular clinic procedures and for treatment progress monitoring purposes. Questionnaires were administered and completed using Research Electronic Data Capture (REDCap; Harris et al., 2009, 2019). At pre-treatment, participants in both the OCD and ANX samples were administered the OC-TCDQ (Summerfeldt et al., 2014) and NJRE-QR (Coles et al., 2003). The OCD sample was administered measures of OCD symptom severity and general distress, and the OC-TCDQ and NJRE-QR were re-administered at week 1 of treatment and post-treatment to allow for a test-retest reliability and treatment sensitivity analysis, respectively. All disorder-specific CBT groups consisted of 12, two-hour sessions, once per week. The CBT protocols included psychoeducation, cognitive skills (e.g., challenging distorted beliefs), and behavioural skills (e.g., exposures to stimuli, activities, or situations that cause fear or anxiety) tailored to the respective disorder being treated. The collection and use of this data was approved by the institution's local research ethics board. All participants provided informed consent to have their data used for research purposes.

Measures

Obsessive-Compulsive Trait Core Dimensions Questionnaire (OC-TCDQ)

The OC-TCDQ (Summerfeldt et al., 2014) is a 20-item self-report measure of the core motivations of OCD with two subscales: HA and INC. Ten items comprise each subscale (e.g., HA: "I get a sense of apprehension, as though something bad might happen or may have already happened", INC: "I feel I must do things in a 'set way', though I might have difficulty putting

that set way into words") and the items are rated on a five-point scale from 0 (*never applies to me*) to 4 (*always applies to me*). The HA and INC subscale scores range from 0 to 40.

Not Just Right Experiences Questionnaire- Revised (NJRE-QR)

The NJRE-QR (Coles et al., 2003) is a 19-item self-report measure of NJREs. First, 10 specific NJREs (e.g., " I have had the sensation after getting dressed that parts of my clothes didn't feel just right") are presented and respondents indicate whether or not they have experienced each NJRE over the past month. A Checklist score that ranges from 0 to 10 is generated by summing the positive responses. Based on the most recent NJRE, respondents rate the frequency, intensity, immediate distress, delayed distress, rumination, urge to respond, and felt sense of responsibility on a scale from 1 (absence) to 7 (extreme) to generate a Severity score based on the average of these ratings.

Yale-Brown Obsessive-Compulsive Scale – Self Report (YBOCS-SR)

The YBOCS-SR (Baer et al., 1993; Goodman et al., 1989) is a 10-item measure of OCD severity. Items assess the time spent, interference, distress, resistance, and control of obsessions and compulsions over the last seven days. Each item is rated on a five-point scale from 0 (*none*) to 4 (*extreme*). Total scores range from 0 to 40, with higher scores reflecting greater severity. The YBOCS-SR has previously and consistently demonstrated excellent internal consistency (Baer et al., 1993; Federici et al., 2010; Steketee et al., 1996). This measure has also shown high test-retest reliability, and good convergent validity with other OCD measures including the interviewer-administered version of the YBOCS (Federici et al., 2010; Steketee et al., 1996) as well as modest divergent validity with measures of worry and depression (e.g., Ólafsson et al., 2010). The internal consistency (McDonald's omega) coefficients for the YBOCS-SR Total score in this study were $\omega = .82$ at pre-treatment and $\omega = .94$ at post-treatment.

The Depression Anxiety Stress Scale (DASS-21)

The DASS-21 is a 21-item self-report measure of recent (i.e., past week) distress with 3 subscales: depression, anxiety, and stress (Lovibond & Lovibond, 1995). Seven items comprise each subscale and each item is rated on a 4-point scale from 0 (*did not apply to me at all)* to 3 (*applied to me very much or most of the time)*. Subscale scores are generated by summing the ratings and higher scores indicate increased symptom severity. The DASS-21 has previously demonstrated excellent psychometric properties across several studies including high internal consistency for each of the subscales indicating strong reliability, as well as good convergent and discriminant validity (Antony et al., 1998; Coker et al., 2018; Lovibond & Lovibond, 1995). In the present study the internal consistency coefficients at pre-treatment were ω = .90 for the Depression subscale, ω =.77 for the Anxiety subscale, and ω = .87 for the Stress subscale. At post-treatment. the internal consistency coefficients were ω = .93 for the Depression subscale, ω = .86 for the Anxiety subscale, and ω = .91 for the Stress subscale.

Data Analysis

Distributions of the variables were examined for normality prior to statistical analyses. There was no evidence of significant skewness or kurtosis in our samples (Field, 2009; Kim, 2013). We began by performing a confirmatory factor analysis (CFA) of the OC-TCDQ and the NJRE-QR Severity scale using the OCD sample data collected at pre-treatment. CFAs were conducted using Amos 26 (Arbuckle, 2019) with maximum likelihood estimation. The 20 items of the OC-TCDQ were used as indicators of two correlated latent factors (i.e., HA and INC). Each item was specified to load on only one factor and correlated errors were not specified in the model. Then we conducted a nested model comparison for the OC-TCDQ data to determine if a one-factor model had a better fit than a two-factor model. Next, we conducted a CFA using the 7

items that comprise the NJRE-QR Severity scale as indicators of a single latent factor (i.e., NJRE), correlated errors were not specified in the model. The following CFA fit indices were examined: the χ^2 test statistic (non-significant values $p > .05$ indicate good model fit, however, because this test is sensitive to large sample sizes it often leads to rejection of well-fitting models), χ^2/degrees of freedom (DF) ratio (< 2 indicates good fit; 2 to 3 indicates acceptable fit), the comparative fit index (CFI) and the Tucker–Lewis index (TLI; ≥ 0.95 indicates good fit, while values ≥ 0.90 are acceptable), the root mean square error of approximation (RMSEA; ≤ 0.06 indicates good fit, with ≤ 0.08 considered acceptable), and the standardized root mean square residual (SRMR; ≤ 0.05 indicates good fit, ≤ 0.08 indicates an acceptable fit). For an overview of the various CFA fit indices see Brown (2015) and Sun (2005).

To evaluate the reliability of the OC-TCDQ and the NJRE-QR, we examined the internal consistency and test-retest reliability of these measures. Internal consistency refers to the degree to which the items on a scale are measuring the same construct. The internal consistency of the HA and INC subscales of the OC-TCDQ was calculated using McDonald's omega (ω) to overcome the concerns with Cronbach's alpha (Hayes & Coutts, 2020). For the NJRE-QR, the Kuder-Richardson Formula #20 (KR-20) was used to evaluate the internal consistency of the 10 items that comprise the Checklist score, and McDonald's omega was used for the Severity score.

To assess the temporal stability of the measures, Pearson's *r* was calculated for a subsample of the OCD participants who completed the OC-TCDQ ($n = 31$) and the NJRE-QR ($n = 25$) at both pre-treatment and week 1 of group CBT for OCD. This time frame was chosen so that the results would not be confounded with potential changes occurring due to treatment.

Pearson correlations were calculated to examine the association of the measures in the present study. According to Cohen's (1988) classification, correlations .50 and above were

defined as large, correlations between .30 and .49 were defined as medium, and correlations between .10 and .29 were defined as small. Convergent validity was investigated by examining the correlations between the INC scale of OC-TCDQ and the NJRE-QR (Checklist and Severity scale), and these measures with the YBOCS-SR. Divergent validity was examined by examining the correlations between our measures of interest with the HA scale of the OC-TCDQ and the DASS-21 Depression, Anxiety, and Stress subscales. To test for significant differences of correlations between measures, Steiger's *z*-test of dependent correlations was used (I. A. Lee & Preacher, 2013; Steiger, 1980)

To determine if scores on the OC-TCDQ and NJRE-QR at pre-treatment differed between the OCD and ANX samples, we conducted a series of analyses with analysis of covariance (ANCOVA) so that recent (i.e., past week) non-specific distress and arousal (i.e., DASS-21 Stress subscale) could be controlled for given the treatment-seeking nature of our sample. As the samples significantly differed in age, we investigated whether age was significantly correlated to either measure. Age was not significantly correlated with the HA (r = -.05, p = .329) and INC (r = -.08, p = .135) scales of the OC-TCDQ, or the Checklist (r = .01, p = .904) and Severity (r = -.01, p = .860) scales of the NJRE-QR. Therefore, age was not added as a covariate in the analyses. Partial eta squared (η_p^2) effect sizes were calculated following the definitions for small (≤ 0.06), medium (0.06 - 0.14), and large (≥ 0.14) effects (Kinnear & Gray, 2006). Then, to investigate if scores on HA and INC significantly differed within the samples, paired-samples *t*-tests were conducted. Effect sizes for *t*-tests were calculated using Cohen's *d* (Cohen, 1988), following conventions for small (0.2), medium (0.5), and large effects (0.8) .

To examine the measures' sensitivity to change, data from participants in the OCD sample who completed the OC-TCDQ and NJRE-QR at pre-treatment and post-treatment (n =

84) were compared using paired-samples *t*-tests. The analyses described above were performed using IBM® SPSS v.25 and v.30.

Results

Factor Analysis

OC-TCDQ

A CFA of the OC-TCDQ pre-treatment data from the OCD sample ($N = 193$) was conducted to examine the validity of HA and INC as independent latent constructs (Table 2). Item loadings for the two-factor model were all significant at $p < .001$ and ranged from .52 to .84 on factor 1 (HA) and from .57 to .85 on factor 2 (INC). The two factors were significantly and moderately correlated, $r = .43$. $p < .001$. The fit indices of the two-factor model were: $\chi^2 = 403.85$, $p < .001$, $\chi 2/df$ ratio = 2.4, CFI = .90, TLI = .89, RMSEA = .08, SRMR = .07. Therefore, the fit indices suggested acceptable fit with the exception of TLI which was just below acceptable. To determine whether a one factor model had a better fit than the two-factor model we compared the nested models and found that the one-factor model ($\chi^2 = 1124.01$) fit significantly worse than the two-factor model ($\chi^2 = 403.85$), $\chi^2_{diff}(1) = 720.15$, $p < .001$. Additionally, we examined the Akaike Information Criterion (AIC), where lower scores indicate better fit (Akaike, 1987) and the one factor model (AIC = 1204.01) continued to demonstrate poorer fit than the two-factor model (AIC = 485.85).

NJRE-QR Severity Score

Next, a CFA of the NJRE-QR pre-treatment data from the OCD sample ($N = 184$) was conducted to examine the validity of NJREs as a single latent construct (Table 3). Item loadings for the one-factor model were all significant at $p < .001$ and ranged from .65 to .87. The fit indices of the one factor model were: $\chi^2 = 174.04$, $p < .001$, $\chi 2/df$ ratio = 12.4, CFI = .83, TLI =

.75, RMSEA = .25, SRMR = .06. These fit indices all suggested poor fit, with the exception of SRMR which was deemed acceptable.

Given this unexpected finding we conducted an EFA on the same sample to explore the latent structure of the NJRE-QR Severity scale. A principal-axis factoring method was used as the extraction method and the unrotated matrix yielded one factor with an eigenvalue of 4.64 and explained 66.3% of the total variance. All of the NJRE-QR Severity items loaded significantly on the single factor, with loadings ranging from .65 (items 13 and 16) to .87 (item 15), providing support for a unidimensional latent factor of NJRE.

Reliability Analysis

Internal Consistency

OC-TCDQ. The HA scale at pre-treatment: OCD sample (N = 193) ω = .92, ANX sample (N = 143) ω = .91 and at post-treatment: OCD sample (n = 84) ω = .95. The INC scale at pre-treatment: OCD sample (N = 193) ω = .92, ANX sample (N = 143) ω = .92 and at post-treatment: OCD sample (n = 84) ω = .96. These values indicate that the HA and INC scales of the OC-TCDQ had excellent internal consistency in this study.

NJRE-QR. The internal consistency of the Checklist score at pre-treatment was: OCD sample (n = 184) = .76, ANX sample (n = 141) = .82 and at post-treatment: OCD sample (n = 84) = .80, indicating good internal consistency. The McDonald's omega for the Severity score at pre-treatment was: OCD sample (n = 184) ω = .91, ANX sample (n = 141) ω = .95 and at post-treatment: OCD sample (n = 84) ω = .93 indicating excellent internal consistency.

Test-retest reliability

OC-TCDQ. The time between participants' (n = 31) completion of the questionnaire at pre-treatment and at week 1 of treatment was on average 4.10 (SD = 2.26) days, with a range of 1

– 8 days. Pearson's correlations demonstrated excellent test-retest reliability, $r = .89$, $p < .0001$ for both HA and INC.

NJRE-QR. The time between participants' ($n = 25$) completion of the questionnaire at pre-treatment and at week 1 of treatment was on average 4.00 ($SD = 2.24$) days, with a range of 1 – 8 days. Pearson's correlations demonstrated excellent test-retest reliability, $r = .94$, $p < .0001$, for the Checklist score, and good reliability, $r = .80$, $p < .0001$, for the Severity score.

Convergent and Discriminant Validity

Table 4 shows the correlations between OC-TCDQ (HA and INC), NJRE-QR (Checklist and Severity), YBOCS-SR, and the Depression, Anxiety, and Stress subscales of the DASS-21 in the OCD sample ($n = 183$). All correlations were statistically significant. The large positive correlations between INC and both the NJRE-QR Checklist and Severity, indicate good convergent validity which aligns with the theoretical connection between INC and NJRE constructs. Further evidence of convergent validity was found with the medium positive correlations between the OCD severity (i.e., YBOCS-SR) and both INC and NJRE severity. The correlation between INC and OCD severity was not significantly different than the correlation between NJRE severity and OCD severity ($z = - 0.14$, $p = .889$) indicating that both INC and the severity of NJREs are similarly associated with OCD severity. Although the strength of INC's correlation with OCD severity was not significantly different from its correlation with anxiety ($z = 0.73$, $p = .465$) or stress ($z = - 0.62$, $p = .538$). Similarly, the strength of NJRE-QR Severity's correlation with OCD severity was not significantly different from its correlation with anxiety ($z = 1.94$, $p = .053$) or stress ($z = 1.57$, $p = .117$).

To assess discriminant validity, given the conceptual similarity between INC and NJREs we investigated if the large correlation between INC and NJRE severity was significantly greater

than the medium correlations between INC and HA ($z = 2.44$, $p = .015$) and NJRE severity and HA ($z = 3.95$, $p < .001$) and found that it was, supporting the distinction between INC/NJREs and HA. Additionally, the correlation between INC and NJRE severity was significantly stronger than the correlations of NJRE severity with depression ($z = 4.09$, $p < .001$), anxiety ($z = 3.66$, $p < .001$), and stress ($z = 3.41$, $p < .001$), and the correlations of INC with depression ($z = 4.40$, $p < .001$) and anxiety ($z = 2.34$, $p = .019$), but not stress ($z = 1.06$, $p = .290$).

OC-TCDQ and NJRE-QR Scores in the OCD versus ANX sample

ANCOVAs were conducted to examine the effects of group membership, OCD ($N = 193$) vs. ANX ($N = 143$), on pre-treatment levels of HA and INC, while controlling for recent non-specific distress and arousal as measured by the Stress subscale of the DASS-21. The covariate of stress was found to be significant in both analyses, indicating that stress had a significant impact on levels of HA, $F(1, 333) = 96.36$, $p < .001$, $\eta_p^2 = .224$ and INC, $F(1, 333) = 96.36$, $p < .001$, $\eta_p^2 = .240$. There was no significant main effect of group membership on HA, $F(1, 333) = .42$, $p = .518$, $\eta_p^2 = .001$; the OCD and ANX samples did not significantly differ on the pre-treatment levels of HA. However, there was a significant main effect of group membership on INC, $F(1, 333) = 9.59$, $p = .002$, $\eta_p^2 = .028$. Specifically, the OCD sample reported significantly higher pre-treatment levels of INC compared to the ANX sample[2].

Next, ANCOVAs were conducted to examine the effects of group membership, OCD ($n = 184$) vs. ANX ($n = 141$), on pre-treatment NJRE-QR Checklist and Severity scores, while

[2] This analysis was reconducted with a subsample of the OCD sample who did not have a comorbid anxiety disorder diagnosis ($n = 93$) to determine if there was any potential confound of co-occurring anxiety on the results. The same pattern of results was found. The covariate of stress was found to be significant, indicating that stress had a large significant effect on levels of HA, $F(1, 233) = 73.65$, $p < .001$, $\eta_p^2 = .240$ and INC, $F(1, 233) = 57.85$, $p < .001$, $\eta_p^2 = .199$. There was no significant main effect of group membership on HA, $F(1, 233) = 0.25$, $p = .621$, $\eta_p^2 = .001$; the OCD and ANX samples did not significantly differ on the pre-treatment levels of HA. However, there was a small significant main effect of group membership on INC, $F(1, 233) = 6.17$, $p = .014$, $\eta_p^2 = .026$. Specifically, the OCD sample reported significantly higher pre-treatment levels of INC compared to the ANX sample.

controlling for stress. The covariate of stress was found to be significant in both analyses, indicating that stress had a significant impact on the NJRE-QR Checklist score, $F(1, 322) = 44.29$, $p < .001$, $\eta_p^2 = .121$ and Severity scores, $F(1, 322) = 75.12$ $p < .001$, $\eta_p^2 = .189$. There was no significant main effect of group membership on the NJRE-QR Checklist score, $F(1, 322) = 2.70$, $p = .101$, $\eta_p^2 = .008$; the OCD and ANX samples did not significantly differ on pre-treatment number of NJREs. However, there was a significant main effect of group membership on the NJRE-QR Severity score, $F(1, 322) = 16.51$, $p < .001$, $\eta_p^2 = .049$, after controlling for stress. Specifically, the OCD sample reported significantly more severe NJREs compared to the ANX sample[3].

Means and covariate-adjusted means for the OC-TCDQ and NJRE-QR in the OCD and ANX sample are presented in Table 5.

