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MAIN

Modelling OCD: a test of the inflated responsibility model

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Abstract

Background: The Salkovskis (1999) model of obsessive compulsive disorder (OCD), which emphasizes the role of inflated responsibility, has proven highly influential in both the understanding and treatment of OCD.

Aims: This study aimed to empirically test several core processes of this model.

Method: The individual components of the model were measured using multiple indicators in a sample of undergraduate students ($n = 170$), and confirmatory factor analyses were used to ascertain the most reliable, valid and theoretically consistent latent variables. Structural equation modelling was used to test proposed relations between latent constructs in the model.

Results: The inflated responsibility model was a good fit for the data in the present sample. As predicted by the model, misinterpretations of intrusive thoughts as indicating personal responsibility fully mediated the relationships between responsibility beliefs and counterproductive safety strategies, neutralizing actions and mood changes.

Conclusions: The Salkovskis (1999) inflated responsibility model of OCD is empirically supported in the present sample of undergraduate students, lending support to the proposed mechanisms in the model and supporting prior evidence.

Keywords: obsessive beliefs; obsessive compulsive disorder; responsibility; structural equation modelling

Introduction

Salkovskis' (1999) model of obsessive-compulsive disorder (OCD) has been highly influential in OCD theory and research (Taylor *et al.*, 2007). It is one of the most commonly used clinical theories of OCD (Fenger *et al.*, 2007), and has informed cognitive behavioural treatment approaches featuring in the official UK National Institute for Health and Care Excellence guidelines (NICE, 2005). The theory builds upon the cognitive specificity hypothesis (Beck, 1976), which suggests that particular maladaptive beliefs will lead to certain patterns of psychological difficulty. This and other central concepts have been developed by Salkovskis and colleagues in a series of papers (Salkovskis, 1985; Salkovskis, 1989; Salkovskis *et al.*, 1998; Salkovskis, 1999).

Salkovskis' model asserts that certain critical incidents and early experiences elicit the formation of maladaptive assumptions and beliefs around responsibility for harm, which in turn lead to misinterpretations of the significance of otherwise innocuous intrusive thoughts (e.g. an image of a man with cancer) as indicating personal responsibility (e.g. 'If I don't wash my hands 10 times, my husband will die'). This element of the model draws upon Rachman's (1997, 1998) theory, wherein he describes how 'catastrophic misinterpretations' of intrusive thoughts lead to distressing obsessions. The appraisal of personal responsibility for harm elicits significant

anxiety and engenders the urge to engage in neutralizing actions. Neutralizing can be both external and behavioural (e.g. hand washing), and/or internal and cognitive (e.g. visualizing the intrusive thought being ‘put right’). These neutralizing actions are carried out in order to prevent the content of the intrusive thought from occurring. In addition, the principle of negative reinforcement means that neutralizing efforts persist as long-term behaviour patterns due to their capacity to provide immediate relief from anxiety. Engagement in neutralizing actions also perpetuate OCD symptoms by preventing disconfirmation of the feared outcome or misinterpreted appraisal (i.e. by engaging in handwashing compulsions, the individual does not learn that her husband will not come to harm). The model also suggests that responsibility appraisals provoke heightened attentional biases for threat related stimuli, as well as changes in mood, and additional counterproductive attempts at controlling thoughts/avoiding triggers that maintain the disorder (Salkovskis, 1999).

Empirical support exists for the relevance of the individual components of Salkovskis’ model in OCD, i.e. early experiences (Briggs and Price, 2009), critical incidents (Rhéaume *et al.*, 1998), responsibility assumptions and beliefs (Abramowitz *et al.*, 2003; Romero-Sanchiz *et al.*, 2015), misinterpretation of intrusive thoughts (Abramowitz *et al.*, 2006), neutralizing actions (Salkovskis *et al.*, 1997), attention bias (Amir *et al.*, 2009), counterproductive safety strategies (Abramowitz *et al.*, 2001) and mood changes (Purdon, 2001). In addition, there is also support for the proposed relational pathways within the model, with early experiences and critical incidents being linked to the formation and activation of maladaptive beliefs around responsibility (Coles and Schofield, 2008; Coles *et al.*, 2008; Collins and Coles, 2018) and the misinterpretation of intrusions having a crucial mediating role between maladaptive beliefs and symptoms of OCD (Pleva and Wade, 2006). However, these pathways have typically been examined in isolation and have not been concurrently examined in a comprehensive test of the model. This is a limitation of the current evidence base, as the model was developed as a comprehensive aid to the understanding and treatment of OCD.

Research into the specific types of beliefs and appraisals that underlie obsessive compulsive symptoms suggests that constructs additional to responsibility may also be relevant. For example, beliefs about cognitive capacities including memory, attention and perception have been implicated in OCD (Hermans *et al.*, 2008), with negative beliefs about memory having been shown to induce checking in an experimental manipulation (Alcolado and Radomsky, 2011). The widely studied belief and appraisal domains identified by the Obsessive Compulsive Cognitions Working Group (OCCWG, 1997, 2001, 2003, 2005) of responsibility/elevated threat estimation, perfectionism/intolerance of uncertainty and the importance of/need to control thoughts are all associated with symptoms of OCD (Wheaton *et al.*, 2010). However, Taylor *et al.* (2010) conducted a large scale modelling study ($n = 5015$) with belief and symptom data, and found that responsibility/threat estimation predicted all six OCI-R symptom subtypes when controlling for the other Obsessive Belief Questionnaire (OBQ) belief domains. Perfectionism/intolerance of uncertainty predicted ordering symptoms beyond the effects of importance/control of thoughts and responsibility/threat estimation, whereas importance/control of thoughts predicted neutralizing, washing and obsessions beyond the effects of the other domains. Similarly, Gagné *et al.* (2018b) found that when administering a shortened 9-item version of the OBQ to a sample of participants who were seeking intensive inpatient treatment for OCD, the responsibility/threat over-estimation subscale was the only significant predictor of all four symptom dimensions on the Dimensional Obsessive-Compulsive Scale (DOCS; Abramowitz *et al.*, 2010). While these cross-sectional findings are commensurate with the general cognitive model of the OCCWG (Frost and Steketee, 2002), they are also highly supportive of Salkovskis’ (1999) model, in that responsibility was the most consistent predictor of symptoms. Pozza and Dèttore (2014) recently reviewed case control studies and found a large effect size for responsibility beliefs favouring groups with OCD over non-OCD groups, and a medium effect size for groups with OCD over other anxiety disorder groups. However, they suggested that