Within samples, paired samples *t*-tests revealed that the ANX sample scored significantly higher on HA than on INC, $t(142) = 2.84$, $p = .005$, $d = 0.24$, whereas in the OCD sample the scores on HA and INC were comparable, $t(192) = -.58$, $p = .561$, $d = 0.04$[4].

Sensitivity to Change

Table 6 demonstrates the results of the paired samples *t*-tests for OCD sample participants ($n = 84$) who completed the OC-TCDQ and the NJRE-QR before and after a 12-week group CBT for OCD program. Scores on the HA and INC scales decreased significantly,

[3] This analysis was reconducted with a subsample of the OCD sample who did not have a comorbid anxiety disorder diagnosis ($n = 93$) to determine if there was any potential confound of co-occurring anxiety on the results. The same pattern of results was found. The covariate of stress was found to be significant, indicating that stress had a medium significant effect on the NJRE-QR Checklist score, $F(1, 229) = 25.00$, $p < .001$, $\eta_p^2 = .098$ and a large effect on the Severity score, $F(1, 229) = 50.48$ $p < .001$, $\eta_p^2 = .181$. There was no significant main effect of group membership on the NJRE-QR Checklist score, $F(1, 299) = 2.75$, $p = .523$, $\eta_p^2 = .002$; the OCD and ANX samples did not significantly differ on pre-treatment number of NJREs. However, there was a small significant main effect of group membership on the NJRE-QR Severity score, $F(1, 299) = 11.39$, $p < .001$, $\eta_p^2 = .047$, after controlling for stress. Specifically, the OCD sample reported significantly more severe NJREs compared to the ANX sample

[4] When reconducted in a subsample of the OCD sample who did not have a comorbid anxiety disorder diagnosis ($n = 93$), scores on HA and INC remained non-significantly different, $t(92) = -.83$, $p = .407$, $d = 0.09$.

indicating that the OC-TCDQ is sensitive to change, despite the small effect size. Scores on the NJRE-QR Checklist scale did not significantly change from pre- to post-treatment, whereas scores on the NJRE-QR Severity scale decreased significantly with a medium effect size. These results suggest that although the NJRE-QR may not be sensitive to changes in the number of NJREs experienced over the past month, it appears to be sensitive to changes in the severity of how NJREs are experienced.

Discussion

This study sought to examine and compare the psychometric properties (factor structure, reliability, validity, and treatment sensitivity) of two of the most commonly used self-report measures of OCD-related INC/NJRE phenomena – the OC-TCDQ and NJRE-QR – in large Canadian clinical samples. Though previous studies have provided evidence of the reliability and validity of these measures in nonclinical and clinical samples (e.g., Coles et al., 2003; Summerfeldt et al., 2014), the two have not been evaluated systematically and concurrently within the same clinical sample. Therefore, we aimed to replicate and extend on this work by examining both measures' reliability and validity in a comparative analysis that may help inform researchers and clinicians about their potential uses.

The OC-TCDQ CFA fit indices indicated acceptable fit of a two-factor model, and a significantly worse fit for a one-factor model, despite HA and INC being significantly moderately correlated. This finding is consistent with previous research that has also found a two-factor solution with both EFA and CFA on the OC-TCDQ (Pietrefesa & Coles, 2008; Summerfeldt et al., 2014). Therefore, although the HA and INC motivations are significantly correlated in several studies (e.g., Belloch et al., 2016; Pietrefesa & Coles, 2008; Summerfeldt et

al., 2014) including the present study, there continues to be factor analytic support of the two-factor structure.

It was hypothesized that the NJRE-QR would have a one factor solution based on EFA conducted by Ghisi et al. (2010). Our CFA fit indices demonstrated that the NJRE-QR items had poor fit with a one factor solution. To the authors' knowledge this was the first CFA of the NJRE-QR and given this unexpected finding, we chose to perform an EFA to explore the measure's factor structure. Our EFA found one factor explaining 66.3% of the total variance, which was very similar to the previous EFA in an Italian language sample that found it accounted for 65% of the total variance (Ghisi et al., 2010). The discrepancy between the CFA and EFA may be attributed to the more stringent nature of CFA. Specifically, there may have been certain tensions between the rigid model constraints of the CFA and the item-level data, for example there may have been some degree of variance not fully explained by the hypothesized structure such as item cross loadings or item specific nuances. Considering that both analyses were conducted in the same sample, the CFA's relatively poor fit may indicate that there are nuances or multidimensionality that are not adequately captured by a single factor. This may be related to the nature of how the NJRE-QR Severity score is calculated as it is an average of various distinct features (e.g., frequency, intensity, immediate and delayed distress, rumination, urge to respond, and felt sense of responsibility) of the NJRE experience. Future studies should aim to see if a one factor structure of the NJRE-QR is replicable in other samples.

Both the OC-TCDQ and the NJRE-QR demonstrated excellent internal consistency in OCD and in mixed anxiety disorder samples. These results provide additional support that the items within the subscales of each measure are assessing the same construct (i.e., INC and NJRE), and replicate previous findings (e.g., Summerfeldt et al., 2014). Further evidence of the

reliability of these measures was found by investigating test-retest reliability. To our knowledge, this had yet to be investigated for the OC-TCDQ so our finding of excellent test-retest reliability (r = .89) provides initial support of the temporal stability of this trait measure of INC. As for the NJRE-QR, the only previous study investigating its test-retest reliability was conducted in a student sample over a one month period and found good (r = .76) temporal stability (Ghisi et al., 2010). Our finding of excellent reliability for the Checklist score and good reliability for the Severity score of the NJRE-QR provides initial support of the temporal stability of this measure in a clinical sample. The relatively lower test-retest reliability for the NJRE-QR Severity score compared to the Checklist score or the INC subscale of the OC-TCDQ is perhaps to be expected when considering the time frame anchor for each of these subscales. The NJRE-QR severity score is comprised of items rated based on the respondents' most recent NJRE (which may change day-to-day or even hour-to-hour), whereas the Checklist score is based on the number of NJREs the respondent has experienced over the past month, and the OC-TCDQ INC scale is based on how the respondent "typically" thinks, feels, and acts. Therefore, evidence of good temporal stability for the NJRE-QR Severity score is encouraging as it may suggest that the items in this scale can reliably measure how intense and distressing the respondent finds an NJRE in general. Overall, our results provide evidence in support of the reliability of the OC-TCDQ and the NJRE-QR in a large clinical sample.

Our findings indicate that both the OC-TCDQ and NJRE-QR have moderate to good convergent and discriminant validity. Regarding convergent validity, the OC-TCDQ INC scale and the NJRE-QR scales were highly inter-correlated, this finding supports the theoretical connection between INC and NJRE constructs. Further, INC and NJREs also demonstrated similar moderate positive correlations with OCD severity. However, it is important to note that

while INC and NJREs were significantly correlated with OCD severity (i.e., our convergent validity measure), the strength of these correlations were comparable to the strength of the correlations between INC/NJREs and general distress measures of anxiety and stress (i.e., our divergent validity measure). Therefore, this suggests that while INC and NJREs show convergent validity with OCD severity, they are also correlated with certain broader distress emotional markers, therefore warranting careful interpretation of their specificity to obsessive-compulsive symptoms. Regarding convergent validity, we found that the correlations between INC and NJRE severity were significantly stronger than their significant but more modest correlations with other constructs such as HA and general measures of distress (i.e., depression, anxiety, and stress). The exception to this was the correlation between INC and NJRE Severity (r = .59), which was not significantly different than that between INC and Stress (r = .52) but was significantly different than that between NJRE Severity and Stress (r = .38). Although this finding was not expected, the moderate positive correlation between INC and the Stress subscale of the DASS-21 suggests that these scales may be in part capturing underlying concepts with shared features. When investigated in a non-clinical sample, Belloch et al. (2016) also found a moderate positive correlation between DASS-21 Stress scores and NJRE Severity (r = .429) and INC (r = .351). The DASS-21 Stress scale is said to be sensitive to levels of chronic non-specific arousal and contains items such as "I was intolerant of anything that kept me from getting on with what I was doing" (Lovibond & Lovibond, 1995). It may therefore have some overlap with INC which involves a general state of discomfort or distress that an individual has difficulty tolerating and seeks to correct by feeling "just right".

In comparing HA and INC scores across those in the OCD sample and the ANX sample, while controlling for general recent distress, given the treatment-seeking nature of our sample,

our hypothesis was supported. HA levels were not significantly different between the samples, however, INC levels were significantly higher in those with a primary diagnosis of OCD as compared to those with a primary anxiety disorder diagnosis. INC has been suggested and found to be highly relevant to obsessive-compulsive phenomena, including OCD and obsessional personality traits (e.g., Ecker et al., 2014; Lee & Wu, 2019; Summerfeldt, 2004) and previous research has also found significantly higher INC scores in OCD samples compared to anxiety samples (Cervin et al., 2020; Ecker et al., 2014). Therefore, our finding is consistent with previous research and supports the importance of INC as a clinical characteristic in individuals with OCD.

Our hypothesis that NJRE-QR scores would be significantly higher in the OCD sample compared to the ANX sample was also partially supported. Interestingly, the OCD and ANX sample both experienced a comparable number of NJREs over the past month, however, as expected individuals in the ANX sample experienced significantly less distress as a result of NJREs as compared to the OCD sample. Our finding is consistent with previous research that has found that NJREs are near universally experienced (Coles et al., 2003) and are relevant to a broad range of symptom types (Fergus, 2014). However, Coles & Ravid (2016) also found significant differences in the number of NJREs experienced between OCD and anxiety samples. Our findings suggest that it is the distress associated with NJREs, and not the number of NJREs, that differentiates individuals with OCD compared to anxiety disorders. To date, the finding that the distress and urge to respond or correct NJREs is significantly greater in those with OCD compared to those with other disorders appears to be consistent across several studies (Chik et al., 2010; Coles & Ravid, 2016; Ghisi et al., 2010; Sica et al., 2015) including the present study. Consistent with the cognitive-behavioural model of OCD, significantly higher levels of NJRE

distress would strengthen the urge to engage in OCD behaviours in an attempt to reduce distress, and the temporary relief experienced would negatively reinforce the belief that the OCD behaviour is effective in reducing discomfort thus ultimately maintaining the OCD cycle.

Finally, our hypothesis that the OC-TCDQ and NJRE-QR would be sensitive to treatment changes was also supported and is consistent with previous research (e.g., Cervin et al., 2020; Coles & Ravid, 2016; Schwartz, 2018). Group CBT for OCD was associated with significant reductions in INC levels and how distressed people are by NJREs. Therefore, there appears to be initial support in the usefulness of these measures in tracking how INC and NJREs change in response to treatment.

Findings of this study expand our knowledge on the psychometric properties of the two most commonly used questionnaires for measuring INC and NJRE. The results provide additional support for the reliability and validity of the OC-TCDQ and NJRE-QR to measure INC and NJREs, respectively, in a clinical OCD sample. Although INC and NJREs share similarities, are significantly correlated, and the terms have often been used interchangeably, it is important for researchers and clinicians to consider the nuances in how they have been operationalized when deciding what measure to use.

The OC-TCDQ assesses INC, as well as HA, by having respondents consider how they "typically think, feel, and act" and appears to measure an individual's stable disposition to engage in behaviours in a specific way to reduce discomfort and feel "just right". Therefore, the OC-TCDQ is useful for measuring the extent to which two of the core motivations underlying OCD (i.e., INC and HA) are characteristic of their overall presentation. Designed as a trait measure, it provides a way to assess INC (and HA) consistently across situations and over time, which was supported by the findings of excellent test-retest reliability. The INC subscale of the

OC-TCDQ was also sensitive to differences between those with a primary diagnosis of OCD compared to those with a primary anxiety disorder, after non-specific distress was controlled for, providing support for its usefulness in determining if levels of INC differ across various clinical groups. Importantly, the OC-TCDQ was also modestly sensitive to change across treatment, therefore, this measure can be used in treatment outcomes studies to understand the extent to which treatment is associated with change in one's disposition of INC (and HA).

Practically, the OC-TCDQ is ideal for trait-focused assessments, particularly when a clinician wants to identify levels of HA and INC underlying a patient's OCD symptoms. The OC-TCDQ can assist in identifying the patient's primary motivation and can facilitate conversations about the extent to which INC and/or HA are driving the symptoms that will be targeted in treatment. This information can help facilitate treatment planning. For example, for symptoms driven by HA, exposures that allow the patient to learn that feared outcomes are unlikely to come true and cognitive techniques to challenge catastrophic thinking may be particularly relevant. Whereas for symptoms driven by INC, exposures that allow for the patient to sit with the discomfort of something feeling "not just right" and resisting the urge to complete or perfect tasks may help them learn they can tolerate these feelings. By administering the OC-TCDQ at different points in treatment, clinicians can track changes in HA and INC levels over time as an additional way to help determine if treatment is having the intended effect.

The NJRE-QR assesses the number and severity of NJREs over the past month and represents a state-like measure of these experiences. The 10 NJRE checklist items provide respondents with examples of NJREs, and the most recent one experienced is used to generate a NJRE severity score based on ratings of how it was experienced (i.e., its frequency, intensity, distress, urge to respond, etc.) Therefore, it is important for users of this measure to keep in mind

that if administering this measure over multiple time points the respondent may be answering the severity scale items with a different NJRE than when they previously completed the questionnaire. This may speak to the finding of good (but not excellent) test-retest reliability despite being assessed with a relatively short retest period. The NJRE-QR Severity scale, but not the Checklist scale, appears to be sensitive to changes across treatment and to differences between those with a primary diagnosis of OCD compared to those with a primary anxiety disorder. Therefore, the NJRE-QR may be particularly useful to determine if the discomfort associated with NJREs differs across treatment or various clinical groups.

Ultimately, when the measures are used in combination they can provide a comprehensive understanding of an important phenomenon in OCD from trait and state perspectives.

Practically, the NJRE-QR suits evaluations of recent NJREs to assess how frequently they occur and their intensity/distress. The items from the Checklist scale could help identify examples of situations that are likely to trigger NJREs and prompt ideas for potentially relevant exposures for the patient. Additionally, the patient's ratings on the items that comprise the Severity scale may help the clinician understand which factors (i.e., frequency, intensity, immediate distress, delayed distress, rumination, urge to respond, and felt sense of responsibility) related to the NJRE are contributing to their distress/interference. By administering the NJRE-QR at different points in treatment, clinicians can track changes in NJREs' frequency and impact. A reduction particularly in the Severity score may indicate that the client is becoming less reactive to NJREs, suggesting that the treatment is having the desire effect. Whereas, if the Severity score remains high over treatment, this may prompt the clinician to adjust treatment strategies to incorporate more exposures to practice tolerating NJREs and possibly cognitive techniques to challenge beliefs related to perfectionism and control.

Strengths of this study include our large clinical sample of individuals with OCD and anxiety disorders. Additionally, evaluating the reliability and validity of the OC-TCDQ and NJRE-QR simultaneously in one paper may help researchers and clinicians interested in these concepts have easier access to the measures' psychometrics and inform their use. However, our findings should be interpreted within the context of study limitations. First, our sample was comprised of treatment-seeking patients referred to a specialized anxiety and related disorders outpatient clinic within a Canadian hospital. Additionally, the sample was relatively homogenous and there was considerable amounts of missing demographic data which limits our understanding of who comprises the samples. Therefore, while the clinical samples included in this study enhances the study's relevance to clinical practice, it may limit the generalizability to more diverse or non-clinical populations. Additionally, because the study was conducted in a naturalistic treatment setting not all participants were assessed using the DART. Although the psychiatrist assessments were comprehensive, it would be ideal to have greater consistency in the assessment process across participants. Further, despite our large sample size, some analyses had sample sizes that were smaller than ideal. Specifically, our sample size of 193 OCD participants for the CFA of the OC-TCDQ is slightly below the generally recommended adequate sample size requirements of a minimum sample size of 200 or a ratio of sample size to model variables of ≥10 (Myers et al., 2011). This may have contributed to reduced power for this analysis, especially as some CFA fit indices (i.e. chi-square/df ratio) are more influenced by sample size compared to others (i.e., RMSEA). Additionally, our sample size for the test-retest reliability analysis was comparably smaller than our other analyses as the questionnaires were added to the week 1 timepoint at a later date than the pre- and post-treatment timepoints. Given this, we urge caution in interpreting the strength of the conclusions drawn from the CFAs and the test-retest

reliability analyses. Future studies may wish to replicate these analyses with a larger sample. Additionally, our test-retest reliability time frame (i.e., pre-treatment to week 1 of treatment) was short because the questionnaires were being administered to participants in active treatment and we wished to avoid the potential confound of changes due to treatment. Therefore, it would be helpful to explore the temporal stability of these measures at longer time frames when participants are not in active treatment. Finally, for the treatment sensitivity analysis, given that there was not a control group that did not receive treatment we cannot determine the extent to which the changes in OC-TCDQ and NJRE-QR scores were a result of treatment rather than natural fluctuations over time. Future research conducted with a control group that does not receive active treatment is needed to help clarify this.

The OC-TCDQ and the NJRE-QR have allowed for significant insights to be gained into the constructs of INC and NJREs within OCD and related disorders over the past two decades since their initial development. Although the purpose of this study was to evaluate the psychometric properties of two of the most commonly used measures in this area of research, it is important to acknowledge that our understanding of these constructs has evolved since the development of these measures and thus have limitations. Specifically, these measures may not fully capture the nuanced ways in which INC and NJREs manifest across diverse clinical and nonclinical populations. Additionally, research has suggested that INC can be thought of as a multidimensional construct (e.g., Sibrava et al., 2016; Summers et al., 2014; Zor et al., 2011). For example, Boisseau et al. (2018) developed the Brown Incompleteness Scale (BINCS) to create a clinician-rated multidimensional measure with a range of relevant characteristics to INC including perfectionism, sensory manifestations, and difficulties with goal-directed behaviour. Additionally, behavioural paradigms have been developed to cause a sense of INC across various

sensory domains which can allow for an assessment of INC while reducing retrospective self-report bias (e.g., Cougle et al., 2013; Summers et al., 2014). Alternative methods to assess INC/NJREs should continue to be investigated particularly in clinical populations to further advance of understanding of these phenomena.

Conclusion

In conclusion, the OC-TCDQ and NJRE-QR are brief and easy-to-administer self-report questionnaires that assess INC and NJRE respectively. These distinct but related constructs are important to understanding the phenomenology of OCD. Using data from large naturalistic treatment-seeking clinical samples, the present findings expand our knowledge of the psychometric properties of these two most commonly used questionnaires for measuring INC and NJRE. Overall, this study provides further evidence of the reliability and validity (i.e., structural, internal and test-retest reliability, construct, convergent and discriminant validity, and treatment sensitivity) of the OC-TCDQ and NJRE-QR to measure INC (trait) and NJRE (state) phenomena respectively in OCD and anxiety disorder samples.

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Table 1

Demographics.

Variable	OCD sample (N = 193)	ANX sample (N = 143)	Comparisons
Age			$t(334) = -4.77$, $p < .001$
Mean (*SD*)	31.53 (10.47)	37.33 (11.70)	
Gender			$\chi^2(1)^a = 1.32$, $p = .290$
Man	54 (28.0%)	30 (21.0%)	
Woman	111 (57.5%)	84 (58.7%)	
Trans Man	0 (0.00%)	1 (0.7%)	
Non-Binary	2 (1.0%)	0 (0.0%)	
Other	0 (0.0%)	1 (0.7%)	
Missing	26 (13.5%)	27 (18.9%)	
Sex			$\chi^2(1) = 1.00$, $p = .340$
Male	61 (31.6%)	38 (26.6%)	
Female	132 (68.4%)	105 (73.4%)	
Relationship status			$\chi^2(1) = .99$, $p = .340$
Single	62 (32.1%)	59 (41.3%)	
In a relationship	96 (49.7%)	72 (50.4%)	
Missing	35 (18.1%)	12 (8.4%)	
Education			$\chi^2(2) = 6.61$, $p = .037^b$
Some or completed high school	18 (9.3%)	19 (13.3%)	
Some or completed post-secondary education	121 (62.7%)	86 (60.1%)	
Some or completed graduate school	23 (11.9%)	6 (4.2%)	
Missing	31 (16.1%)	32 (22.4%)	
Ethnicity			$\chi^2(1)^c = .26$, $p = .710$
White	143 (74.1%)	89 (62.2%)	
Indigenous	2 (1.0%)	3 (2.1%)	
Black	1 (0.5%)	3 (2.1%)	
Asian	13 (6.7%)	7 (4.9%)	
Hispanic	1 (0.5%)	0 (0.0%)	
Biracial	0 (0.0%)	2 (1.4%)	
Other	3 (1.6%)	0 (0.0%)	
Missing	30 (15.5%)	39 (27.3%)	

Note. Full demographic data were not available for all participants. A category for missing data was added to each of the demographic variables where there was missing data.

[a] The chi-square analysis was only conducted on those who identified as a man or women due to the small sample size in the other gender categories.

[b] Although the chi-square analysis indicated a significant difference in the distribution of education level between the OCD sample and the ANX sample post-hoc comparisons revealed no significant differences after using Bonferroni corrections for multiple comparisons.

[c] The ethnicity data was recoded to non-racialized (i.e. white) and racialized (i.e., all other ethnicity groups) for the chi-square analysis.

Table 2

Confirmatory Factor Analysis and Item-Level Descriptives for the OC-TCDQ

Item #	Item (abbreviated)	Factor Loading	*SE*	95% CI	*M*	*SD*	r^{it}
Factor 1: Harm Avoidance							
1	Sense of apprehension	.669			2.31	1.98	.694
3	Need to prevent harm	.758	.080	.601 - .915	2.22	1.29	.796
5	Steps to prevent	.719	.079	.563 - .875	2.41	1.24	.759
7	More threatening to me	.524	.077	.373 - .675	2.12	1.30	.606
9	Things could cause harm	.665	.079	.510 - .820	1.39	1.20	.716
11	Afraid of consequences	.818	.081	.659 - .977	2.40	1.26	.832
13	On the lookout	.808	.081	.650 - .966	2.19	1.25	.822
15	Can't ignore fears	.831	.081	.672 - .990	2.80	1.22	.834
17	Think what might happen	.835	.081	.677 - .993	2.59	1.18	.837
19	Wish could avoid	.702	.079	.547 - .857	2.13	1.21	.734
Factor 2: Incompleteness							
2	Do in set way	.685			2.23	1.17	.714
4	Sense of imperfect	.766	.079	.612 - .920	2.11	1.25	.794
6	Not feel right	.799	.078	.645 - .953	2.56	1.22	.818
8	Re-do or prolong	.738	.078	.584 - .892	2.27	1.20	.757
10	Activities take longer	.763	.078	.610 - .916	2.20	1.28	.775
12	Trying to get "just right"	.847	.080	.691 - 1.00	2.33	1.24	.841
14	Feeling when completed	.585	.077	.434 - .736	2.22	1.26	.665
16	Very particular	.780	.078	.626 - .934	2.33	1.31	.809
18	Time to feel certain	.679	.078	.527 - .831	2.53	1.10	.715
20	Know if something certain	.567	.077	.416 - .718	2.19	1.21	.647

Note. The standard error (SE) and 95% confidence interval (CI) is not available for the first item of each factor as the weight was fixed to 1 for model identification purposes. All factor loadings and item-total correlations were significant at $p < .001$

Table 3

Confirmatory Factor Analysis and Item-Level Descriptives for the NJRE-QR

Item #	Item (abbreviated)	Factor Loading	*SE*	95% CI	*M*	*SD*	r^{it}
13	Frequency	.656			5.79	1.72	.710
14	Intensity	.841	.086	.673 - 1.01	4.17	1.66	.850
15	Distress at the time	.873	.087	.703 - 1.04	4.02	1.67	.866
16	Distress later that day	.647	.082	.486 - .808	2.98	1.85	.716
17	Persistence	.814	.086	.646 - .982	3.39	1.94	.854
18	Urge	.821	.086	.653 - .989	4.34	2.06	.850
19	Responsibility	.787	.084	.621 - .953	4.17	2.13	.831

Note. The standard error (SE) and 95% confidence interval (CI) is not available for the first item as the weight was fixed to 1 for model identification purposes. All factor loadings and item-total correlations were significant at $p < .001$

Table 4

Correlations Demonstrating Convergent and Discriminant Validity of the OC-TCDQ and NJRE-QR in the OCD Sample (n = 183)

	OC-TCDQ: INC	NJRE-QR Checklist	NJRE-QR Severity	YBOCS-SR	DASS-21 Depression	DASS-21 Anxiety	DASS-21 Stress
OC-TCDQ: HA	.415**	.180*	.319**	.298**	.307**	.417**	.456**
OC-TCDQ: INC		.555**	.586**	.478**	.251**	.425**	.518**
NJRE-QR: Checklist			.475**	.269**	.178*	.264**	.372**
NJRE-QR: Severity				.486**	.272**	.342**	.379**
YBOCS-SR					.282**	.350**	.445**
DASS-21 Depression						.502**	.550**
DASS-21 Anxiety							.696**

Note. * = $p < .05$, ** $p = \leq .01$

Table 5

Unadjusted and Covariate-Adjusted Descriptive Statistics of the OC-TCDQ and the NJRE-QR for the OCD and ANX Samples

	Unadjusted		Co-variate Adjusted	
	M	*SD*	*EMM*	*SE*
OC-TCDQ: HA				
OCD *(N = 193)*	22.55	9.29	23.16	.57
ANX *(N = 143)*	23.41	8.24	22.59	.66
OC-TCDQ:INC				
OCD *(N = 193)*	22.97	9.22	23.61	.57
ANX *(N = 143)*	21.75	8.59	20.90	.66
NJRE-QR: Checklist				
OCD (*n* = 184)	4.22	2.73	4.36	.19
ANX (*n* = 141)	4.06	2.86	3.87	.22
NJRE-QR: Severity				
OCD (*n* = 184)	4.12	1.51	4.22	.10
ANX (*n* = 141)	3.70	1.61	3.58	.12

Note. The covariate was the pre-treatment Stress subscale of the DASS-21.

M = Mean; *SD* = Standard Deviation; *EMM* = Estimated Marginal Means; *SE* = Standard Error.

Table 6

Paired Samples t-tests of the OC-TCDQ and NJRE-QR Before and After Group CBT for OCD (n = 84)

Measure	Pre-treatment	Post-treatment	*t*-test	Effect Size (Cohen's d)
OC-TCDQ: HA	22.64 (9.79)	20.98 (10.09)	$t = 2.00$, $p = .049$*	0.22
OC-TCDQ: INC	22.56 (9.43)	20.31 (10.25)	$t = 2.64$, $p = .010$**	0.29
NJRE-QR Checklist	4.33 (2.73)	3.98 (2.89)	$t = 1.63$, $p = .106$	0.18
NJRE-QR Severity	4.18 (1.51)	3.71 (1.50)	$t = 3.18$, $p = .002$**	0.35

Note. * = $p < .05$, ** $p = \leq .01$, all $df = 83$

CHAPTER 4

STUDY 3: CHANGES IN HARM AVOIDANCE AND INCOMPLETENESS ACROSS GROUP CBT FOR OCD AND THEIR RELATIONSHIP WITH SYMPTOM CHANGE

Puccinelli, C., Rowa, K., Summerfeldt, L. J., & McCabe, R. E. (2024). Changes in harm avoidance and incompleteness across group CBT for OCD and their relationship with symptom change. *Behavioural and Cognitive Psychotherapy*, 1-15. https://doi.org/10.1017/S1352465824000274

The previous chapter demonstrated that the core motivations can be reliably and validly assessed with existing measures such as the OC-CDQ. Given that OCD has significant negative impacts on functioning and quality of life it is important to explore if the core motivations that underlie and drive symptoms are being adequately reduced in our current psychological treatments for OCD. This chapter examined if HA and INC significantly decrease across group CBT for OCD and explored how 1) pre-treatment HA and INC levels and 2) changes in the core motivations across treatment, are predictive of OCD treatment outcomes. This study contributes

to a better understanding of whether HA/INC are moderators of treatment outcomes and considerations regarding if and how treatment can be tailored to the core motivations.

Changes in harm avoidance and incompleteness across group CBT for OCD and their relationship with symptom change

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Abstract

Background: Obsessive-compulsive disorder (OCD) symptoms are hypothesized to be driven by two core motivations: harm avoidance and incompleteness. While cognitive-behavioural therapy (CBT) is an effective treatment for OCD, many posit that OCD presentations characterized by high incompleteness may be harder to treat. The relationship between the core motivations and treatment outcomes remains to be further explored. **Aims:** To investigate if harm avoidance and incompleteness decrease across group CBT and to examine the relationship between treatment outcomes and both baseline and changes in harm avoidance and incompleteness throughout treatment. **Method:** A naturalistic sample of 65 adult outpatients with OCD completed self-report questionnaires measuring OCD symptom severity and the core motivations before, during, and after 12 weeks of group CBT for OCD. **Results:** Harm avoidance and incompleteness scores significantly decreased from pre- to post-treatment. Pre-treatment harm avoidance and incompleteness levels did not predict post-treatment symptom severity, but changes in the core motivations throughout treatment were significant predictors of treatment outcome. Specifically, reductions in harm avoidance across treatment and reductions in incompleteness early in treatment, were associated with better treatment outcomes. **Conclusions:** Participants who completed group CBT for OCD experienced modest reductions in the core motivations thought to maintain OCD symptoms and these changes predicted better outcomes. However, pre-treatment levels of harm avoidance and incompleteness do not appear to moderate treatment outcome.

Keywords: Obsessive-compulsive disorder, cognitive-behavioural therapy; harm avoidance; incompleteness; not just right experiences; treatment outcome

Introduction

Obsessive-compulsive disorder (OCD) affects approximately 1-3% of people (Kessler et al., 2012; Ruscio et al., 2010). Without treatment, individuals with OCD often experience chronic symptoms, significant impairment in functioning, and reduced quality of life (American Psychiatric Association [APA], 2013; Macy et al., 2013). The first-line psychological treatment for OCD is cognitive-behavioural therapy (CBT) with exposure and response prevention (ERP; National Institute for Health & Clinical Excellence, 2005) and studies have demonstrated its efficacy (McKay et al., 2015) and effectiveness (Ferrando & Selai, 2021). However, many patients who complete treatment do not achieve symptom remission or experience a significant treatment response (Simpson et al., 2006). Therefore, there have been efforts to determine what factors contribute to and predict treatment response (e.g., Keeley et al., 2008; Raffin et al., 2009).

One avenue has been to investigate if the clinical presentation of OCD affects treatment outcomes. Given that OCD has a heterogeneous presentation, there have been efforts to categorize the various obsessions and compulsions (Calamari et al., 1999, 2004; Leckman et al., 1997). OCD presentations are commonly categorized based on overt symptom presentations, such as contamination obsessions/decontamination compulsions, doubting obsessions/checking compulsions, unacceptable thoughts/mental compulsions, and symmetry obsessions/ordering compulsions (McKay et al., 2004). However, symptom-based subtyping has unreliably advanced our understanding of which OCD presentations demonstrate poor treatment outcomes. There is some evidence that when hoarding (which are no longer conceptualized as part of OCD) or unacceptable thoughts/mental compulsions are the primary concern, individuals have attenuated outcomes compared to other OCD symptom presentations (Mataix-Cols et al., 2002; Rufer et al., 2006; Starcevic & Brakoulias, 2008; Williams et al., 2014). However, other studies have not

found significant differences in treatment outcomes for unacceptable thoughts (Abramowitz et al., 2003; Chase et al., 2015). Additionally, there are larger discussions in the literature regarding the issues with categorical diagnostic approaches to mental health (including OCD symptom categorization) and the move towards transdiagnostic approaches to understanding clinical presentations (e.g., Dalgleish et al., 2020). Symptom-based categorization also does not account for the heterogeneity in the underlying processes motivating and maintaining OCD symptoms. For example, an individual with contamination obsessions might engage in excessive handwashing to prevent themselves/others from getting sick, whereas someone else might be doing so because they do not feel completely clean. By shifting the focus from *what* overt symptoms someone with OCD experiences to *why* the obsessions and compulsions are occurring, we can develop a new perspective to understand treatment response.

The Core Dimensions Model of OCD states that two core motivations underlie OCD symptoms – harm avoidance (HA) and incompleteness (INC; Summerfeldt, 2004; Summerfeldt et al., 2014). HA is the motivation to engage in compulsions to prevent a potential feared consequence or decrease the probability of a negative event and is often accompanied by emotions such as anxiety or fear (e.g., "My books need to be arranged a certain way to prevent my mom from getting in a car crash"). INC is the motivation to engage in compulsions to counteract an internal sense of discomfort, described as feeling like something is "not just right", often accompanied by emotions such as tension and feeling discontented or stuck (e.g., "My books need to be arranged a certain way to feel complete"). It is believed that HA (i.e., attempting to prevent harm) and INC (i.e., reducing subjective feelings of internal discomfort) in combination, and to varying degrees, are the underlying motivational factors driving compulsions.

Many studies support the validity of the HA and INC motivations in OCD. Confirmatory factor analyses support that HA and INC are separate constructs in nonclinical and clinical samples, despite being significantly correlated (Pietrefesa & Coles, 2008; Summerfeldt et al., 2014). HA and INC have consistently correlated with OCD symptoms (e.g., Belloch et al., 2016; Pietrefesa & Coles, 2008), and INC has predicted obsessive-compulsive symptoms, even after controlling for HA (Taylor et al., 2014).

INC is more specific to OCD than HA and is useful for discriminating between those with OCD and those with anxiety disorders or depression (Ecker et al., 2014; Ghisi et al., 2010). Although INC can be present to varying extents in many individuals with OCD and throughout the general population, high or problematic levels of INC are associated with increased OCD severity, higher rates of comorbidity, lower functioning and quality of life, and increased rates of unemployment and disability as compared to those with little or no current INC (Belloch et al., 2016; Sibrava et al., 2016). Therefore, it is important to examine if INC levels impact treatment outcomes and better understand whether existing OCD treatments are adequately addressing this underlying motivation.

Cognitive-behavioural models of OCD emphasize catastrophic misinterpretations of the significance of one's intrusive thoughts, causing fear or distress which prompts the performance of compulsions in attempt to reduce distress and prevent perceived feared consequences (Rachman, 1997, 1998; Salkovskis, 1985, 1989). Consistent with this, CBT for OCD typically involves ERP where obsessions are purposefully and repeatedly triggered to practice refraining from compulsions to learn that the feared outcome does not come true, resulting in fear extinction over time. Treatment can also involve cognitive strategies to challenge threat-related distorted beliefs about the likelihood of negative events, the importance of thoughts, and inflated

sense of responsibility. The applicability of these treatment components to HA OCD presentations is clear, but their application to INC presentations remains to be better understood. Given that INC is not associated with a feared consequence and instead compulsions are motivated to reduce the discomfort of the experience, fear habituation/extinction through ERP or modifying threat-related cognitive biases through cognitive techniques may not be as directly applicable.

Early indirect evidence suggested that OCD presentations motivated by INC may be less likely to respond to treatment. For example, patients with OCD who did not endorse feared consequences were less likely to benefit from ERP treatment than those who did endorse feared consequences (Foa et al., 1999). However, some recent research has provided a more hopeful outlook for OCD presentations characterized by INC and not just right experiences (NJREs). INC and NJREs are closely related and the terms have been used interchangeably in this line of research (e.g., Coles & Ravid, 2016). Whereas INC is conceptualized as a trait-like construct, NJREs may represent fluctuating state expressions of INC (Belloch et al., 2016; Summerfeldt et al., 2014). Coles and Ravid (2016) found that treatment led to significant reductions in HA and INC, significantly fewer NJREs, and less NJRE distress. A meta-analysis found that INC levels had significant but modest improvements throughout treatment (Schwartz, 2018). It was also suggested that unless current treatments are explicitly tailored to INC, they may not sufficiently target INC (Schwartz, 2018).