publication bias was likely to have influenced these results, preventing definitive confirmation of the specificity of inflated responsibility to OCD. In addition to the above evidence from cross-sectional psychometric studies, a significant body of experimental work is supportive of the causal role of inflated responsibility in OCD. For example, Ladouceur *et al.* (1995) manipulated perceived responsibility in a manual classification task and found that participants in the 'high responsibility' group experienced significantly higher checking, hesitation and anxiety than participants in the 'low responsibility' group. Similarly, in a sample of adults with compulsive checking, Lopatka and Rachman (1995) found that induced declines in perceived responsibility led to a reduction in estimated probability of harm, urge to check, and likelihood of the particular misfortune occurring. Moreover, Arntz *et al.* (2007) also found an effect of experimentally induced responsibility on checking behaviours. Importantly, participants with OCD in the 'high responsibility' condition showed more checking behaviour and OCD-like experiences than a control group with anxiety but not OCD, and a group of non-patients, suggesting responsibility is particularly pertinent in OCD. More recently, Leonhart and Radomsky (2017) demonstrated that inducing responsibility beliefs in an experimental task led to higher covert reassurance seeking from a confederate in the task, which was suggested to be a form of compulsive checking by proxy. While this robust experimental evidence strongly suggests a causal role for responsibility experiences in eliciting symptoms of OCD, the studies do not draw discrete boundaries between the concepts of responsibility beliefs and appraisals, as the model would suggest, with participants typically being asked about feelings of responsibility or urges to neutralize, rather than explicit pre-existing beliefs or appraisal tendencies. Similarly, the outcome measures in these experimental studies focus on neutralizing and compulsions more so than mood changes and counterproductive safety strategies as delineated in the model. A recent meta-analysis concluded that while responsibility appraisals are implicated in the maintenance of OCD symptoms, current research cannot clearly demonstrate the specificity of this construct to OCD (Mantz and Abbott, 2017). Further research into the inflated responsibility hypothesis is thus warranted, in order to comprehensively synthesize the robust experimental findings around induced responsibility and compulsions, and the theoretical and psychometric studies which have differentially emphasized the processes and pathways in Salkovskis' model.

While accepting that any theoretical model is likely to be an imperfect approximation (MacCallum, 2003), the Salkovskis (1999) inflated responsibility model appears to balance solid supporting evidence with clinical utility and relative parsimony. With this in mind, the current study focused specifically on testing the Salkovskis (1999) inflated responsibility model.

Rationale and aims

To the authors' knowledge, no study has used multiple indicators to test the proposed latent constructs in the Salkovskis model, including the symptom constructs of 'neutralizing actions', 'counterproductive safety strategies', and 'mood changes'. These constructs extend beyond a single measure of symptoms of OCD, and provide useful theoretical information to guide clinicians. For example, counterproductive safety strategies including avoidance and thought suppression are qualitatively different from neutralizing rituals, and this distinction is likely to have clinical relevance. As such, the current study aimed to concurrently examine several core components of the inflated responsibility model, evaluating its empirical plausibility, and hence strengthening the theoretical basis behind current OCD treatment. Structural equation modelling (SEM) was used to cross-sectionally test an inflated responsibility model that was an approximation of the original Salkovskis (1999) theory. Mediational pathways were then analysed, with the prediction that responsibility appraisals would mediate the relationships between responsibility beliefs and neutralizing, counterproductive safety strategies and mood.

Method

Design

The study was a cross-sectional correlational study utilizing a large battery of quantitative self-report questionnaires to measure OCD-related variables. SEM was selected as an analysis methodology as it afforded the possibility to test complex theoretical relationships between a large number of psychological constructs – as well as their directionality – whilst accounting for measurement error (Schreiber *et al.*, 2006). The questionnaires were used to operationalize latent variables within the Salkovskis (1999) model of OCD. These variables included: *Early Experiences*, *Critical Incidents*, *Responsibility Assumptions and Beliefs*, *Responsibility Appraisals/Misinterpretation of Intrusions*, *Mood Changes*, *Counterproductive Safety Strategies*, and *Neutralising Actions*. Questionnaires were administered both on paper and online in psychology classes, and repeated measures *t*-tests indicated no significant differences on any variable based on mode of administration. A brief experimental measure of attention biases was also administered.

Participants

Participants were an opportunity sample of undergraduate psychology students at Queen's University Belfast ($n = 170$). Participants took part voluntarily and received course credit for their participation. Mean age was 20.29 years ($SD = 4.78$; range = 18–48; 140 women).

Measures

OCD symptoms and neutralizing behaviour

The Yale-Brown Obsessive Compulsive Scale (self-report) (Y-BOCS; Baer et al., 1993). The 10-item self-report version of the Y-BOCS measures five aspects of obsessions and compulsions, namely: time occupied/frequency, interference, distress, resistance, and perceived control. Reliability has been demonstrated to be satisfactory (Steketee *et al.*, 1996), and both convergent and divergent validity are supported (Ólafsson *et al.*, 2010). The self-report version tends to produce lower symptom scores than the clinician-administered version; however, correlations between participant- and clinician-rated scores are moderate to large (Federici *et al.*, 2010).