Furthermore, the implications of baseline HA and INC motivations on OCD treatment outcomes are not well understood. In children with OCD, higher baseline levels of INC, but not HA, predicted poorer treatment outcomes (Cervin & Perrin, 2021). This has yet to be investigated in adults. It is also important to investigate if and when changes in the underlying

core motivations of OCD are associated with treatment outcomes. This would help us understand if the underlying motivations maintaining OCD are mediators of CBT outcome. Additionally, it may prompt ideas about how to better tailor treatments for OCD or what strategies to emphasize in treatment and when. Cervin et al. (2020) found that change in INC, but not HA, was related to pre- to post-treatment change in OCD severity for children with OCD. To our knowledge, this has not been investigated in an adult sample.

The purpose of this study was to examine if core motivations of OCD (i.e. HA and INC) significantly decrease across treatment and are associated with treatment outcomes in adults who completed group CBT for OCD. Specifically, we investigated a) if pre-treatment levels of the HA and INC motivations are significant predictors of post-treatment OCD outcomes, and b) if changes in HA and INC throughout treatment (including changes early and later in treatment) were associated with post-treatment OCD outcomes. Based on previous studies, we hypothesized that the HA and INC motivations would significantly decrease from pre- to post-treatment. Given the general discourse that OCD presentations characterized by high levels of INC may not respond as well to existing treatments and previous research (e.g., Cervin & Perrin, 2021), we hypothesized that higher pre-treatment levels of INC would predict poorer post-treatment OCD outcomes, however, we believed that higher pre-treatment levels of HA would not be a significant predictor of treatment outcome . Finally, because the core motivations are thought to maintain OCD symptoms we hypothesized that decreases in HA and INC would be associated with better outcomes.

Methods

Participants

Participants were 65 treatment-seeking adult outpatients at a specialized anxiety and related disorders clinic in Ontario, Canada. All participants had a confirmed diagnosis of OCD and OCD was the primary mental health concern when they were referred to group CBT for OCD treatment. To ensure that participants had clinically significant symptoms of OCD when starting treatment, only those with a pre-treatment Yale-Brown Obsessive-Compulsive Scale (YBOCS) score > 12 were retained in the sample[1]. A YBOCS score of ≤ 12 has been commonly used to define symptom remission (e.g., Mataix-Cols et al., 2016; Simpson et al., 2006), by including participants with a score >12 we retained those with more mild yet clinically significant OCD presentations. The participants represent a naturalistic treatment-seeking sample, therefore, participants were not excluded based on factors such as additional diagnoses, medication status[2], or age. Twenty-two (33.8%) participants had no additional diagnoses, 21 (32.3%), 12 (18.5%), 6 (9.2%), and 4 (6.2%) participants had one, two, three, and four additional diagnoses respectively. The most common additional diagnoses were generalized anxiety disorder (33.9%), major depressive disorder (21.5%), social anxiety disorder (18.5%), and persistent depressive disorder (10.8%). See Table 1 for a summary of the study sample demographics.

Procedure

Participants were referred to the clinic by a healthcare professional (e.g., primary care physician). All participants received a diagnostic assessment from a trained mental health clinician according to the 5th edition of the *Diagnostic and Statistical Manual of Mental*

[1] The authors acknowledge that a YBOCS score of ≥16 is the typical cut-off score for inclusion in clinical research. A cut-off score of >12 was decided in this naturalistic study as all participants were required to have a diagnosis of OCD and we did not want to exclude those with milder presentations. Four participants in our sample had a pre-YBOCS score >12 but <16.
[2] Medication status was not routinely collected and therefore is not available for this study.

Disorders (*DSM-5*; APA, 2013). A total of 55.4% (*n* = 36) were assessed using the Diagnostic Assessment and Research Tool (McCabe et al., 2017; Schneider et al., 2022) and 44.6% (*n* = 29) received an assessment through a psychiatric consult which consists of a comprehensive diagnostic assessment with an experienced psychiatrist. Participants were referred for and completed group CBT for OCD. Self-report measures were administered electronically as part of regular treatment procedures before, during, and after treatment via Research Electronic Data Capture (REDCap; Harris et al., 2009, 2019). The study questionnaires were part of a larger battery of measures completed by participants. The data was collected from January 2019 to August 2022.

Study procedures were approved by the institution's local research ethics board. All participants provided informed consent for their data to be used in research.

Treatment

All participants included in this sample completed group CBT for OCD. The 12-week manualized treatment protocol was developed at our clinic based on several widely used CBT treatment guides and protocols for OCD (e.g., Antony et al., 2007; Foa et al., 2012) and emphasized ERP with additional cognitive strategies to address underlying OCD-relevant beliefs. Participants received 12 weekly 2-hour group sessions that focused on psychoeducation about OCD and CBT, creation of an exposure hierarchy, in-session ERP, review and troubleshooting of exposures completed between sessions, and exercises designed to challenge beliefs (e.g., responsibility pie). The initial sessions focused on psychoeducation, ERP began early in treatment (i.e., by the 3rd or 4th session), cognitive techniques were added by session 6, and both skills were continued throughout treatment, session 12 reviewed skills and discussed how to maintain gains and prevent relapse. Although not explicitly mentioned in the treatment

manual, INC and NJREs were integrated into the treatment discourse as examples of the range of affective responses associated with symptoms at the therapists' discretion.

Groups consisted of approximately eight to 12 patients and were led by two to three clinicians. Clinicians had graduate-level or post-professional training in CBT and included at least one senior clinician with extensive training in CBT for OCD. Graduate-level clinicians received weekly supervision from a senior psychologist.

Participants included in this study completed treatment, which was defined as having attended ≥ 8 sessions and attended at least one of sessions 10 - 12. Participants who completed treatment between January 2019 and December 2020 received treatment in-person (n = 17, 26.2%). Due to the COVID-19 pandemic, those who attended treatment between January 2020 and April 2020 received hybrid (i.e., both in-person and virtual treatment via videoconference) treatment (n = 3, 4.6%), and those who completed treatment between May 2020 and August 2022 received virtual treatment (n = 45, 69.2%). Studies using data from our clinic have shown no significant differences in outcomes of group CBT for OCD delivered face-to-face or via videoconference (Milosevic et al., 2022) and therefore all participants were merged for analyses. See the supplementary material for additional analyses that support that there were no significant effects of treatment modality on the results of this current study.

Measures

Yale-Brown Obsessive-Compulsive Scale- Self-report (YBOCS-SR; Baer et al., 1993; Goodman et al., 1989). The YBOCS-SR is a 10-item measure of OCD severity. Items assessing the time spent, interference, distress, resistance, and control of obsessions and compulsions over the last seven days are rated on a five-point scale from 0 (none) to 4 (extreme). Total scores range from 0 to 40, with higher scores reflecting greater severity. The YBOCS-SR has demonstrated excellent

internal consistency, test-retest reliability. and good convergent validity with other OCD measures and the interviewer-administered version of the YBOCS (Baer et al., 1993; Federici et al., 2010; Steketee et al., 1996) as well as discriminant validity (Ólafsson et al., 2010). The internal consistency coefficients for the YBOCS-SR total score in this study were α = .78 at pre-treatment and α = .94 at post-treatment.

Obsessive-Compulsive Trait Core Dimensions Questionnaire (OC-TCDQ; Summerfeldt et al., 2014). The OC-TCDQ is a 20-item self-report measure assessing the HA (10 items; e.g., "Even if harm is very unlikely, I feel the need to prevent it at any cost") and INC (10 items; e.g., "I feel driven to re-do or prolong activities or tasks until they feel 'just right'") motivations on a five-point Likert-type scale from 0 (never applies to me) to 4 (always applies to me). The HA and INC subscale scores range from 0 to 40. The OC-TCDQ has demonstrated good psychometric properties including high internal consistency, and strong structural and convergent validity (Coles et al., 2005; Summerfeldt et al., 2014). The internal consistency coefficients for both the HA and INC subscales were α = .92 at pre-treatment and α =.94 at post-treatment.

Statistical Analyses

Analyses were conducted using SPSS (version 23.0) and R v4.3.1 (R Core Team, 2023). The analysis is a completers-only analysis[3] and complete pre- and post-treatment data were available for all measures. Paired-sample t-tests were used to analyze the statistical significance of pre- to post-treatment changes in the self-report measures administered. The effect size of these changes is represented by Cohen's *d*.

[3] A random sample of 30 treatment non-completers from our clinic was compared to our current sample using independent samples *t*-tests and we found no significant differences on any of the baseline clinical measures (i.e., YBOCS-SR, OC-TCDQ; all *p*s > .05)

To examine the relationship between pre-treatment levels of the HA and INC motivations and treatment outcome, a series of hierarchical linear mixed models predicting post-treatment OCD severity (YBOCS-SR) were fit with the fixed effect of pre-treatment OCD severity (YBOCS-SR) and the simple random effect of OCD group entered in block 1 and pre-treatment levels of HA and INC (OC-TCDQ) entered as fixed effects in block 2. These regression models examined whether pre-treatment levels of the core motivations predicts the severity of OCD symptoms at post-treatment while controlling for the severity of OCD symptoms at pre-treatment. Overall hierarchical model comparisons and tests of individual predictors were performed with likelihood ratio tests (LRTs), with mixed models being fit using the R v4.3.1 (R Core Team, 2023) package lme4 v1.1-34 (Bates et al., 2015) or glmmTMB v1.1.7 (Brooks et al., 2017) in the case of a singular fit with lme4.

To examine whether changes in HA and INC over treatment are predictive of OCD treatment outcomes, change scores were calculated for HA and INC (i.e., time point 2 score subtracted from time point 1 score; therefore, negative scores indicate reductions in scores over time). First, we fit a series of hierarchical linear mixed models to examine whether the change scores in HA and INC from pre- to post-treatment are predictive of post-treatment OCD severity, while controlling for pre-treatment OCD severity. To understand when changes in HA and INC are predictive of treatment outcomes we conducted a set of analyses with early change (i.e., change from pre- to mid-treatment) and late change (i.e., change from mid- to post-treatment) in HA and INC as predictors in the models. Ten participants did not complete the mid-treatment questionnaires and therefore the early and late change analyses have a sample size of 55 participants. Independent samples t-tests indicated that these 10 participants did not differ from

the 55 participants who completed the questionnaires at all time points on any of the baseline clinical measures (all *p*s > .05).

All assumptions of the statistical tests described above were met. The Holm-Bonferroni correction method (Holm, 1979) was subsequently applied to the 4 series of hierarchical linear mixed-effects models to adjust the family-wise error rate for multiple comparisons to determine if findings held.

Results

Pre- to Post-Treatment Changes in OCD Symptoms and Motivations

Table 2 shows the means (and standard deviations), paired t-test values, and effect sizes for all study measures pre-and post-treatment. Participants experienced large significant decreases in OCD symptom severity. Additionally, the HA and INC motivations significantly decreased from pre- to post-treatment, with small to medium effect sizes.

Do Pre-Treatment HA and INC Scores Predict Treatment Outcome?

The first model, which only included pre-treatment YBOCS-SR scores as a fixed effect and OCD treatment group as a random effect, indicated that pre-treatment OCD severity was significantly associated with post-treatment OCD severity ($\beta = .616$, SE = .0987, LRT $\chi^2_1 = 30.65$, $p < .0001$). However, the second model, which additionally included pre-treatment HA and INC scores did not show significant improvement from the first model (LRT $\chi^2_2 = .536$, $p = .765$). Pre-treatment levels of HA ($\beta = -.016$, SE = 0.11, LRT $\chi^2_1 = .039$, $p = .84$) and INC ($\beta = .071$, SE = .11, LRT $\chi^2_1 = .53$, $p = .46$) were not significant predictors of post-treatment OCD severity after controlling for pre-treatment OCD severity. This finding remained non-significant after correcting for multiple comparisons. Although pre-treatment HA and INC scores were

correlated, $r(63) = .311$, $p = .01$, the collinearity statistics (variance inflation factor [VIF] values < 2 and tolerance values > .8) were within acceptable limits.

Does Change in HA and INC Predict Treatment Outcome?

Pearson Correlations

The correlations between the change scores for YBOCS-SR (total, obsessions, compulsions) and OC-TCDQ (HA and INC) throughout treatment were examined (see Table 3). Changes in HA and INC across treatment (including early and late in treatment) had moderate to strong correlations. Pre- to post-treatment changes in HA and INC were both significantly correlated with changes in self-reported OCD symptom severity across treatment. Early treatment change in INC, but not HA, was significantly correlated with changes in OCD symptom severity across treatment. Late treatment change in HA, but not INC, was significantly correlated with changes in OCD symptom severity (total and compulsions, not obsessions).

Pre- to Post-Treatment Change in HA and INC

Adding the predictors of pre- to post-treatment change in HA and INC was associated with a significant improvement in model fit over the model including only pre-treatment OCD severity and a random effect of OCD group (LRT $\chi^2_2 = 19.78$, $p < .0001$). Pre-treatment OCD severity ($\beta = .49$, SE = .089, LRT $\chi^2_1 = 24.51$, $p < .0001$) and change in HA ($\beta = .32$, SE = .11, LRT $\chi^2_1 = 7.67$, $p = .0056$), but not INC ($\beta = .15$, SE = .11, LRT $\chi^2_1 = 1.85$, $p = .17$), were significant predictors of post-treatment OCD severity. This finding remained significant after correcting for multiple comparisons.

Early Treatment Change in HA and INC

Adding the predictors of pre- to mid-treatment change in HA and INC was associated with a significant improvement in model fit over the model including only pre-treatment OCD

severity and a random effect of OCD group (LRT $\chi^2_2 = 8.76$, $p = 0.013$). Pre-treatment OCD severity ($\beta = .58$, SE = .096, LRT $\chi^2_1 = 28.00$, $p < .0001$) and early change in INC ($\beta = .32$, SE = .11, LRT $\chi^2_1 = 7.38$, $p = .0066$), but not HA ($\beta = -.027$, SE = .11, LRT $\chi^2_1 = .056$, $p = .81$), were significant predictors of post-treatment OCD severity. This finding remained significant after correcting for multiple comparisons.

Late Treatment Change in HA and INC

Adding the predictors of mid- to post-treatment change in HA and INC was associated with a significant improvement in model fit over the model including only pre-treatment OCD severity and a random effect of OCD group (LRT $\chi^2_2 = 7.30$, $p = 0.026$). Pre-treatment OCD severity ($\beta = .53$, SE = .10, LRT $\chi^2_1 = 22.29$, $p < .0001$) and late change in HA ($\beta = .33$, SE = .12, LRT $\chi^2_1 = 7.15$, $p = 0.0075$) but not INC ($\beta = -.12$, SE = .12, LRT $\chi^2_1 = 1.10$, $p = 0.29$) were significant predictors of post-treatment OCD severity. However, late treatment change in HA did not remain a significant predictor when the *p* values were adjusted for multiple comparisons.

Table 4 summarizes the findings from the series of hierarchical linear mixed effects models presented above.

Discussion

This study examined changes in the core motivations of OCD in participants who completed group CBT for OCD and their relationship to treatment outcomes. Results indicated that participants who completed treatment experienced significant reductions in HA and INC, the motivations that are believed to maintain OCD symptoms. This was consistent with our hypothesis and previous research (Cervin et al., 2020; Coles & Ravid, 2016; Schwartz, 2018). The observed small to medium effect sizes for the pre- to post-treatment changes in HA and INC are similar to the effect sizes seen in previous studies. A meta-analysis found that INC improved

modestly but significantly over treatment with medium effect sizes (Schwartz, 2018). However, when limiting the analysis to studies that used the OC-TCDQ, large effect sizes were typically found, but it was noted that most these studies also tailored treatments to INC (Schwartz, 2018). Given that we found small to medium effect sizes for INC using the same measure, the differences in effect sizes are likely because we did not specifically tailor treatment to INC. This perhaps indicates that larger changes in INC can be observed if treatments are tailored to it, but this needs to be further investigated. Tailoring treatments to INC could involve providing psychoeducation about INC and NJREs, clinicians being aware of the role of INC and addressing this throughout treatment such as conducting exposures that focus on experiencing and learning to tolerate the associated discomfort (Coles & Ravid, 2016; Summerfeldt, 2004). Given the smaller effect sizes, when compared to the large effect sizes seen for changes in OCD symptom severity and to when treatment is tailored to INC, there is likely room to improve how CBT for OCD targets the underlying motivations which remains to be further explored.

Pre-treatment levels of HA and INC were not significant predictors of OCD treatment outcomes. These findings were partially contrary to our hypothesis that higher levels of INC, but not HA, predict treatment resistance. Our result is inconsistent with the findings of Cervin and Perrin (2021) that a high baseline level of INC in children with OCD was a predictor of poorer treatment outcomes. Cervin and Perrin (2021) used the clinician-administered Obsessive-Compulsive Core Dimensions Interview (OC-CDI; Summerfeldt et al., 2014) while we used the self-report OC-TCDQ, which may have affected results. The OC-CDI may be more sensitive to levels of INC. It is also possible that INC is harder to treat in children versus adults. It is difficult to know whether the difference in findings is due to a methodological difference or a true

difference. Our finding is encouraging because it suggests that increased baseline levels of INC are not necessarily reliable predictors of poorer treatment outcomes in adults.

Changes in HA and INC across treatment were positively correlated with change in OCD severity. However, when change in HA and INC were included in the same model to account for covariances, only change in HA across treatment was predictive of lower post-treatment OCD symptom severity. This is contrary to Cervin et al. (2020) where changes in INC, and not HA, were associated with changes in OCD severity. However, a significant proportion of participants in that study did not engage in ERP and thus did not receive gold-standard treatment (Cervin et al., 2020). Given the relevance of ERP to HA this may account for the difference in findings between the studies. Overall, because these are the first studies to investigate the relationship between changes in the core motivations of OCD to changes in OCD severity, and the mixed findings to date, further research is warranted.

We were also interested in exploring *when* changes in HA and INC predict positive symptom change. Interestingly, early changes in INC (but not HA) and late changes in HA (but not INC), were associated with better treatment outcomes. Importantly, the late treatment change finding did not remain significant when corrected for multiple comparisons. These findings may relate to when treatment components are introduced and emphasized throughout treatment. Early in treatment, clinicians typically educate patients on the importance of learning to tolerate distress (i.e., unpleasant emotions and sensations) without engaging in compulsions. Considering that INC is the motivation related to engaging in compulsions to counteract internal discomfort, learning to tolerate distress may be particularly relevant and underlie the importance of early changes in INC on improved treatment outcomes. Further, early symptom improvement in CBT for OCD is a significant predictor of treatment response (e.g., Krompinger et al., 2017) and our

finding may be another indicator of this. Changes in HA across treatment may be associated with improved treatment outcomes because the crucial learning that comes from the disconfirmation of feared outcomes may require the accumulation of evidence after several weeks of engaging in exposures (including more challenging exposures typically conducted later in treatment) and challenging distorted beliefs. This is the first study to our knowledge to investigate if and when changes in the core motivations are associated with group CBT for OCD outcomes in an adult clinical OCD sample.

Our results provide evidence for the relationship between the underlying core motivations of OCD and group CBT for OCD treatment outcomes. Although CBT models and treatment have traditionally appeared more congruent with a HA conceptualization of OCD, INC has an important role in the maintenance and treatment of OCD. This study adds to the small yet growing body of literature that has found that both HA and INC motivations can be reduced with treatment. Our methodology does not allow for causal conclusions therefore it will be important to investigate if changes in the core motivations cause changes in OCD severity. This would allow for a better understanding of what treatment strategies to focus on to facilitate symptom change and when clinicians should focus on these strategies. For example, if our findings were replicated in a randomized control trial (RCT) study where the active treatment condition involves explicitly targeting the core motivations it may suggest that clinicians should encourage changes in HA over the entire treatment period, while early in treatment it may be particularly important to encourage changes in INC to maximize reductions in OCD symptom severity. Clinically this may involve a very strong emphasis of learning to tolerate uncomfortable feelings and sensations early in treatment, perhaps even providing explicit coaching on managing discomfort.

This study focused on HA and INC as the core motivations of OCD as identified by Summerfeldt and colleagues in the core dimensions model of OCD (Summerfeldt, 2004; Summerfeldt et al., 2014). It must be noted that disgust is another core feature in several presentations of OCD, particularly in contamination symptoms (e.g., Bhikram et al., 2017; Melli et al., 2015), with implications for treatment outcomes (e.g., Athey et al., 2015; Cervin & Perrin, 2021; Ludvik et al., 2015). Future studies may find it useful to investigate disgust along with HA and INC to broaden understanding of the motivations contributing to OCD presentations. Additionally, it is important to remember that OCD behaviours can be motivated by more than one motivation at a time (e.g., "I wash my hands because I don't want to contract an illness, but I also wash them until the ritual feels complete").

The findings should be interpreted within the context of the study's limitations, which also suggest directions for future research. Our data were from a naturalistic sample of adult outpatients who completed group CBT at a specialized clinic within a Canadian hospital and was relatively homogenous and non-diverse. The extent to which these findings generalize to other treatment settings and more diverse populations is unknown. Future studies should investigate these findings in different treatment settings, including individual CBT, and with diverse individuals to better understand the generalizability of the conclusions. Given the naturalistic nature of our study, there are aspects of the methodology that lack control and limit the strength of our conclusions. For example, the DART was only administered to part of our sample due to the assessment process in our clinic. Although the psychiatric assessments were thorough, and all participants had a confirmed diagnosis of OCD, a standardized assessment method minimizes bias introduced by variations in data collection procedures. Additionally, the participants' medication status was not routinely collected for this study nor was it an exclusion criterion.

Given that concurrent medication can impact treatment outcomes, medication information should be collected and reported to provide additional context to the results.

Additionally, the results are based entirely on self-report measures which relied on participants' subjective interpretations and may introduce biases. Future studies may wish to include clinician-administered measures such as the YBOCS, the OC-CDI, or the Brown Incompleteness Scale (BINCS; Boisseau et al., 2018) to allow for trained professionals to use their clinical judgement to assess responses and account for contextual factors. For example, the OC-CDI assesses how HA and INC apply to the various symptoms an individual endorses and may allow for a more wholistic understanding and scoring of the core motivations involved in one's OCD presentation (see Summerfeldt et al., 2014 for more information about the OC-CDI). Using the OC-CDI in future studies would also help indicate if the results found in this study are consistent across the methods of measuring the core dimensions.

Our study also only included those who completed treatment and the questionnaires. This allowed us to understand the relationship between the core dimensions and treatment response for those who complete treatment as indicated. However, the drawbacks to this approach include that the results may not generalize to those who are less treatment-compliant and can introduce selection bias which may overstate the benefit of group CBT for reducing the core motivations. However, given that there were no significant differences in the questionnaires of interest at baseline between a random sample of treatment non-completers and completers, it is unlikely that baseline HA and INC levels strongly predict treatment non-completion.

We examined the core dimensions as continuous scores in a naturalistic sample; we did not select cases demonstrating relative extremes on either dimension. Such design would allow more definitive conclusions about the treatment implications of OCD presentations highly

characterized by INC and is a consideration for future research. OCD presentations on the extremes of the core dimensions continuum (i.e., very high INC/very low HA and vice versa) may be relatively uncommon, therefore, future research might oversample individuals who strongly endorse one dimension. However, there is not an agreed-upon way to define extreme groups for the core dimensions (see Bragdon & Coles, 2017; Sibrava et al., 2016 for examples of how high INC has been defined) and this will need to be further investigated and defined.

An RCT with an active treatment (where the core motivations are explicitly targeted) and control condition is warranted given the mixed results to date. Such a study would aid in understanding whether changes in the core motivation are causing improved treatment outcomes. Collecting information on medication status, participant attendance, and homework completion would help to better understand what contributes to treatment outcomes. Including questionnaires at theoretically-based measurement time points would also provide a detailed understanding of how the core dimensions are changing during the various treatment components and thus would provide more guidance on how treatment can be tailored to optimize outcomes. Future studies may also want to collect post-treatment follow-up data to investigate whether the core dimensions differentially predict sustained treatment gains. Overall, further research is needed before strong conclusions can be made about the relationship between the core motivations and OCD treatment outcomes.

In conclusion, participants who completed group CBT for OCD experienced significant but modest reductions in HA and INC, the core motivations that drive OCD symptoms. Decreases in the core motivations throughout treatment were predictive of improved treatment outcomes, but *when* these changes occur may be important to consider. This study adds to the growing body of research highlighting the important insights that can be gained from

investigating OCD treatment response through the lens of the motivations that underlie the symptoms.

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Table 1

Sample Demographics

Variable	*n*	
Age, mean (*SD*)	65	37.84 (12.87)
Gender (% Women)[a]	65	72.3%
Relationship Status (% in relationship/married)	57	61.4%
Education Level (% completed college/university)	60	78.3%
Ethnicity (% White)[b]	60	91.6%
Employment Status (% Employed)	60	73.3%

Note. Due to the nature of the retrospective database analysis, full demographic data were not available for all participants; *n* represents sample sizes of available data for each variable. [a] 26.2% self-reported as men, and 1.5% self-reported as non-binary, [b] 6.7% self-reported as Asian, and 1.7% self-reported as other (Guyanese).

Table 2

Means (Standard Deviations) and Paired Sample T-Test Comparisons Between Self-Report Questionnaires Pre- and Post-CBT for OCD (N = 65).

	Mean (*SD*) Range					
Measure	Pre-treatment	Post-treatment	*t*	*df*	*p*	*d*
YBOCS-SR	22.62 (4.90)	16.00 (7.28)	9.25	64	<.001	1.15
	13 – 34	3 – 33				
OC-TCDQ: HA	24.23 (9.73)	22.05 (9.67)	2.91	64	.005	0.36
	0 – 39	2 – 40				
OC-TCDQ: INC	24.08 (9.56)	21.94 (9.23)	2.58	64	.012	0.32
	0 – 39	0 – 40				

Note. CBT = Cognitive-behavioural therapy. YBOCS-SR = Yale-Brown Obsessive-Compulsive Scale- Self-report. OC-TCDQ = Obsessive-Compulsive Trait Core Dimensions Questionnaire. HA = Harm Avoidance. INC = Incompleteness.

Table 3

Pearson Correlations for YBOCS-SR (Total, Obsessions, and Compulsions) and OC-TCDQ (HA and INC) Change Scores Throughout Treatment.

		Pre- to Post-Treatment Change (N = 65)		Pre- to Mid-Treatment Change (n = 55)		Mid- to Post-Treatment Change (n = 55)	
		HA	INC	HA	INC	HA	INC
		.62**		.48**		.51**	
Pre- to Post-Treatment Change	YBOCS-SR Total	.44**	.40**	.15	.37**	.29*	.05
	YBOCS-SR Obsessions	.29*	.29*	.12	.29*	.16	.04
	YBOCS-SR Compulsions	.41**	.38*	.05	.32*	.37**	.06

Note. YBOCS-SR = Yale-Brown Obsessive-Compulsive Scale - Self-Report. OC-TCDQ = Obsessive-Compulsive Trait Core Dimensions Questionnaire. HA = Harm Avoidance; INC = Incompleteness. * indicates $p < .05$. ** indicates $p < .01$.

Table 4

Summary of Results from Series of Hierarchical Linear Mixed Effects Models

Analysis	Did fit of model improve by adding HA and INC?	Predictors	
		HA	INC
Do pre-treatment HA and INC scores predict treatment outcome?	No (LRT $\chi^2_2 = .536$, $p = .765$)	No ($\beta = -.016$, SE = 0.11, LRT $\chi^2_1 = .039$, $p = .84$)	No ($\beta = .071$, SE = .11, LRT $\chi^2_1 = .53$, $p = .46$)
Does change in HA and INC predict treatment outcome?			
Change across treatment (pre- to post-treatment)	Yes (LRT $\chi^2_2 = 19.78$, $p < .0001$)	Yes ($\beta = .32$, SE = .11, LRT $\chi^2_1 = 7.67$, $p = .0056$)	No ($\beta = .15$, SE = .11, LRT $\chi^2_1 = 1.85$, $p = .17$)
Early change (pre to mid-treatment)	Yes (LRT $\chi^2_2 = 8.76$, $p = 0.013$)	No ($\beta = -.027$, SE = .11, LRT $\chi^2_1 = .056$, $p = .81$)	Yes ($\beta = .32$, SE = .11, LRT $\chi^2_1 = 7.38$, $p = .0066$)
Late change (mid- to post-treatment)	Yes (LRT $\chi^2_2 = 7.30$, $p = 0.026$[a])	Yes ($\beta = .33$, SE = .12, LRT $\chi^2_1 = 7.15$, $p = 0.0075$)	No ($\beta = -.12$, SE = .12, LRT $\chi^2_1 = 1.10$, $p = 0.29$)

Note. Pre-treatment OCD severity (YBOCS-SR) was always a significant predictor in the models. *p* values displayed for improvement of model fit are before the Holm-Bonferroni method was applied to the models to correct for multiple comparisons.

[a]The improvement in the fit of the late change model by adding in the predictors of HA and INC was no longer significant after the Holm-Bonferroni correction was applied.

CHAPTER 5: GENERAL DISCUSSION

This dissertation aimed to deepen our understanding of the core motivations underlying OCD, HA and INC, as posited by the Core Dimensions Model of OCD by Summerfeldt and colleagues (2004, 2014). OCD has long been recognized for its heterogeneous symptom presentations, but growing evidence suggests that these core motivations underlie, drive, and maintain the disorder's symptoms. Therefore, this program of research examined the core motivations of OCD in clinical samples from phenomenological, measurement, and treatment perspectives across three empirical studies. The goal of this dissertation was to strengthen our understanding of HA and INC's relationship to OCD and add to the growing body of research investigating the core motivational dimensions while considering the related clinical implications for the assessment and treatment of OCD.

Summary of Dissertation Findings

Study 1

In the first study (Chapter 2), the purpose was to examine how HA and INC present and are experienced in the daily lives of those with OCD. While a majority of the studies to date in this area of research have used cross-sectional correlational designs in clinical and lab-based settings, through the use of ESM we were able to understand how HA and INC present and change across time and context in the participants' naturalistic environments. We also examined how HA and INC differentially contribute to how OCD is experienced using the framework of the cognitive-behavioural model of OCD.

Findings from this study revealed four distinct motivation profiles (1. high HA and INC, 2. moderate HA and INC, 3. high HA and low INC, 4. low HA and high INC), with a majority of participants experiencing a relatively even blend of both motivations. Interestingly, the

percentage of participants who had high endorsement in one motivation but not the other were equivalent in size. Taken together, this provides evidence that both HA and INC are important core motivations to understand the heterogeneity in OCD, despite HA previously dominating our understanding. HA and INC appear to function as stable trait-like motivations across time when examining our sample as a whole, but individual-level variability suggests that the core motivations can exhibit state-dependent fluctuations. The core motivations also demonstrated unique patterns of association with how individuals interpreted and responded to their obsessive-compulsive experiences. HA was predictive of beliefs of future harm, avoidant behaviours, reassurance seeking, and thought suppression. Whereas INC was predictive of reduced self-negative beliefs and increased compulsive behaviours. These results suggest that HA and INC are both influential and differentially contribute to how OCD is experienced cognitively and behaviourally. Therefore, there appears to be value in assessing the core motivations that comprise an individual's OCD presentation as it may allow us to better understand what cognitions and behaviours to target in treatment, although this remains an area for future research.

Study 2

In the second study (Chapter 3), the purpose was to examine the psychometric properties of two of the most commonly used measures to assess INC (and HA) and NJREs, the OC-CDQ (Summerfeldt et al., 2014) and the NJRE-QR (Coles et al., 2003), respectively. Although previous studies have examined the reliability and validity of these measures (e.g., Coles et al., 2003; Summerfeldt et al., 2014) given the importance of these measures to this area of research we aimed to replicate and extend these findings. Additionally, because the questionnaires measure INC and NJREs which are conceptually and theoretically related, simultaneously

evaluating both measures in the same samples allowed for more direct comparisons which could help inform their use in research and clinical practice.

The findings of this study provided additional evidence of the good to excellent reliability and validity of the OC-CDQ and NJRE-QR to measure INC/HA and NJREs in OCD and anxiety disorder samples. While the OC-CDQ may be particularly useful as a trait measure of the core motivations to determine the extent to which HA and/or INC are part of the patient's presentation; the NJRE-QR is a useful state-like measure of NJREs to assess how frequently they occur and the distress/interference they cause. Both measures can have important clinical utility in the assessment and treatment of OCD. Additionally, given that the measures were sensitive to changes in the core motivations and severity of NJREs following group CBT for OCD, this indicates they can be used to track if and how these constructs change in response to treatment.

Study 3

In the third study (Chapter 4), the purpose was to examine if the core motivations (i.e., HA and INC) decrease across group CBT for OCD and to examine the relationship between treatment outcomes and both baseline levels and changes in HA and INC throughout treatment. Given that HA dominated our cognitive-behavioural understanding of OCD until more recently, early indirect research suggesting that OCD presentations without feared consequences fared worse in treatment, and due to the unclear nature of whether the distress (e.g., discomfort or tension) evoked by INC habituates over time with ERP like anxiety does with HA presentations; the findings of this study could help inform whether INC is being adequately addressed in our current gold-standard psychological treatment for OCD and if the core motivations moderate treatment outcomes. This was the first study to our knowledge to investigate these questions in a large clinical OCD adult sample completing group CBT for OCD.

Findings from this study revealed that HA and INC significantly but modestly decreased in those who completed group CBT for OCD. Interestingly, pre-treatment levels of both HA and INC did not significantly predict post-treatment OCD symptom severity. Therefore, our hypothesis that higher pre-treatment levels of INC would predict poorer treatment outcomes due to the potential reasons described above was not supported. This finding is encouraging as it suggests that high levels of INC are not a reliable predictor of poor treatment outcomes in adults with OCD. Additionally, the results suggested that changes in HA and INC across treatment were significantly associated with treatment changes in OCD severity. Specifically, reductions in HA across treatment and in INC early in treatment were significantly associated with better treatment outcomes. Overall, this study contributed to our understanding of the relationship between the core motivations and CBT treatment outcomes for those with OCD and offers insights into clinical applications and future directions for research.

Clinical Implications

Altogether, the findings of this program of research investigating the core motivations in OCD have important clinical implications for the assessment and treatment of OCD. Through this series of studies, we aimed to learn more about HA and INC to gain further insights into the heterogeneity of OCD, which in turn can help inform clinicians working with those with OCD. Study 1 (Chapter 2) highlighted that distinct HA/INC motivational profiles exist in individuals with OCD. While some individuals highly endorse one motivation over the other, our results suggest that a majority of individuals with OCD endorse both HA and INC, and relatively equally, as part of their presentation. Recognizing this may help clinicians be aware of the utility of asking their patients questions or using measures like those evaluated in Study 2 (Chapter 3) to assess the degree to which these motivations are at play as this could help inform their

conceptualization of what is motivating and maintaining their symptoms of OCD. Additionally, our results from Study 1 (Chapter 2) suggest that it is important for clinicians to ask about and assess the motivations underlying their symptoms multiple times over the course of treatment as the differential impact of HA and INC may shift across time and context. An ongoing conceptualization of the core motivators of symptoms can help guide treatment planning.