The Obsessive Compulsive Inventory Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18-item self-report measure. It requires participants to rate the extent to which they have experienced OCD symptoms in the past month, and how bothered they have been by them (from 0: 'not at all', to 4: 'very much'). Six symptom domains are assessed: washing, checking/doubting, obsessing, neutralizing, ordering, and hoarding. The measure has shown good reliability and validity (Foa *et al.*, 2002), and the six-factor structure has been replicated in a non-clinical sample of college students (Hajcak *et al.*, 2004).

The neutralizing subscale of the Y-BOCS and the neutralizing, washing, checking and ordering subscales of the OCI-R were used to indicate 'neutralizing actions'. The neutralizing subscale of the OCI-R specifically measured mental neutralizing, so the additional scales were included to assess overt neutralizing behaviours.

Responsibility beliefs and appraisals

Responsibility beliefs

The latent variable of 'responsibility beliefs' was indicated by the responsibility/threat estimation subscale of the OBQ-44, and the Responsibility Attitude Scale (RAS).

The Obsessive Beliefs Questionnaire Responsibility Subscale (OBQ-44). This subscale featured 14 items assessing inflated responsibility and elevated threat estimation.

The Responsibility Attitudes Scale (RAS; Salkovskis et al., 2000). This measure contains 26 statements regarding beliefs about personal responsibility. The RAS has shown high test-retest reliability

($r = .94$) and high internal consistency ($\alpha = .92$), along with good concurrent validity for measures of OCD symptoms (Salkovskis *et al.*, 2000).

Appraisal/misinterpretation of intrusive thoughts

The 'responsibility appraisals' latent variable was indicated by the Responsibility Interpretations Questionnaire (RIQ) frequency and belief subscales, in addition to the responsibility appraisal item from the Revised Obsessional Intrusions Inventory (ROII).

The Responsibility Interpretations Questionnaire (RIQ; Salkovskis et al., 2000). The RIQ is a self-report questionnaire assessing the extent to which individuals appraise intrusive thoughts as indicating personal responsibility. Pleva and Wade (2006) reported good internal consistencies for both subscales of the RIQ ($\alpha = .90$ and $.93$, respectively).

The Revised Obsessional Intrusions Inventory (ROII; Purdon and Clark, 1994). This is a self-report questionnaire consisting of three parts. Part 1 assesses the presence and frequency of unwanted intrusions. Part 2, the appraisal scale, requires participants to indicate their most distressing intrusion, then assesses the appraisal of this intrusion on a number of dimensions (unpleasantness, guilt, worry thought will come true, uncontrollability, unacceptability, likelihood thought will come true, importance of control, harm/danger, responsibility, and desire to avoid triggers.) These appraisals are in line with the appraisal dimensions indicated by the OCCWG. In addition, ten final items evaluate strategies used to deal with intrusions. The ROII has demonstrated good psychometric properties when used with student samples (Clark *et al.*, 2000).

Mood changes

The latent variable of 'mood changes' was measured by the subscales of the Profile of Mood States – Short Form.

The Profile of Mood States – Short Form (POMS-SF; Curran et al., 1995). This is a 37-item measure of mood state. The questionnaire measures six subscales of mood, including depression, anger, vigour, confusion, tension and fatigue. The 37-item short version used in this study has comparable psychometric properties to the original long form, and subscale correlations between the two forms were all greater than $.95$ (Curran *et al.*, 1995).

Counterproductive safety strategies

A 'counterproductive safety strategies' latent variable consisting of deleterious forms of thought suppression and control, and experiential avoidance was indicated by the White Bear Suppression Inventory (WBSI), the Thought Control Questionnaire *worry* and *punishment* scales and the Acceptance and Action Questionnaire (AAQ-2).

Thought suppression/counterproductive control strategies

The White Bear Suppression Inventory (WBSI; Wegner and Zanakos, 1994). The WBSI measures motivation to suppress thoughts, rather than success in doing so. The available evidence suggests that the WBSI measures a single factor (Palm and Strong, 2007), and internal consistency is satisfactory ($\alpha = .88$).

The Thought Control Questionnaire (TCQ; Wells and Davies, 1994). The TCQ is a 30-item measure, scored on a 4-point scale from 'never' to 'almost always'. It assesses five different thought suppression strategies: distraction, social control, worry, punishment, and reappraisal. It is psychometrically sound in non-clinical samples (Wells and Davies, 1994). Previous research has indicated that the punishment and worry subscales of the TCQ are the most relevant in OCD (Amir *et al.*, 1997; Clark and Beck, 2010; Fergus and Wu, 2010).

Avoidance

The Acceptance and Action Questionnaire (AAQ-2; Hayes et al., 2004). This is a 9-item questionnaire which assesses experiential avoidance. The AAQ-2 measures the extent to which an individual purposely avoids their emotions, thoughts and other experiences, and is unable to act in difficult situations. Psychometric properties are good (Bond and Bunce, 2003).

Excluded variables

Critical Incidents, Early Experiences and attention biases were also measured by the Parental Bonding Instrument (Parker *et al.*, 1979), the Life Experiences Survey (Sarason *et al.*, 1978), the Trauma History Questionnaire (Green, 1996), and a brief experimental test of attention to OCD-related stimuli. However, the data from these measures did not meet validity and reliability criteria to form latent variables and were thus not included in further modelling. The focus of empirical validation in the present study was therefore on the maintenance processes implied in Salkovskis' model, rather than the hypothesized historical causative factors.