This is because as also shown in the first study (Chapter 2), the core motivations appear to significantly contribute to how OCD is experienced in daily life through distinct cognitive and behavioural pathways. For example, higher levels of HA were associated with an increased likelihood of beliefs that "…something bad can/has/will happen" and with avoidance behaviours (including thought suppression) as well as reassurance-seeking. Therefore, for HA presentations, ERP exercises should be designed to allow the individual to have opportunities to disconfirm catastrophic predictions by systematically approaching feared triggers while resisting engaging in subtle avoidance strategies including thought suppression and reassurance seeking. Additionally, incorporating cognitive techniques such as the cumulative probabilities technique which can help the individual have a more realistic assessment of the likelihood that a feared event will occur may be particularly beneficial. Whereas, for symptoms primarily motivated by INC, ERP exercises designed to evoke the discomfort/tension associated with INC while encouraging the client to systemically practice tolerating the discomfort without engaging in compulsions can allow the individual to have opportunities to learn that although these feelings are uncomfortable, they can tolerate them and function even when things do not feel "just right". However, clinicians should remember that OCD symptoms can and often are driven by more than one motivation (and to different degrees) at the same time. For example, an individual with contamination OCD symptoms may engage in excessive handwashing after touching public

surfaces to prevent getting sick and they may need to wash their hands in a particular way (e.g., a certain number of times, in a particular sequence, etc.) or else they will feel "not just right". Therefore, an exposure exercise that incorporates both motivations may look like having the person touch something they feel is contaminated/could get sick from (e.g., a public bathroom door handle) and permitting them to wash their hands but encouraging them to purposefully stop before they achieve that "just right feeling" (i.e., doing their compulsion in an incomplete/ "not just right" manner). This type of exposure would allow for the individual to test out the feared prediction of whether they will get sick as well as provide an opportunity to learn that they can tolerate and handle the feelings of discomfort associated with INC when their compulsions are not performed perfectly. These findings open the opportunity for more tailored and personalized interventions within CBT for OCD, although the extent to which this would help improve treatment outcomes remains a matter for future research.

Study 2 (Chapter 3) has important implications for assessing and tracking HA/INC and NJREs over treatment. The OC-CDQ's trait-based approach to assessing HA and INC is a valuable self-report measure that clinicians can use to help understand how their patient "typically thinks, feels, and acts" to determine the extent to which HA and INC are underlying a patient's OCD symptoms. This can be particularly useful in the initial assessment of OCD and help to inform treatment planning as described above. Given how the OC-CDQ is worded and the finding of excellent test-retest reliability, this measure is ideal for tracking HA and INC over time. Additionally, despite being a trait measure, it was sensitive to changes in the core motivations across treatment, indicating its use in research studies investigating treatment outcomes as well as an additional way to determine a patient's progress in treatment. Because HA and INC are conceptualized as stable traits underlying OCD (e.g., Summerfeldt et al., 2014),

significant reductions on the OC-CDQ may indicate to clinicians that their intervention is helping to target the core motivational dimensions underlying and maintaining OCD across overt symptoms. Although this remains to be investigated, since the OC-CDQ measures the stable underlying traits of HA and INC, it may be particularly effective for predicting long-term outcomes or relapse in symptoms by identifying the underlying motivational drivers that could maintain or re-trigger OCD symptoms, even after initial treatment response.

In contrast, the NJRE-QR is an important questionnaire that provides a state-based assessment of NJREs that can capture their fluctuations in frequency (over the past month) and intensity (of their most recent NJRE) over time. Our results suggested that it is not the frequency but instead the severity of NJREs that differentiates those with anxiety disorders from those with OCD. This measure can provide clinicians with an idea of what situations can trigger an NJRE and use this information to help inform exposure planning. Additionally, it provides a way to assess how the patient's most recent NJRE impacted them such as how distressing it was in the moment, later that day, the urge they had to respond, and how responsible they felt. This information can also be useful to guide what to target during treatment. The NJRE-QR, particularly the Severity score, was also sensitive to changes that occur over treatment indicating that this measure can be used to determine if the discomfort associated with NJREs is improving over time. Therefore, using both the OC-CDQ and NJRE-QR across treatment can offer a comprehensive understanding of the patient's progress in reducing the impact of INC/NJREs from trait and state perspectives.

Study 3 (Chapter 4) demonstrated that our existing gold-standard psychological treatment for OCD, CBT with ERP, is effective for reducing both HA and INC in those who completed group treatment. Although our results suggested significant but modest reductions indicating that

there may be added value in tailoring interventions to help ensure the relevant core motivation(s) are being targeted through exposures and cognitive techniques. Additionally, our results provide a more hopeful outlook for those with OCD presentations characterized by high levels of INC as this was not found to significantly predict worse treatment outcomes. This finding challenges the widely held assumption that INC may not respond as well to existing treatments. Although we did not specifically tailor our treatment to INC, it is possible that if clinicians are more familiar with this motivation of OCD (as may be the case in the clinic where this study was conducted) they may feel more comfortable incorporating it as a treatment target by helping the client design and conduct relevant exposures. Examining clinicians' familiarity, confidence, and experience treating OCD presentations predominately motivated by INC (as compared to HA) remains an area for future research. This could highlight the importance of educating clinicians about the core dimensions of OCD so that they are not only knowledgeable about HA and INC but also feel competent in using this information to help tailor treatment.

Our findings from Study 3 (Chapter 4), upon replication and with a more carefully designed methodology (e.g., an RCT where the core motivations are explicitly targeted), that *when* changes in HA and INC occur are significantly predictive of treatment outcomes can provide important insights to clinicians about when to target the core motivations in treatment. For example, early changes in INC and changes in HA across treatment were associated with better treatment outcomes in our study. This may suggest there is clinical value in clinicians helping their clients learn the importance of expecting and learning to tolerate discomfort caused by obsessions without engaging in compulsions, particularly early on in treatment, while continuing to encourage exposures to increasingly challenging feared situations across treatment.

Finally, there has been more recent interest in integrating or using third-wave CBT approaches that incorporate aspects of mindful non-judgmental awareness and acceptance, such as Mindfulness-Based Cognitive Therapy (MBCT) to treat OCD (e.g., Key et al., 2017; Selchen et al., 2018). Using MBCT or incorporating mindfulness practices where individuals can practice observing NJREs and the discomfort of INC non-judgmentally and without acting on autopilot to "fix" these feelings may be particularly useful for OCD presentations characterized by high levels of INC and remains an area for future investigation.

In summary, the current findings highlight the importance of recognizing and incorporating HA and INC motivations into clinical conceptualization, assessment, and treatment of OCD. This research adds to the growing empirically supported body of literature that highlights the important insights and the clinical value that can be gained by understanding, researching, and treating OCD from the lens of its underlying core motivational dimensions.

Limitations and Future Directions

The studies that comprise this dissertation have contributed to advances in our understanding of the core motivations in OCD, specifically, the phenomenology of HA and INC in the daily lives of those with OCD, how they are commonly measured, and their relationship to CBT for OCD treatment outcomes. Importantly, the results of these studies should be interpreted within the context of their methodological limitations to prevent an overinterpretation of the results. First, although a significant strength across the three studies is the large clinical samples of individuals with OCD, it is important to acknowledge that our samples may not fully represent the broader population of individuals with OCD. Our clinical OCD samples are relatively homogenous in their demographics and are comprised of treatment-seeking adults at a tertiary care specialized anxiety and related disorders clinic. This may limit the generalizability of our

findings to more diverse populations, different treatment settings, or levels of OCD symptom severity. Future research that aims to investigate these research questions in more diverse samples such as varied cultural, socioeconomic, and age groups would increase the generalizability of the findings. Additionally, this would allow for opportunities to explore whether HA and INC manifest differently across these diverse groups.

Furthermore, there are limitations in our methodology that hinder our ability to make causal conclusions regarding the relationship between the core motivations and group CBT for OCD treatment outcomes. Specifically, given the naturalistic treatment setting there was reduced control over certain aspects of the study's design (e.g., variability in assessment method, potential medication changes, etc.) that may have introduced additional variability that could influence the findings. Additionally, given that we did not have a control group that did not receive active treatment we cannot directly speak to the extent to which the changes observed were due to natural fluctuations over time versus as a direct result of the treatment. This area of research would benefit from conducting an RCT with an active treatment condition where the core motivations are directly targeted/treatment is tailored based on the individual's core dimension profile, a treatment-as-usual condition, and a control condition. This study design would provide a clearer understanding of the causal role of HA and INC on treatment outcomes and the direction of the relationship between changes in core motivations and changes in OCD symptom severity.

Another notable limitation of the studies in this dissertation is the reliance on self-report measures. Although study 1 used ESM to help reduce some of the biases (e.g., retrospective recall bias) inherent in self-report questionnaires there was still a reliance on participants reporting their subjective interpretations to the questions asked across all three studies. Future

studies would benefit from utilizing additional and complementary methods to assess the core motivations in OCD such as clinician-administered measures like the Obsessive-Compulsive Core Dimensions Interview (OC-CDI; Summerfeldt et al., 2014) or the Brown Incompleteness Scale (BINCS; Boisseau et al., 2018), and assessments using behavioural paradigms to provoke the core motivations (e.g., Cougle et al., 2013; Summers et al., 2014) to provide alternative perspectives and determine if the findings are consistent across these various methods of assessing HA and INC.

Finally, an additional future direction for this area of research involves investigating the neurobiological correlates and neural underpinnings of HA and INC. For example, neuroimaging studies could explore how brain regions and neural circuits are differentially activated in HA as compared to INC-driven compulsions. Identifying this may help clarify HA and INC's unique contribution to OCD and offer insights that could help inform therapeutic approaches that target the neurobiological alterations that underlie certain OCD presentations (Dougherty et al., 2018; Shephard et al., 2021, 2022).

General Conclusion

In summary, three studies from phenomenological, measurement, and treatment perspectives were conducted that advanced our understanding of HA and INC, the core motivational dimensions of OCD. The findings of this research support the value of investigating OCD from the lens of its underlying core motivations as this dissertation has contributed to important insights that can help us better understand the heterogeneity of OCD while informing its assessment and treatment. Although HA had dominated our cognitive-behavioural understanding of OCD until more recently, our findings underscore the importance and value that is gained when INC/NJREs are understood, assessed, and treated.

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APPENDIX

SUPPLEMENTARY MATERIALS FOR CHAPTER 2 (STUDY 1)

Table S1

Experience Sampling Questionnaire

Question	Response Option
Did you experience an obsessive-compulsive episode since the last prompt?	• Yes • No
Please answer the following questions based on the most recent, distressing obsessive-compulsive episode you experienced since the last text prompt.	
What triggered the obsession (i.e., intrusive thought, image, impulse, or pervasive feeling)?	• The trigger was something in my external environment (i.e., something I saw, heard, touched, etc.) • The trigger was internal (i.e., a psychological or mental event; the perception of inner discomfort; an uncomfortable physical sensation, etc.) • There was no external or internal trigger I could identify; the obsession arose spontaneously
To what extent was this obsessive-compulsive episode associated with the need to have things 'just so' or 'perfect', otherwise you would feel incomplete, tense, or very uncomfortable	Rated on a sliding scale from Not at all (0) to Extremely (100)
To what extent was this obsessive-compulsive episode associated with the fear that something harmful/bad might happen, often linked with a feeling of anxiety or apprehension?	Rated on a sliding scale from Not at all (0) to Extremely (100)
When you had this obsession, what was your interpretation(s) of what it meant? (*Select all that apply*)	• This means something bad has/can/will happen • This means something awful about me as a person • This means that I will have an intolerable/uncomfortable feeling

	• This means that I will have an intolerable/uncomfortable feeling that will be long lasting • Other • I had no further interpretation
What OCD behaviour(s) did you engage in? (*Select all that apply*)	• Compulsions • Avoidance • Thought Suppression • Seeking Reassurance • I did not engage in an OCD behaviour

Table S2

Tests for Demographics Covariates in HA, INC Models

			LMM (gaussian)				Zero-inflated Beta GLMM				Ordinal logistic CLMM			
Measure	N	Covariate	Estimate (SE)	LRT χ^2 (df)	*p*	95 % CI	Estimate (SE)	LRT χ^2 (df)	*p*	95 % CI	Estimate (SE)	LRT χ^2 (df)	*p*	95 % CI
HA	545 (50 IDs)	Intercept (Threshold for CLMM)	60.5 (19.2)	.	.	22.0, 98.8	ZI: 0.14 (1.14) Cond: 1.00 (0.75)	.	.	ZI: -2.05, 2.44 Cond: -0.51, 2.48	Q1 | Q2: -2.32 (1.86) Q2 | Q3: -0.22 (1.85) Q3 | Q4: 1.21 (1.85) Q4 | Q5: 2.77 (1.85)	.	.	Q1 | Q2: -5.96, 1.32 Q2 | Q3: -3.85, 3.41 Q3 | Q4: -2.42, 4.84 Q4 | Q5: -0.87, 6.40
		Gender	F: 3.45 (8.73) NB: -1.98 (15.2)	0.26 (2)	0.88	F: -14.0, 20.9 NB: -32.5, 28.4	F, ZI: 0.47 (0.42) F, Cond: 0.29 (0.34) NB, ZI: -0.18 (0.72) NB, Cond: -0.086 (0.61)	ZI: 2.08 (2) Cond: 0.99 (2)	ZI: 0.35 Cond: 0.61	F, ZI: -0.33, 1.34 F, Cond: -0.39, 0.98 NB, ZI: -1.77, 1.15 NB, Cond: -1.31, 1.13	F: 0.36 (0.85) NB: -0.020 (1.46)	0.22 (2)	0.89	F: -1.31, 2.03 NB: -0.020, 2.88
		Age	-0.16 (0.47)	0.12 (1)	0.73	-1.09, 0.78	ZI: -0.085 (0.029) Cond: 0.019 (0.018)	ZI: 11.6 (1) Cond: 1.06 (1)	ZI: 0.00066 Cond: 0.30	ZI: -0.15, -0.033 Cond: -0.055, 0.018	-0.0016 (0.045)	0.0013 (1)	0.97	-0.090, 0.086
		Relationship status (single / in relationship)	8.52 (7.80)	1.18 (1)	0.28	-7.05, 24.1	ZI: 0.32 (0.33) Cond: 0.35 (0.31)	ZI: 0.98 (1) Cond: 1.28 (1)	ZI: 0.32 Cond: 0.26	ZI: -0.32, 0.97 Cond: -0.27, 0.97	0.67 (0.77)	0.76 (1)	0.38	-0.83, 2.17
		Education (up to some university / at least completed university)	-16.5 (9.5)	3.13 (1)	*0.077*	-34.9, 1.84	ZI: -0.23 (0.40) Cond: -0.60 (0.36)	ZI: 0.35 (1) Cond: 2.66 (1)	ZI: 0.55 Cond: 0.10	ZI: -1.03, 0.52 Cond: -1.32, 0.13	-1.02 (0.89)	1.28 (1)	0.26	-2.77, 0.73
			LMM (gaussian)				Zero-inflated Beta GLMM				Ordinal logistic CLMM			
			Estimate (SE)	LRT χ^2 (df)	*p*	95 % CI	Estimate (SE)	LRT χ^2 (df)	*p*	95 % CI	Estimate (SE)	LRT χ^2 (df)	*p*	95 % CI
INC	545 (50 IDs)	Intercept (Threshold for CLMM)	20.3 (15.3)	.	.	-10.2, 50.9	ZI: 2.81 (1.32) Cond: -0.59 (0.62)	.	.	ZI: 0.32, 5.51 Cond: -1.83, 0.63	Q1 | Q2: 1.29 (1.30) Q2 | Q3: 1.21 (1.30) Q3 | Q4: 2.40 (1.31) Q4 | Q5: 3.92 (1.32)	.	.	Q1 | Q2: -1.26, 3.83 Q2 | Q3: 0.33, 5.43 Q3 | Q4: 1.56, 6.70 Q4 | Q5: 3.11, 8.27
		Gender	F: 14.9 (7.00) NB: 24.7 (12.1)	5.80 (2)	*0.055*	F: 0.84, 28.8	F, ZI: -1.60 (0.42) F, Cond: 0.85 (0.28)	ZI: 18.6 (2) Cond: 9.22 (2)	ZI: < 0.0001 Cond: 0.0099	F, ZI: -2.45, -0.78 F, Cond: 0.28, 1.41	F: 1.45 (0.60) NB: 2.22 (1.03)	7.05 (2)	0.029	F: 0.28, 2.62 NB: 0.21, 4.23

Age	0.72 (0.37)	3.64 (1)	*0.056*	NB: 0.44, 48.9 -0.020, 1.45	NB, ZI: -19.8 (7986) NB, Cond: 1.05 (0.48) ZI: -0.11 (0.034) Cond: 0.016 (0.014)	ZI: 15.8 (1) Cond: 1.27 (1)	ZI: < 0.0001 Cond: 0.26	NB, ZI: ~-Inf, Inf NB, Cond: 0.095, 2.01 ZI: -0.18, -0.051 Cond: -0.013, 0.045	0.049 (0.031)	2.46 (1)	0.12	-0.012, 0.11
Relationship status (single / in relationship)	4.65 (6.25)	0.55 (1)	0.46	-7.90, 17.1	ZI: -1.34 (0.45) Cond: 0.075 (0.25)	ZI: 12.0 (1) Cond: 0.092 (1)	ZI: 0.00054 Cond: 0.76	ZI: -2.34, -0.58 Cond: -0.42, 0.57	0.35 (0.53)	0.43 (1)	0.51	-0.69, 1.39
Education (up to some university / at least completed university)	26.1 (7.29)	11.4 (1)	0.00072	11.6, 40.7	ZI: -2.74 (0.71) Cond: 1.14 (0.29)	ZI: 23.1 (1) Cond: 13.6 (1)	ZI: < 0.0001 Cond: 0.00023	ZI: -4.33, -1.48 Cond: 0.56, 1.72	2.36 (0.63)	12.9 (1)	0.00033	1.13, 3.59

Table S3

Ordinal Logistic CLMM Diagnostics

Measure		Model term	LRT (df), *p*
HA	Tests of nominal effects	Prompt	2.50 (3), 0.48
		Time of day	2.44 (6), 0.87
	Tests of scale effects	Prompt	3.74 (1), 0.053
		Time of day	0.098 (2), 0.95
INC	Tests of nominal effects	Prompt	3.99 (3), 0.26
		Time of day	9.38 (6), 0.15
		Gender	9.64 (6), 0.14
		Education	6.40 (3), 0.094
	Tests of scale effects	Prompt	0.016 (1), 0.90
		Time of day	0.045 (2), 0.98
		Gender	4.43 (2), 0.11
		Education	1.24 (1), 0.27

Note. The data was modelled as an ordinal logistic regression by categorizing the HA and INC scales according to their 20%, 40%, 60%, and 80% quantiles, and created cumulative link mixed-effects regressions (CLMMs) using the clmm function in the ordinal package (Christensen, 2023).