Analysis

After data screening, modelling was carried out in a two-step approach (Anderson and Gerbing, 1988). First, a measurement model was developed, wherein exploratory factor analysis was used to ensure accurate construct identification. Confirmatory procedures also ensured validity and reliability of the latent constructs. Second, the proposed specific relationships between these latent variables were analysed in a theoretically informed structural model. Maximum likelihood estimation was used, and model fit was assessed by several indices: (1) chi-square; (2) squared error of approximation (RMSEA); (3) comparative fit index (CFI), and (4) parsimony goodness-of-fit index (PGFI). RMSEA values of 0.8 or below (MacCallum *et al.*, 1996) combined with CFI values of 0.9 or more (Bentler, 1992) are indicative of acceptable model fit. PGFI values of 0.5 or greater are to be expected in parsimonious models (Mulaik *et al.*, 1989). In addition, Akaike's Information Criterion (AIC) was used as a further aid to assessing relative model fit. A model within <2 AIC points of the model with the lowest AIC has some support, models between 4 and 7 AIC points higher have less support and models with >10 points over the lowest AIC scoring model have no support (Burnham and Anderson, 2004). Mediation was tested using 2000 bias corrected bootstrap samples in AMOS.

Results

Descriptive statistics

Table 1 displays descriptive information and Cronbach's alpha values for the selected indicator variables in the study. All values were above 0.70, with the exception of OCI-R neutralizing, which was close at 0.66, indicating acceptable to excellent internal consistency for all scales.

Data screening

The data were screened for missing values. Cases were deleted if any individual questionnaire within this larger survey was more than 20% incomplete. After these cases were deleted ($n = 15$), 170 cases remained. The survey consisted of a total of 253 individual items. Of the 170 participants, two had three data points missing, five had two data points missing and, 27 had one data point missing. Median imputation was used to replace these missing values.

Due to their high combined kurtosis and skewness values, which were not improved by transformation, OCI-Rneut, POMSdep and POMSang were removed from the analysis.

Measurement model of inflated responsibility (Salkovskis) model

Figure 1 shows the measurement model, with standardized regression coefficients and correlations displayed.

Table 1. Descriptive statistics and internal consistencies for indicator variables ($n = 170$)

Study measures	Mean	SD	Range	Potential range	α
OCI-R total	18.46	11.71	0–52	0–72	.89
OCI-R washing	2.36	2.52	0–12	0–12	.75
OCI-R checking	3.27	2.82	0–12	0–12	.80
OCI-R ordering	3.61	3.09	0–12	0–12	.87
OCI-R obsessing	3.34	3.00	0–12	0–12	.88
OCI-R hoarding	3.99	3.00	0–11	0–12	.76
OCI-R neutralizing	1.91	2.46	0–11	0–12	.66
Y-BOCS	8.71	6.47	0–31	0–40	.90
Y-BOCS neutralizing	4.21	4.06	0–16	0–20	.90
WBSI	50.16	11.89	16–74	15–75	.91
AAQ-2	31.66	11.82	10–64	10–70	.91
TCQ worry	10.63	3.02	6–19	6–24	.80
TCQ punish	10.07	2.99	6–21	6–24	.72
OBQ responsibility/threat	54.74	16.73	15–96	15–105	.90
RAS (reversed)	75.83	24.36	17–141	1–157	.93
POMS depression	4.62	6.20	0–28	0–32	.92
POMS anger	5.08	5.41	0–25	0–28	.90
POMS tension	6.75	5.72	0–24	0–24	.87
POMS confusion	5.61	4.34	0–17	0–20	.77
POMS fatigue	8.77	5.67	0–20	0–20	.90
ROI breadth/frequency	45.19	38.14	0–212	0–364	n/a
ROI appraisals	12.62	8.29	0–40	0–40	.86
RIQ frequency	30.49	14.94	0–61	0–88	.87
RIQ Belief	71.47	38.09	0–147	0–220	.89

OCI-R, Obsessive Compulsive Inventory Revised; Y-BOCS, Yale-Brown Obsessive Compulsive Scale; WBSI, White Bear Suppression Inventory; AAQ-2, Acceptance and Action Questionnaire; TCQ, Thought Control Questionnaire; OBQ-44, Obsessive Beliefs Questionnaire; RAS, Responsibility Attitudes Scale; RIQ, Responsibility Interpretations Questionnaire; POMS, Profile of Mood States; ROI, Revised Obsessional Intrusions Inventory.

Figure 1. Measurement model for the inflated responsibility model.

Table 2. Fit statistics for the responsibility measurement model

χ^2	d.f.	p	RMSEA	CFI
94.99	77	.08	.04	.99

Figure 2. Structural model for the inflated responsibility model.

Reliability and validity

Reliability and validity were assessed by calculating composite reliability scores (CR), average variance extracted (AVE) and maximum shared variance (MSV). In line with Fornell and Larcker (1981), AVE was compared with MSV for each construct. If the AVE was greater than the MSV, then this would indicate discriminant validity. All latent variables showed adequate discriminant validity according to this method, with the exception of ‘neutralizing’, which had an AVE of .43 and an MSV of .44. Accordingly, the lowest loading indicator on this construct in the exploratory factor analysis was removed (OCI-Rcheck) and the analysis was re-run. This new measurement model showed good discriminant validity of latent constructs. Hair *et al.* (2010) have suggested that an AVE greater than 0.50 indicates good convergent validity, and a CR greater than 0.70 indicates sufficient reliability. All latent variables met both of these cut-offs, with the exception of ‘neutralizing’, which had sufficient reliability, but had an AVE score of 0.45. However, as this value was close to the suggested cut-off of 0.5, and the construct was theoretically important, reliable and distinct within our model, it was retained.

Model fit

Table 2 shows fit statistics for the inflated responsibility measurement model. As can be seen from the table, the model was a good fit for the data.

Inflated responsibility structural model

The inflated responsibility structural model was then specified and tested for fit. Figure 2 displays the final inflated responsibility model, with significant standardized coefficients reported. As can

Table 3. Fit statistics for the responsibility model

χ^2	d.f.	<i>p</i>	RMSEA	CFI	PGFI
107.53	83	.036	.04	.98	.64

be seen, all predicted paths in the model were supported; responsibility beliefs predicted responsibility appraisals/misinterpretations (95% CI: 0.55–0.82, $p < .01$), which in turn predicted counterproductive safety strategies (95% CI: 0.71–0.97, $p < .01$), mood changes (95% CI: 0.47–0.75, $p < .01$), and neutralizing actions (95% CI: 0.58–0.90, $p < .01$). Table 3 displays model fit statistics. As this table shows, the model was a good fit for the data, according to RMSEA, CFI and PGFI values.

Mediation

The hypothesis that responsibility appraisals/misinterpretations of intrusions would mediate the relationship between responsibility beliefs and outcome measures was tested using 2000 bias corrected bootstrap samples in AMOS. The bootstrap indicated significant indirect paths from responsibility beliefs to mood (95% CI: 0.30–0.56, $p < .01$), neutralizing (95% CI: 0.36–0.66, $p < .01$), and counterproductive safety strategies (95% CI: 0.47–0.72, $p < .01$). These results suggest that responsibility appraisals (i.e. misinterpretation of intrusive thoughts) mediated the relationship between responsibility beliefs and mood, neutralizing and counterproductive safety strategies.

A second model was tested which included additional direct paths from responsibility beliefs to mood, neutralizing and counterproductive safety strategies, to determine whether or not responsibility appraisals fully mediated the relationships between responsibility beliefs and symptoms. However, none of these direct paths was significant, and the Akaike's Information Criterion (AIC) for this partial mediation model was more than 2 points higher than for the full mediation model (184.42), providing stronger support for the more parsimonious full mediation model (Burnham and Anderson, 2004).

Discussion

The study provided empirical support for several key pathways within Salkovskis' (1999) model of OCD. The results support Salkovskis' (1985, 1999) assertion that dysfunctional appraisals of intrusive thoughts, in line with beliefs about responsibility, would lead to escalating thought control efforts, neutralizing behaviours, and negative mood changes. The results also suggest that the model is empirically plausible whenever these paths are considered concurrently, rather than solely in isolation. The results are in accordance with Pleva and Wade (2006) who found a significant indirect effect of responsibility appraisals on the relationship between responsibility attitudes and symptoms of OCD. However, the findings of the current study and Pleva and Wade (2006) both evidenced a significant indirect effect via misinterpretation of intrusions. In addition, the present study expanded upon the work of Pleva and Wade (2006) by using multiple outcome measures to focus on Salkovskis' proposed specific cognitive, affective and behavioural manifestations of OCD (i.e. neutralizing, counterproductive strategies, mood changes), beyond a single measure of symptoms. Consistent with prior work, responsibility appraisals predicted neutralizing (e.g. Shafraan, 1997), counterproductive safety strategies (e.g. Morillo *et al.*, 2007; Yorulmaz *et al.*, 2010), and mood changes (Kumar *et al.*, 2012).

Clinical implications

The present findings are supportive of the theoretical plausibility of Salkovskis' (1999) inflated responsibility model. By extension, this adds further support to the case for using this model

as an aid to formulation and intervention with OCD, as suggested in national guidelines (NICE, 2005). Drawing attention to and helping clients to challenge responsibility beliefs and appraisals is likely to be of benefit in OCD, given the strong predictive relationships of these variables with the maladaptive outcome variables in this study. The findings are also consistent with the broader literature, which suggests that misinterpretation of intrusive thoughts is a core feature of OCD across cognitive models (Clark, 2004; Frost and Steketee, 2002; Rachman, 1997; Salkovskis, 1999).

Limitations

The present study has several limitations. Three components of the Salkovskis model were not included in the structural analyses, namely early experiences, critical incidents, and attention bias as the indicators selected did not provide suitable data to construct latent variables, thus the study is not a full and comprehensive test. Crucially, the failure to develop appropriate latent variables in this study with these measures should not be interpreted as an indication that these variables are not relevant. The OCI-R neutralizing subscale and the POMS depression and anger subscales had to be dropped from the analyses due to combined skewness and kurtosis, which is a significant limitation of the study. However, the latent variables all had a broad range of relevant indicator variables, and the study is the most comprehensive test to date to our knowledge.

The latent variable of ‘neutralizing’ also had borderline discriminant validity. Given the conceptual overlap with ‘counterproductive safety strategies’, this is unsurprising. However, it was reliable, distinct and theoretically important, so these constructs were retained as separate in the analyses.

The study was cross-sectional and cannot confirm the causality of the processes under investigation. However, in accordance with prior research, the current results suggest that the model is theoretically plausible. The sample had limited representativeness as it was conducted on a student population, reducing its generalizability to people with OCD. It may be that the processes involved in the onset and maintenance of clinical OCD are not comparable to those in subclinical obsessive compulsive symptoms. However, several recent review articles have found strong support for the validity of using analogue samples in OCD research (Abramowitz *et al.*, 2014; De Putter *et al.*, 2017; Gagné *et al.*, 2018a).

A final limitation regards the focus on responsibility. Extensive research has implicated beliefs and phenomena additional to responsibility in OCD (OCCWG, 2005). The current study is deliberately focused on responsibility as this model has been arguably the most influential in cognitive therapy for OCD (Taylor *et al.*, 2007). It is possible that adding the other OCCWG beliefs and appraisals may increase the percentage of variance explained in the endogenous latent variables. However, this was beyond the scope of the current study, which was focused on the empirical plausibility of the inflated responsibility model.