Christensen, Rune H. B. (2023). ordinal-Regression Models for Ordinal Data. R package version 2023.12-4, https://CRAN.R-project.org/package=ordinal.

Table S4

Do Motivations Underlying OCD (HA, INC) Change Across Time Explored with LMM and CLMM

		LMM (gaussian)					Ordinal logistic CLMM				
Measure	N	Fixed effects	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI	Fixed effects	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
HA	545 (50 IDs)	Intercept	55.9 (4.50)	.	.	47.0, 64.8	Threshold Intercept	Q1 | Q2: -2.47 (2.50) Q2 | Q3: -0.28 (2.49) Q3 | Q4: 1.25 (2.49) Q4 | Q5: 2.77 (2.49)	.	.	-3.41, -1.76 -1.21, 0.36 0.25, 1.80 1.84, 3.46
		Prompt	0.046 (0.033)	1.87 (1)	0.17	-0.020, 0.11					
		Time of day	Aft: -1.34 (2.64) Eve: -0.58 (2.85)	0.31 (2)	0.86	-6.52, 3.85 -6.18, 5.02	Prompt	0.0031 (0.0037)	0.68 (1)	0.41	-0.0042, 0.010
							Time of day	Aft: -0.18 (0.26) Eve: -0.10 (0.28)	0.55 (2)	0.76	-0.68, 0.32 -0.65, 0.44
		Random effects	Estimate	LRT χ^2 (df)	*p*	95% CI	Random effects	Estimate	LRT χ^2 (df)	*p*	95% CI
		Slope	SD: 0.13	4.94 (2)	*0.085*	0.071, 0.24	Slope	SD: 0.017	14.5 (2)	0.00073	.
		Intercept	SD: 25.8	391 (1)	< 0.0001	20.5, 32.6	Intercept	SD: 2.04	370 (1)	< 0.0001	.
		LMM (gaussian)					Ordinal logistic CLMM				
		Fixed effects	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI	Fixed effects	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
INC	545 (50 IDs)	Intercept	57.5 (4.63)	.	.	48.2, 66.7	Threshold Intercept	Q1 | Q2: -0.76 (0.65) Q2 | Q3: 0.90 (0.65) Q3 | Q4: 2.22 (0.66) Q4 | Q5: 3.89 (0.67)	.	.	-2.03, 0.51 -0.38, 2.17 0.93, 3.51 2.56, 5.21
		Prompt	0.029 (0.033)	0.77 (1)	0.38	-0.037, 0.094					
		Time of day	Aft: -2.97 (2.63) Eve: -5.37 (2.84)	3.70 (2)	0.16	-8.13, 2.19 -11.0, 0.19	Prompt	0.0034 (0.0035)	2.78 (1)	0.10	-0.0034, 0.010
							Time of day	Aft: -0.37 (0.24) Eve: -0.40 (0.26)	2.58 (2)	0.28	-0.84, 0.11 -0.92, 0.11
		Random effects	Estimate	LRT χ^2 (df)	*p*	95% CI	Random effects	Estimate	LRT χ^2 (df)	*p*	95% CI
		Slope	SD: 0.13	3.80 (2)	0.15	0.064, 0.25	Slope	SD: 0.015	10.1 (2)	0.0065	.
		Intercept	SD: 21.7	270 (1)	< 0.0001	16.9, 27.9	Intercept	SD: 1.76	183 (1)	< 0.0001	.

Note. For OLMM – Q1 corresponds to 0%-20% quantile, Q2 = 20%-40%, Q3 = 40%-60%, Q4 = 60%-80%, Q5 = 80%-100%.

No current method to obtain 95% CIs for the random effects for clmm model

Table S5

Model Including Demographic Covariates When Investigating the Effects of the Core Motivations on the Trigger

OCD exp.	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
Trigger (external vs. internal)	525 (50 IDs)	Intercept	-0.88 (1.65)	.	.	-4.29, 2.42
		Gender	F: 0.71 (0.76) NB: 0.40 (1.29)	0.89 (2)	0.64	F: -0.79, 2.28 NB: -2.20, 3.05
		Age	0.013 (0.039)	0.10 (1)	0.74	-0.066, 0.092
		Relationship status (single / in relationship)	0.79 (0.66)	1.42 (1)	0.75	-0.53, 2.16
		Education (up to some university / at least completed university)	-0.026 (0.77)	0.0011 (1)	0.97	-1.59, 1.55

Table S6

Model Including Demographic Covariates When Investigating the Effects of the Core Motivations on the Interpretations

OCD exp.	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
Interpretation 1 ("This means something bad can/has/will happen")	545 (50 IDs)	Intercept	0.054 (1.76)	.	.	-3.46, 3.71
		Gender	F: -1.30 (0.80) NB: 0.26 (1.49)	3.27 (2)	0.19	F: -2.97, 0.30 NB: -2.77, 3.30
		Age	0.030 (0.043)	0.49 (1)	0.49	-0.058, 0.12
		Relationship status (single / in relationship)	0.099 (0.71)	0.019 (1)	0.89	-1.33, 1.58
		Education (up to some university / at least completed university)	-0.67 (0.83)	0.68 (1)	0.41	-2.45, 0.94
Interpretation 2 ("This means something awful about me as a person")	545 (50 IDs)	Intercept	-0.51 (2.12)	.	.	-5.00, 3.74
		Gender	F: -0.019 (0.92) NB: -0.78 (1.64)	0.25 (2)	0.88	F: -1.92, 1.90 NB: -4.24, 2.51
		Age	-0.053 (0.052)	0.99 (1)	0.32	-0.16, 0.055
		Relationship status (single / in relationship)	1.04 (0.82)	1.58 (1)	0.21	-0.62, 2.78
		Education (up to some university / at least completed university)	-0.081 (0.99)	0.0067 (1)	0.93	-2.17, 1.93
Interpretation 3 ("This means that I will have an intolerable/uncomfortable feeling")	545 (50 IDs)	Intercept	2.30 (1.76)	.	.	-1.17, 6.02
		Gender	F: 0.83 (0.79) NB: -0.17 (1.49)	1.37 (2)	0.50	F: -0.81, 2.44 NB: -3.24, 2.89
		Age	-0.043 (0.040)	1.15 (1)	0.28	-0.13, 0.037
		Relationship status (single / in relationship)	0.94 (0.73)	1.60 (1)	0.21	-0.55, 2.45
		Education (up to some university / at least completed university)	-0.86 (0.87)	0.97 (1)	0.33	-2.65, 0.90
Interpretation 4 ("This means that I will have an intolerable/uncomfortable feeling that will be long lasting")	545 (50 IDs)	Intercept	1.13 (1.59)	.	.	-2.02, 4.45
		Gender	F: -0.99 (0.75) NB: -1.61 (1.57)	2.12 (2)	0.35	F: -2.58, 0.45 NB: -4.91, 1.28
		Age	-0.053 (0.039)	1.79 (1)	0.18	-0.13, 0.026
		Relationship status (single / in relationship)	0.59 (0.86)	0.50 (1)	0.48	-1.01, 2.39
		Education (up to some university / at least completed university)	0.68 (0.92)	0.50 (1)	0.48	-1.33, 2.42

Table S7

Model Including Demographic Covariates When Investigating the Effects of the Core Motivations on the OCD Behaviours

OCD exp.	N	Fixed Effect	Estimate (SE)	LRT χ^2 (df)	*p*	95% CI
Behaviour 1 (Compulsions)	545 (50 IDs)	Intercept	1.19 (1.86)	.	.	-2.54, 5.05
		Gender	F: 0.13 (0.87) NB: 0.17 (1.39)	0.027 (2)	0.99	F: -1.72, 1.85 NB: -2.69, 3.01
		Age	0.030 (0.044)	0.46 (1)	0.50	-0.060, 0.12
		Relationship status (single / in relationship)	0.092 (0.74)	0.016 (1)	0.90	-1.42, 1.61
		Education (up to some university / at least completed university)	0.062 (0.86)	0.0053 (1)	0.94	-1.69, 1.83
Behaviour 2 (Avoidance)	545 (50 IDs)	Intercept	-0.46 (1.63)	.	.	-3.92, 2.74
		Gender	F: -0.99 (0.69) NB: -0.97 (1.21)	2.08 (2)	0.35	F: -2.43, 0.40 NB: -3.50, 1.48
		Age	-0.022 (0.040)	0.29 (1)	0.59	-0.10, 0.061
		Relationship status (single / in relationship)	0.22 (0.61)	0.13 (1)	0.72	-1.05, 1.47
		Education (up to some university / at least completed university)	1.28 (0.74)	3.05 (1)	*0.081*	-0.16, 2.89
Behaviour 3 (Thought suppression)	545 (50 IDs)	Intercept	-1.02 (1.64)	.	.	-4.43, 2.27
		Gender	F: 0.098 (0.76) NB: -3.03 (1.47)	5.40 (2)	*0.067*	F: -1.44, 1.68 NB: -6.18, -0.19
		Age	0.014 (0.039)	0.13 (1)	0.72	-0.064, 0.094
		Relationship status (single / in relationship)	0.89 (0.69)	1.71 (1)	0.19	-0.47, 2.34
		Education (up to some university / at least completed university)	-0.57 (0.80)	0.51 (1)	0.47	-2.23, 1.02
Behaviour 4 (Seeking reassurance)	545 (50 IDs)	Intercept	-2.06 (1.66)	.	.	-5.58, 1.22
		Gender	F: -0.78 (0.74) NB: -1.48 (1.44)	1.55 (2)	0.46	F: -2.31, 0.74 NB: -4.52, 1.37
		Age	0.0063 (0.039)	0.026 (1)	0.87	-0.074, 0.087
		Relationship status (single / in relationship)	-0.34 (0.69)	0.25 (1)	0.62	-1.80, 1.04
		Education (up to some university / at least completed university)	0.50 (0.82)	0.37 (1)	0.54	-1.15, 2.23
Behaviour 5 (Did not engage in OCD behaviour)	545 (50 IDs)	Intercept	-4.74 (5.89)	.	.	-16.3, 7.77
		Gender	F: -0.79 (2.09) NB: -17.7 (1097)	0.46 (2)	0.79	F: -5.57, 3.81 NB: ~ -Inf, Inf
		Age	-0.069 (0.13)	0.31 (1)	0.58	-0.43, 0.17
		Relationship status (single / in relationship)	-0.98 (1.88)	0.27 (1)	0.60	-5.57, 3.06
		Education (up to some university / at least completed university)	-0.22 (2.34)	0.0091 (1)	0.92	-6.01, 4.66

Figure S1

Bimodal Distributions of HA and INC.

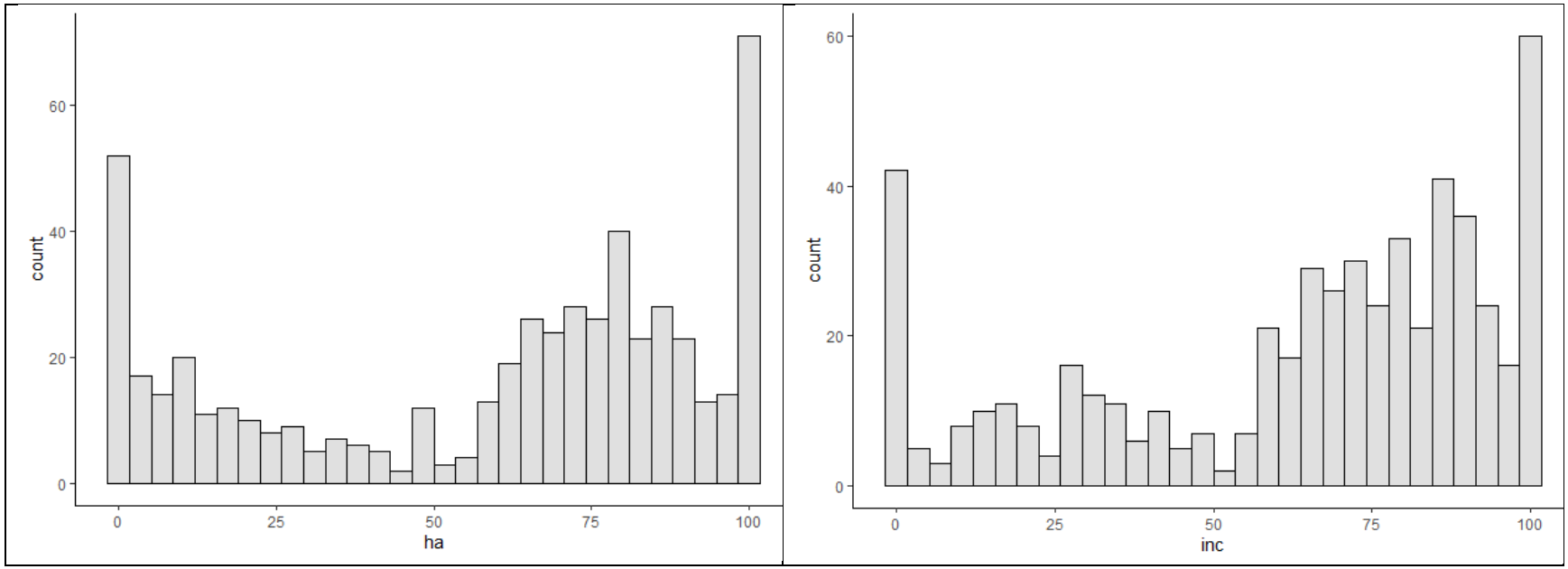
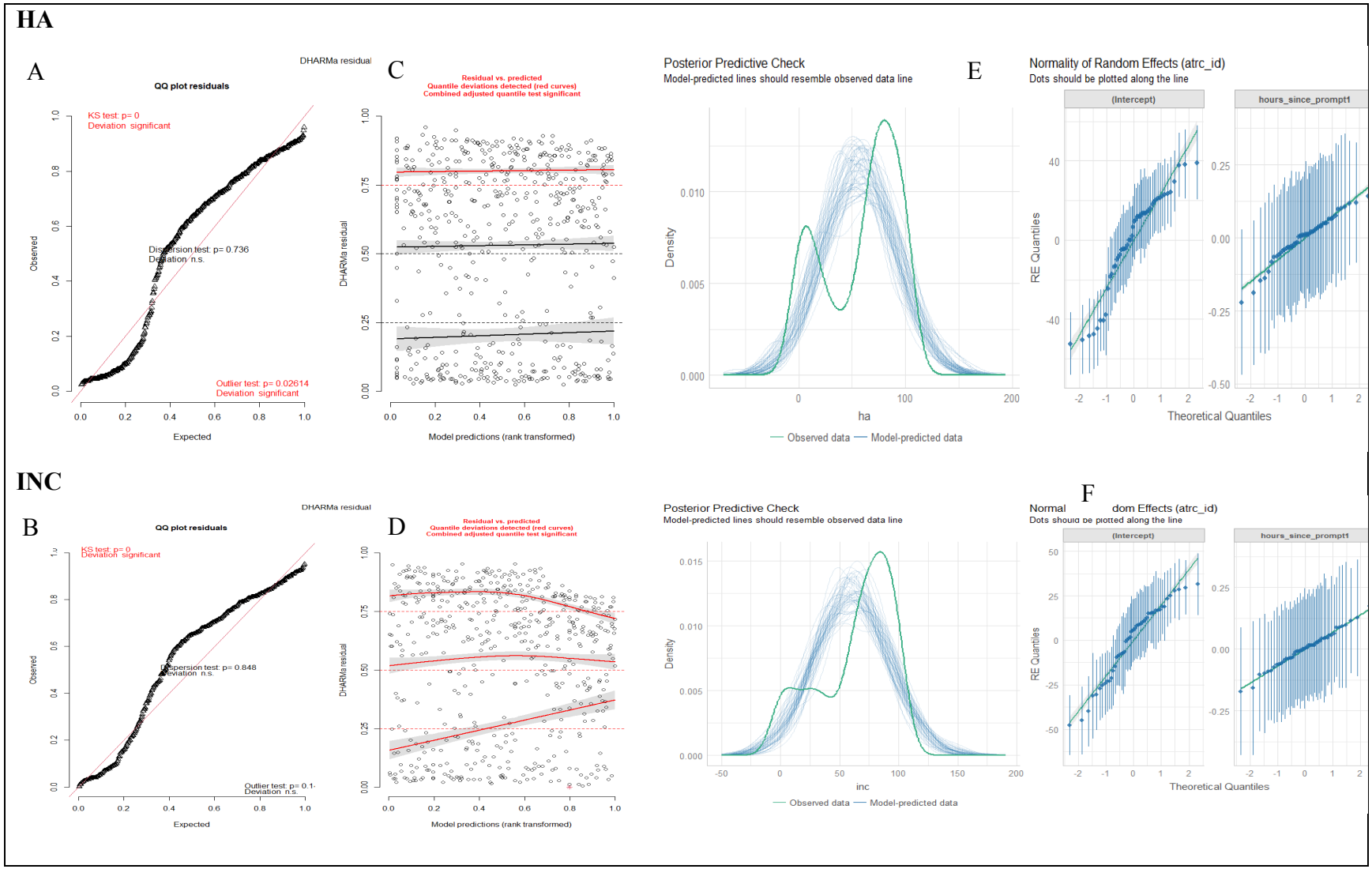