Future directions

Several research avenues arise from the present results. First, the present model should be replicated in different samples, including clinical samples, to further verify validity (Preacher and Merkle, 2012). The collection of additional data at multiple time points would strengthen the causal claims of the model, and in conjunction with data from different samples, would permit more confidence in the theory. Also, selecting more appropriate measures of early experiences and critical incidents may facilitate the development of latent variables of these constructs, thus permitting empirical testing of their proposed relationships in the model. In addition, developing latent variables of other implicated beliefs and appraisals (e.g. OCCWG, 2005) and testing these alongside responsibility beliefs and appraisals in a comprehensive model may help with the clarification of the most appropriate cognitive conceptualization of OCD.

Conclusions

The present study tested an approximation of Salkovskis' (1999) inflated responsibility model. The model was a good fit in the present sample, providing further empirical validation of Salkovskis' (1999) theory and supporting the therapeutic focus on responsibility beliefs and appraisals. Rachman's (1997) emphasis on 'catastrophic misinterpretations' of intrusive thoughts was also a crucial component, suggesting that the manner in which intrusive cognitions are related to is an essential feature in the maintenance of OCD, and should be a primary focus of intervention.

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References

- Abramowitz, J. S., Deacon, B. J., Olatunji, B. O., Wheaton, M. G., Berman, N. C., Losardo, D., Timpano, K. R., McGrath, P. B., Riemann, B. C., Adams, T., & Björgvinsson, T. (2010). Assessment of obsessive-compulsive symptom dimensions: development and evaluation of the Dimensional Obsessive-Compulsive Scale. *Psychological Assessment*, 22, 180–198.
- Abramowitz, J. S., Fabricant, L. E., Taylor, S., Deacon, B. J., McKay, D., & Storch, E. A. (2014). The relevance of analogue studies for understanding obsessions and compulsions. *Clinical Psychology Review*, 34, 206–217.
- Abramowitz, J. S., Khandker, M., Nelson, C. A., Deacon, B. J., & Rygwall, R. (2006). The role of cognitive factors in the pathogenesis of obsessive-compulsive symptoms: a prospective study. *Behaviour Research and Therapy*, 44, 1361–1374.
- Abramowitz, J. S., Schwartz, S. A., & Moore, K. M. (2003). Obsessional thoughts in postpartum females and their partners: content, severity and relationship with depression. *Journal of Clinical Psychology in Medical Settings*, 10, 157–164.
- Abramowitz, J. S., Tolin, D. F., & Street, G. P. (2001). Paradoxical effects of thought suppression: a meta-analysis of controlled studies. *Clinical Psychology Review*, 21, 683–703.
- Alcolado, G. M., & Radomsky, A. S. (2011). Believe in yourself: manipulating beliefs about memory causes checking. *Behaviour Research and Therapy*, 49, 42–49.
- Amir, N., Cashman, L., & Foa, E. B. (1997). Strategies of thought control in obsessive-compulsive disorder. *Behaviour Research and Therapy*, 35, 775.
- Amir, N., Najmi, S., & Morrison, A. S. (2009). Attenuation of attention bias in obsessive-compulsive disorder. *Behaviour Research and Therapy*, 47, 153–157.
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: a review and recommended two-step approach. *Psychological Bulletin*, 103, 411.
- Arntz, A., Voncken, M., & Goosen, A. C. (2007). Responsibility and obsessive-compulsive disorder: an experimental test. *Behaviour Research and Therapy*, 45, 425–435.
- Baer, L., Brown-Beasley, M. W., Sorce, J., & Henriques, A. (1993). Computer-assisted telephone administration of a structured interview for obsessive-compulsive disorder. *American Journal of Psychiatry*, 150, 1737–1738.
- Beck, A. T. (1976). *Cognitive Therapy and the Emotional Disorders*. New York, USA: International Universities Press.
- Bentler, P. M. (1992). On the fit of models to covariances and methodology to the Bulletin. *Psychological Bulletin*, 112, 400–404.
- Bond, F. W., & Bunce, D. (2003). The role of acceptance and job control in mental health, job satisfaction, and work performance. *Journal of Applied Psychology*, 88, 1057.
- Briggs, E. S., & Price, I. R. (2009). The relationship between adverse childhood experience and obsessive-compulsive symptoms and beliefs: the role of anxiety, depression, and experiential avoidance. *Journal of Anxiety Disorders*, 23, 1037–1046.
- Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: understanding AIC and BIC in model selection. *Sociological Methods & Research*, 33, 261–304.
- Clark, D. A. (2004). *Cognitive-Behavioral Therapy for OCD*. New York, USA: Guilford Press.
- Clark, D. A., & Beck, A. T. (2010). *Cognitive Therapy of Anxiety Disorders*. New York, USA: Guilford Press.
- Clark, D. A., Purdon, C., & Byers, E. S. (2000). Appraisal and control of sexual and non-sexual intrusive thoughts in university students. *Behaviour Research and Therapy*, 8, 439–455.
- Coles, M. E., & Schofield, C. A. (2008). Assessing the development of inflated responsibility beliefs: the pathways to Inflated Responsibility Beliefs Scale. *Behavior Therapy*, 39, 322–335.