Figure S2

LMM (gaussian) glmmTMB Diagnostics



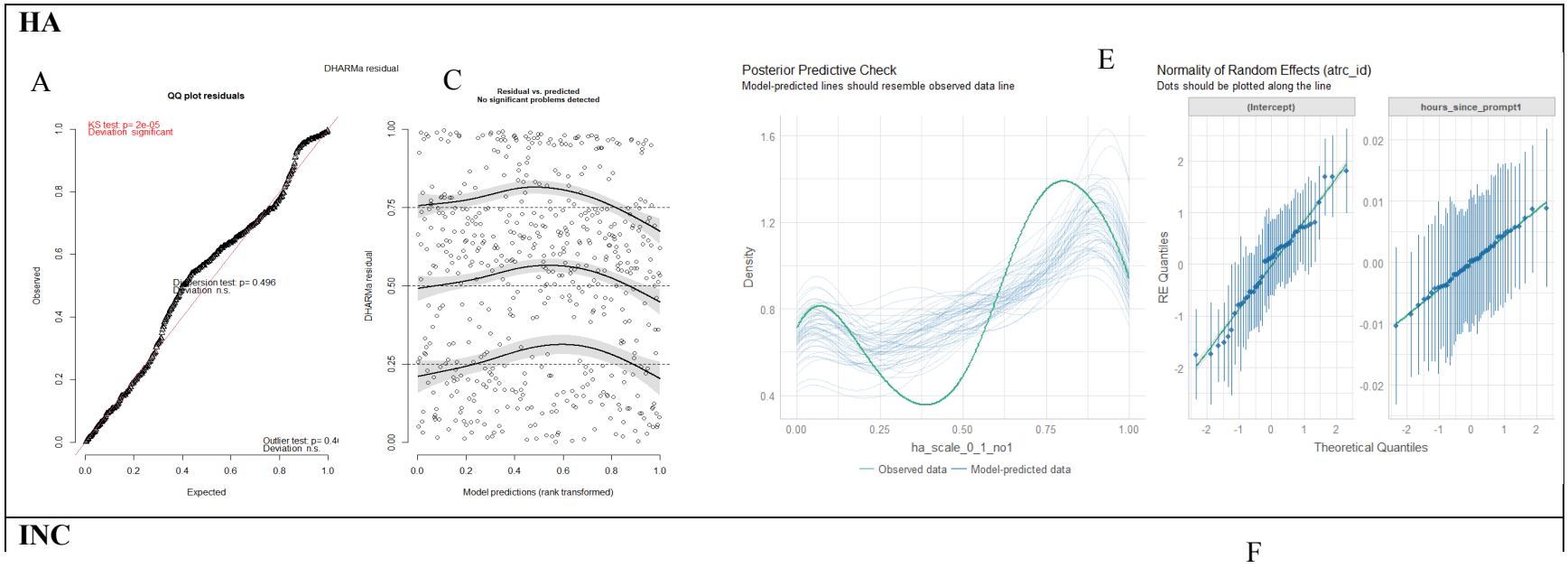
Note. Initial analyses using general linear mixed effects models (LMMs) and raw HA and INC scores revealed the violations of several model assumptions: the normality of the residuals (identified by inspecting the Q–Q plot – Figure S2. A, B), homoscedasticity (identified by inspecting the residual vs. predicted plot – Figure S2. C, D), and normality of the random effects (identified by inspecting random effects Q–Q plots generated using performance package, Lüdecke, 2021; Figure S2. E, F, right panels). Residual diagnostics plots, except for the random effects, were generated with simulation methods employed in the DHARMa package (Hartig, 2022).

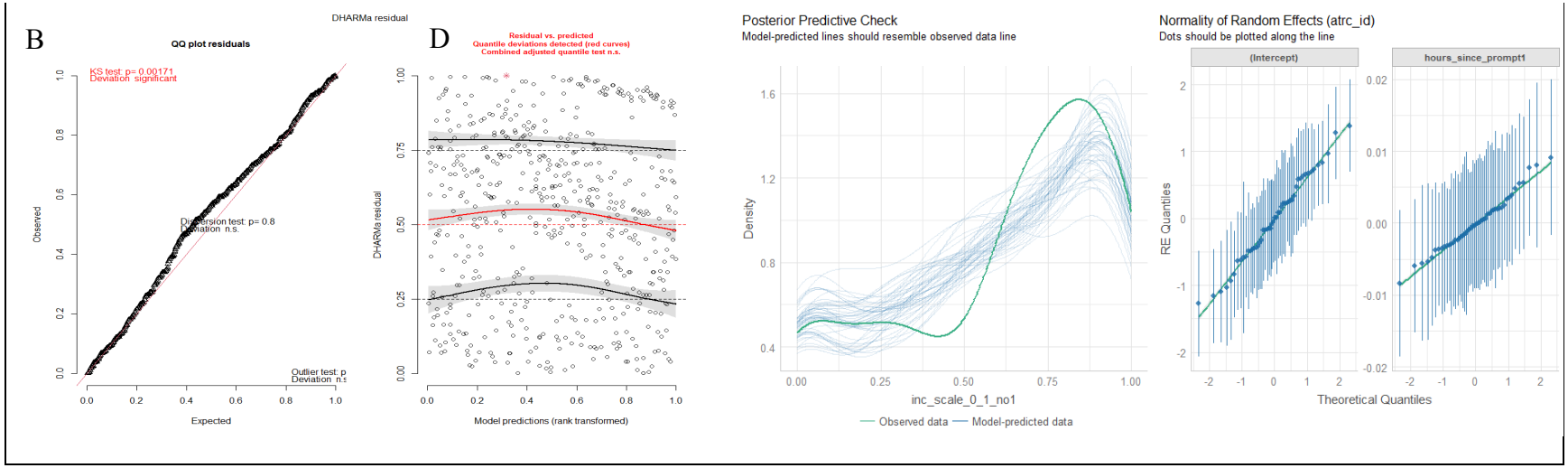
Lüdecke, D., Ben-Shachar, M. S., Patil, I., Waggoner, P., & Makowski, D. (2021). performance: An R package for assessment, comparison and testing of statistical models. Journal of Open Source Software, 6(60).

Hartig, Florian (2022). DHARMa: Residual Diagnostics for Hierarchical (Multi-Level / Mixed) Regression Models. R package version 0.4.6, https://CRAN.R-project.org/package=DHARMa.

Figure S3

Zero-Inflated Beta GLMM – glmmTMB Diagnostics



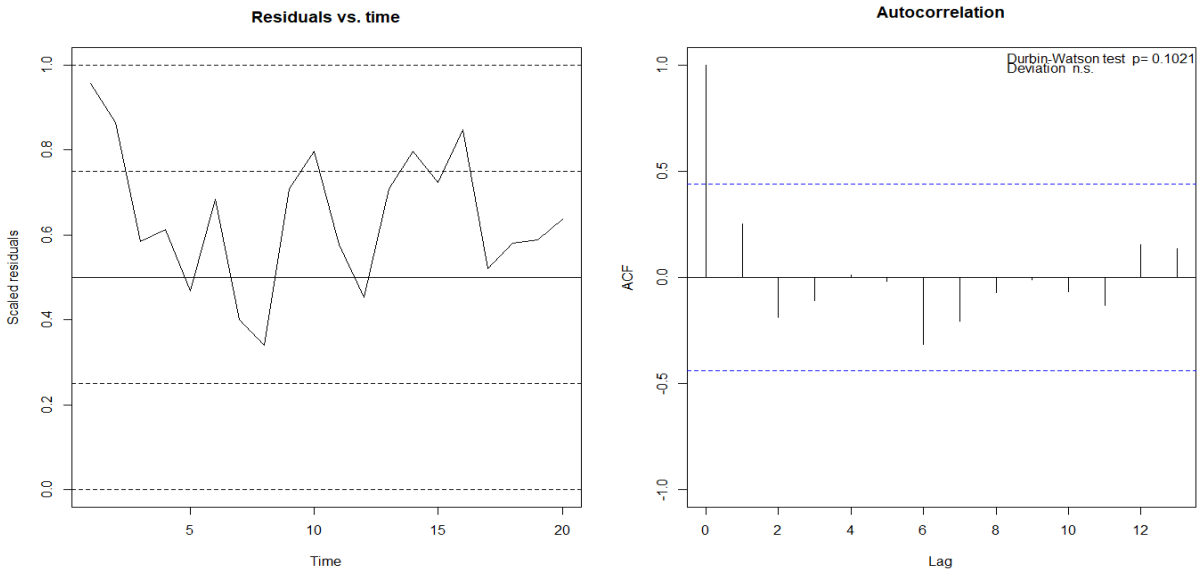


Note. The normality of the residuals (the Q–Q plot – Figure S3. A, B), homoscedasticity (the residual vs. predicted plot – Figure S3. C, D), and normality of the random effects (the random effects Q–Q plots – Figure S3. E, F, right panels).

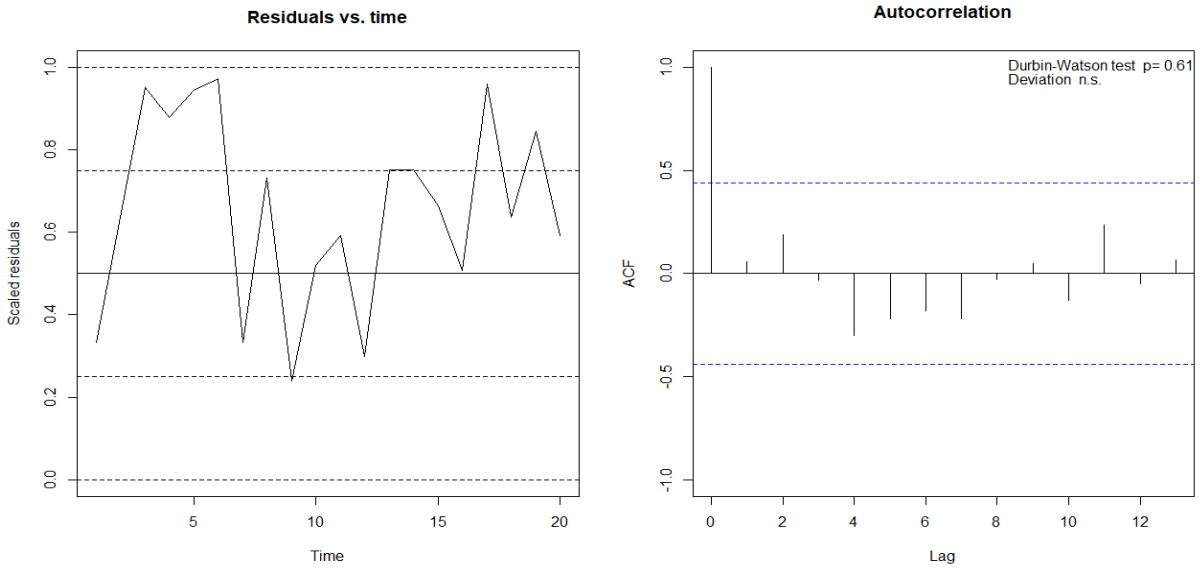
Figure S4

Testing for Temporal Autocorrelation in the Residuals of HA and INC

HA



INC



Note. The presence of autocorrelation in the residuals was tested using the testTemporalAutocorrelation function in the DHARMa package by aggregating time data across individuals, and inspecting the resulting residuals vs. time and autocorrelation function (ACF) plots. No significant autocorrelation was observed.

Figure S5

Scree and Silhouette Plots for K-Means Clustering Analysis with 1 to 10 Centers.

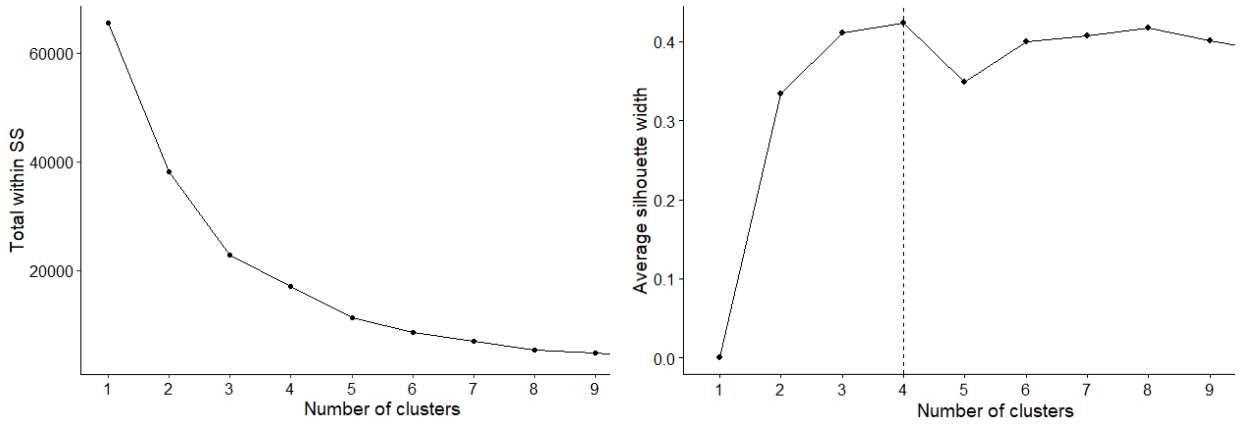


Figure S6

Participants' Change in HA and INC Over Time

SUPPLEMENTARY MATERIALS FOR CHAPTER 4 (STUDY 3)

To determine if the results of the present study were significantly affected by treatment modality (i.e., in-person treatment versus virtual treatment via videoconferencing) we reconducted the analyses. Individuals that received hybrid treatment (n = 3) were removed from these analyses.

Three 2 (in-person treatment, virtual treatment) x 2 (pre-treatment, post-treatment) mixed ANOVAs, with one between-subjects factor (treatment modality) and one within subjects factor (time) were conducted to investigate whether changes in questionnaire (i.e., YBOCS-SR, HA, INC) scores over time differed by treatment modality. There were significant main effects of time for YBOCS-SR [$F(1,60) = 81.21$, $p < .0001$, $\eta^2 = .575$], HA [$F(1,60) = 9.03$, $p = .004$, $\eta^2 = .131$], and INC [$F(1,60) = 6.83$, $p = .011$, $\eta^2 = .102$], which indicated there were significant decreases in questionnaire scores over time. There was no significant main effect of treatment modality for YBOCS-SR [$F(1,60) = .23$, $p = .626$, $\eta^2 = .004$] or HA [$F(1,60) = 2.77$, $p = .101$, $\eta^2 = .044$], however, there was for INC [$F(1,60) = 5.36$, $p = .024$, $\eta^2 = .082$]. Average scores on INC were significantly higher for those that completed treatment virtually (M = 24.42, SE = 1.29) than in-person (M = 18.74, SE = 2.09). Importantly, there were no significant interaction effects between time and treatment modality for all questionnaires (all ps > .05) which indicated that changes in questionnaire scores over time did not significantly differ by treatment modality.

When treatment modality was added into the four series of hierarchical linear mixed models, the findings indicated that there were no significant effects, across all four models, of treatment modality or modality x HA or INC interactions on OCD treatment outcome (see Table 5). Therefore, the results of this present study do not appear to be significantly affected by treatment modality.

Supplementary Table

Updated Hierarchical Linear Mixed Models that Include Modality, Modality x HA and Modality x INC Interactions.

		Beta (SE)	Wald χ^2 (df)	*p*
Model 1: Pre-Treatment HA and INC scores	YBOCS-pre	0.6280 (0.117)	29.0 (1)	< 0.0001
	HA-pre	-0.00432 (0.131)	0.0011 (1)	0.974
	INC-pre	0.0210 (0.126)	0.0277 (1)	0.868
	Modality	0.179 (0.131)	1.88 (1)	0.171
	HA-pre × Modality	-0.0718 (0.133)	0.293 (1)	0.589
	INC-pre × Modality	0.0526 (0.120)	0.191 (1)	0.662
Model 2: Pre- to Post-Treatment Change in HA and INC	YBOCS-pre	0.492 (0.0943)	27.2 (1)	< 0.0001
	HA-pre-post	0.359 (0.145)	6.10 (1)	0.0135
	INC-pre-post	0.0967 (0.123)	0.622 (1)	0.430
	Modality	0.133 (0.0970)	1.89 (1)	0.170
	HA-pre-post × Modality	-0.0907 (0.139)	0.425 (1)	0.515
	INC-pre-post × Modality	0.0968 (0.123)	0.624 (1)	0.430
Model 3: Early Change in HA and INC	YBOCS-pre	0.616 (0.102)	36.4 (1)	< 0.0001
	HA-early-ch	-0.0992 (0.123)	0.650 (1)	0.420
	INC-early-ch	0.278 (0.132)	4.44 (1)	0.0351
	Modality	0.124 (0.128)	0.942 (1)	0.332
	HA-early-ch × Modality	0.101 (0.126)	0.645 (1)	0.422
	INC-early-ch × Modality	0.0377 (0.132)	0.0820 (1)	0.775
Model 4: Late Change in HA and INC	YBOCS-pre	0.517 (0.104)	24.6 (1)	< 0.0001
	HA-late-ch	0.441 (0.143)	9.56 (1)	0.00199
	INC-late-ch	-0.260 (0.198)	1.73 (1)	0.189
	Modality	0.128 (0.134)	0.902 (1)	0.342
	HA-late-ch × Modality	-0.119 (0.138)	0.743 (1)	0.389
	INC-late-ch × Modality	0.197 (0.197)	0.995 (1)	0.319

Note. Tests of effects done with Type III Wald tests due to the presence of interactions.