- Coles, M. E., Pietrefesa, A. S., Schofield, C. A., & Cook, L. M. (2008). Predicting changes in obsessive compulsive symptoms over a six-month follow-up: a prospective test of cognitive models of obsessive compulsive disorder. *Cognitive Therapy and Research*, 32, 657–675.
- Collins, L. M., & Coles, M. E. (2018). A preliminary investigation of pathways to inflated responsibility beliefs in children with obsessive compulsive disorder. *Behavioural and Cognitive Psychotherapy*, 46, 374–379.
- Curran, S. L., Andrykowski, M. A., & Studts, J. L. (1995). Short Form of the Profile of Mood States (POMS-SF): psychometric information. *Psychological Assessment*, 7, 80.
- De Putter, L. M., Van Yper, L., & Koster, E. H. (2017). Obsessions and compulsions in the lab: a meta-analysis of procedures to induce symptoms of obsessive-compulsive disorder. *Clinical Psychology Review*, 52, 137–147.
- Federici, A., Summerfeldt, L. J., Harrington, J. L., McCabe, R. E., Purdon, C. L., Rowa, K., & Antony, M. M. (2010). Consistency between self-report and clinician-administered versions of the Yale-Brown Obsessive-Compulsive Scale. *Journal of Anxiety Disorders*, 24, 729–733.
- Fenger, M. M., Mortensen, E. L., Rasmussen, J., & Lau, M. (2007). Group therapy with OCD: development and outcome of diagnosis specific treatment of patients with OCD in groups. *Nordic Psychology*, 59, 332.
- Fergus, T. A., & Wu, K. D. (2010). Is worry a thought control strategy relevant to obsessive-compulsive disorder? *Journal of Anxiety Disorders*, 24, 269–274.
- Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: development and validation of a short version. *Psychological Assessment*, 14, 485.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18, 9–50.
- Frost, R. O., & Steketee, G. (eds) (2002). *Cognitive Approaches to Obsessions and Compulsions: Theory, Assessment, and Treatment*. Elsevier.
- Gagné, J. P., Kelly-Turner, K., & Radomsky, A. S. (2018a). From the laboratory to the clinic (and back again): how experiments have informed cognitive-behavior therapy for obsessive-compulsive disorder. *Journal of Experimental Psychopathology*, 9. <https://doi.org/10.1177/2043808718810030>
- Gagné, J. P., Van Kirk, N., Hernandez-Vallant, A., Potluri, S., Krompinger, J. W., Cattie, J. E., Garner, L. E., Crosby, J. M., Brennan, B. P., & Elias, A. (2018b). Validating an abbreviated version of the Obsessive Beliefs Questionnaire. *Journal of Clinical Psychology*, 74, 1791–1807.
- Green, B. L. (1996). Trauma history questionnaire. *Measurement of Stress, Trauma, and Adaptation*, 1, 366–369.
- Hair, J., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th edn). Upper Saddle River, New Jersey, USA: Pearson Education International.
- Hajcak, G., Huppert, J. D., Simons, R. F., & Foa, E. B. (2004). Psychometric properties of the OCI-R in a college sample. *Behaviour Research and Therapy*, 42, 115–123.
- Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., ... & McCurry, S. M. (2004). Measuring experiential avoidance: a preliminary test of a working model. *Psychological Record*, 54, 553–578.
- Hermans, D., Engelen, U., Grouwels, L., Joos, E., Lemmens, J., & Pieters, G. (2008). Cognitive confidence in obsessive-compulsive disorder: distrusting perception, attention and memory. *Behaviour Research and Therapy*, 46, 98–113.
- Kumar, A., Sharma, M. P., Kandavel, T., & Janardhan Reddy, Y. C. (2012). Cognitive appraisals and quality of life in patients with obsessive compulsive disorder. *Journal of Obsessive-Compulsive and Related Disorders*, 1, 301–305.
- Ladouceur, R., Rhéaume, J., Freeston, M. H., Aublet, F., Jean, K., Lachance, S., Langlois, F., & de Pokomandy-Morin, K., (1995). Experimental manipulations of responsibility: an analogue test for models of obsessive-compulsive disorder. *Behaviour Research and Therapy*, 33, 937–946.
- Leonhart, M. W., & Radomsky, A. S. (2017). Responsibility causes reassurance seeking, too: an experimental investigation. *Journal of Obsessive-Compulsive and Related Disorders*, 20, 66–74.
- Lopatka, C., & Rachman, S. (1995). Perceived responsibility and compulsive checking: an experimental analysis. *Behaviour Research and Therapy*, 33, 673–684.
- MacCallum, R. C. (2003). 2001 presidential address: working with imperfect models. *Multivariate Behavioral Research*, 38, 113–139.
- MacCallum, R. C., Browne, M. W., and Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1, 130–149.
- Mantz, S. C., & Abbott, M. J. (2017). The relationship between responsibility beliefs and symptoms and processes in obsessive compulsive disorder: a systematic review. *Journal of Obsessive-Compulsive and Related Disorders*, 14, 13–26.
- Morillo, C., Belloch, A., & García-Soriano, G. (2007). Clinical obsessions in obsessive-compulsive patients and obsession-relevant intrusive thoughts in non-clinical, depressed and anxious subjects: where are the differences? *Behaviour Research and Therapy*, 45, 1319–1333.
- Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin*, 105, 430.

- National Institute for Health and Care Excellence (NICE)** (2005). *Obsessive-compulsive disorder and body dysmorphic disorder: treatment*. Clinical guideline (CG-31). Retrieved from: <https://www.nice.org.uk/guidance/cg31>
- Obsessive Compulsive Cognitions Working Group (OCCWG)** (1997). Cognitive assessment of obsessive-compulsive disorder. *Behaviour Research and Therapy*, 35, 667–681.
- Obsessive Compulsive Cognitions Working Group (OCCWG)** (2001). Development and initial validation of the obsessive beliefs questionnaire and the interpretation of intrusions inventory. *Behaviour Research and Therapy*, 39, 987–1006.
- Obsessive Compulsive Cognitions Working Group (OCCWG)** (2003). Psychometric validation of the Obsessive Beliefs Questionnaire and the Interpretation of Intrusions Inventory: Part I. *Behaviour Research and Therapy*, 41, 863–878.
- Obsessive Compulsive Cognitions Working Group (OCCWG)** (2005). Psychometric validation of the obsessive belief questionnaire and interpretation of intrusions inventory – Part 2: Factor analyses and testing of a brief version. *Behaviour Research and Therapy*, 43, 1527–1542.
- Ólafsson, R. P., Snorrason, Í., & Smári, J.** (2010). Yale-Brown Obsessive Compulsive scale: psychometric properties of the self-report version in a student sample. *Journal of Psychopathology and Behavioral Assessment*, 32, 226–235.
- Palm, K. M., & Strong, D. R.** (2007). Using item response theory to examine the White Bear Suppression Inventory. *Personality and Individual Differences*, 42, 87–98.
- Parker, G., Tupling, H., & Brown, L. B.** (1979). Parental bonding instrument (PBI). *British Journal of Medical Psychology*, 52, 1–10.
- Pleva, J., & Wade, T. D.** (2006). The mediating effects of misinterpretation of intrusive thoughts on obsessive-compulsive symptoms. *Behaviour Research and Therapy*, 44, 1471–1479.
- Pozza, A., & Dèttore, D.** (2014). The specificity of inflated responsibility beliefs to OCD: a systematic review and meta-analysis of published cross-sectional case-control studies. *Research in Psychology and Behavioural Sciences*, 2, 75–85.
- Preacher, K. J., & Merkle, E. C.** (2012). The problem of model selection uncertainty in structural equation modeling. *Psychological Methods*, 17, 1.
- Purdon, C.** (2001) Appraisal of obsessional thought recurrences: impact on anxiety and mood state. *Behavior Therapy*, 32, 47–64.
- Purdon, C., & Clark, D. A.** (1994). Perceived control and appraisal of obsessional intrusive thoughts: a replication and extension. *Behavioural and Cognitive Psychotherapy*, 22, 269–285.
- Rachman, S.** (1997). A cognitive theory of obsessions. *Behaviour Research and Therapy*, 35, 793–802.
- Rachman, S.** (1998). A cognitive theory of obsessions: elaborations. *Behaviour Research and Therapy*, 36, 385–401.
- Rhéaume, J., Freeston, M. H., Léger, E., & Ladouceur, R.** (1998). Bad luck: an underestimated factor in the development of obsessive-compulsive disorder. *Clinical Psychology and Psychotherapy*, 5, 1–12.
- Romero-Sanchiz, P., Nogueira-Arjona, R., Godoy-Ávila, A., Gavino-Lázaro, A., & Freeston, M. H.** (2015). Narrow specificity of responsibility and intolerance of uncertainty in obsessive-compulsive behavior and generalized anxiety symptoms. *International Journal of Cognitive Therapy*, 8, 239–257.
- Salkovskis, P. M.** (1985). Obsessional-compulsive problems: a cognitive-behavioural analysis. *Behaviour Research and Therapy*, 23, 571–583.
- Salkovskis, P. M.** (1989). Cognitive-behavioural factors and the persistence of intrusive thoughts in obsessional problems. *Behaviour Research and Therapy*, 27, 677–682.
- Salkovskis, P. M.** (1999). Understanding and treating obsessive-compulsive disorder. *Behaviour Research and Therapy*, 37, S29–52.
- Salkovskis, P. M., Forrester, E., & Richards, C.** (1998). Cognitive-behavioural approach to understanding obsessional thinking. *British Journal of Psychiatry*, supplement 35, 53–63.
- Salkovskis, P. M., Westbrook, D., Davis, J., Jeavons, A., & Gledhill, A.** (1997). Effects of neutralizing on intrusive thoughts: an experiment investigating the aetiology of obsessive-compulsive disorder. *Behaviour Research and Therapy*, 35, 211–220.
- Salkovskis, P. M., Wroe, A. L., Gledhill, A. A., Morrison, N. N., Forrester, E. E., Richards, C. C., & Thorpe, S. S.** (2000). Responsibility attitudes and interpretations are characteristic of obsessive compulsive disorder. *Behaviour Research and Therapy*, 38, 347–372.
- Sarason, I. G., Johnson, J. H., & Siegel, J. M.** (1978). Assessing the impact of life changes: development of the Life Experiences Survey. *Journal of Consulting and Clinical Psychology*, 46, 932.
- Schreiber, J. B., Stage, F. K., King, J., Nora, A., & Barlow, E. A.** (2006). Reporting structural equation modelling and confirmatory factor analysis results: a review. *Journal of Educational Research*, 99, 323–338.
- Shafraan, R.** (1997). The manipulation of responsibility in obsessive-compulsive disorder. *British Journal of Clinical Psychology*, 36, 397–407.
- Steketee, G., Frost, R., & Bogart, K.** (1996). The Yale-Brown obsessive compulsive scale: interview versus self-report. *Behaviour Research and Therapy*, 34, 675–684.
- Taylor, S., Abramowitz, J. S., & McKay, D.** (2007). Cognitive-behavioral models of obsessive-compulsive disorder. In *Psychological Treatment of Obsessive-Compulsive Disorder: Fundamentals and Beyond*, pp. 9–29.
- Taylor, S., Coles, M. E., Abramowitz, J. S., Wu, K. D., Olatunji, B. O., Timpano, K. R., . . . & Tolin, D. F.** (2010). How are dysfunctional beliefs related to obsessive-compulsive symptoms? *Journal of Cognitive Psychotherapy*, 24, 165–176.
- Wegner, D. M., & Zanakos, S.** (1994). Chronic thought suppression. *Journal of Personality*, 62, 615–640.

- Wells, A., & Davies, M. I.** (1994) The Thought Control Questionnaire: a measure of individual differences in the control of unwanted thoughts. *Behaviour Research and Therapy*, 32, 871–878.
- Wheaton, M. G., Abramowitz, J. S., Berman, N. C., Riemann, B. C., & Hale, L. R.** (2010). The relationship between obsessive beliefs and symptom dimensions in obsessive-compulsive disorder. *Behavior Research and Therapy*, 48, 949–954.
- Yorulmaz, O., Gençöz, T., & Woody, S.** (2010). Vulnerability factors in OCD symptoms: cross-cultural comparisons between Turkish and Canadian samples. *Clinical Psychology & Psychotherapy*, 17, 110–121.