ORIGINAL ARTICLE

The Impact of Enhanced Responsibility and Threat Beliefs on Self-Report and Behavioural Indices During a Sorting Task for Young People with OCD

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Abstract

We aimed to experimentally assess the role of cognitive processes in provoking anxiety and compulsive behaviours in young people with OCD, and to determine whether specific cognitive appraisal subtypes (e.g., threat) best explain OCD symptoms. 29 young people with a principal diagnosis of OCD, 30 young people with an anxiety disorder other than OCD, and 25 young people meeting no diagnostic criteria completed a sorting task designed to increase or decrease responsibility/threat biases. We expected that OCD participants in the high responsibility/threat group would demonstrate higher scores on subjective (belief and anxiety ratings) and behavioural variables (e.g., urge to check, time taken to sort) compared to anxious and nonclinical control groups. Young people with OCD in the inflated responsibility/threat condition were more anxious and showed enhanced delay behaviours (e.g., slower on the task, more time checking) compared to control groups, who were not affected by the manipulation. Regression analyses revealed that threat appraisals played a more prominent role than responsibility beliefs in state anxiety ratings, overall time taken and time spent checking. The present study supports cognitive models of OCD showing a clear relationship between inflated responsibility beliefs, threat beliefs and perfectionism levels and OCD-related behaviours.

Keywords Obsessive compulsive disorder · OCD · Paediatric · Beliefs · Responsibility · Threat · Child · Adolescent · Anxiety

Introduction

Obsessive–compulsive disorder (OCD) is a debilitating condition characterised by intrusive obsessional thoughts, images or impulses that are recurrent and cause anxiety for the individual. These thoughts are typically accompanied by repetitive behaviours, called compulsions, which aim to reduce anxiety related to the unwanted thoughts (American Psychiatric Association 2013). Research indicates that this symptom presentation is similar for both adults and paediatric samples (March and Leonard 1996), although children are not required to recognise the unreasonable nature of their obsessions and/or compulsions (APA 2013). Developmental stage must also be considered in the diagnostic process for paediatric samples (Shoenfelt and Weston 2007). Paediatric OCD has been shown to impact between 1 and 4% of young people (Heyman et al. 2003) and is accompanied by significant functional impairment. For instance, studies have shown that over 80% of children and adolescents with OCD experience impairment in academic, social or home/family functioning (Piacentini et al. 2003). Comorbidity rates are typically high (Zohar 1999), and up to 80% of adults with OCD report the onset of symptoms before age 18 (Pauls et al. 1995), further supporting the need for well-researched cognitive models of paediatric OCD.

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Cognitive models of OCD propose that dysfunctional appraisals are primary in the development and maintenance of the disorder (e.g., Rachman 1997). These beliefs are thought to create anxiety as a function of interpreting "normal" intrusive thoughts in unhelpful ways (e.g., Rachman 1993; Salkovskis 1985). Although different cognitive models of OCD exist, there is wide consensus on six cognitive appraisal types being of critical importance in OCD. These include inflated responsibility, threat estimation, intolerance of uncertainty, perfectionism, overimportance of thoughts and need to control thoughts (Obsessive–Compulsive Cognitions Working Group 1997). Such beliefs are theorised to develop in childhood in connection with particular experiences, such as being made to feel responsible for preventing possible negative events (OCCWG 1997). Further, preliminary support has been found for the applicability of adult cognitive models to paediatric samples (Reynolds and Reeves 2008), validating the use of adult OCD cognitive treatments with children and adolescents. Nonetheless, there are mixed opinions about whether particular cognitive appraisals are more important in OCD (Mantz and Abbott 2016a; OCCWG 1997).

A significant amount of research has been conducted on responsibility appraisals, defined as "the belief that one has power that is pivotal to bring about or prevent subjectively crucial negative outcomes" (OCCWG 1997, p. 669). This has included both correlational and experimental data, investigating responsibility on its own (e.g., Salkovskis 1985) or alongside other appraisal types (e.g., OCCWG 1997). Responsibility has been thought to be highly important in OCD, and be directly related to the repetitive behaviours completed in OCD (Salkovskis et al. 1995). Specifically, the individual with OCD interprets their thoughts in such a way that they perceive personal responsibility for some type of harm occurring, either to themselves or to others, leading to anxiety and stress. This is then followed with compulsive behaviours to reduce anxiety and the risk of a negative outcome (Arntz et al. 2007; Salkovskis et al. 1995). The present study focuses on testing the inflated responsibility model of OCD in young people, as well as assessing the role of multiple appraisal types on anxiety levels and OCD-like behaviours during an experimental task.

When reviewing the correlational adult literature, there is a wealth of studies supporting the role of responsibility beliefs in OCD (e.g., Freeston et al. 1993; Rheaume et al. 1995; Wilson and Chambless 1999). There are inconsistencies, however, with some studies failing to differentiate between OCD and controls, both healthy and anxious (Sica et al. 2004; Tolin et al. 2006), leading authors to suggest that inflated responsibility may be related to anxiety in general. The role of threat appraisals has also been queried, with some authors suggesting that a combination of responsibility and threat cognitions better predicts OCD symptoms

(Rachman 2002; Sica et al. 2004). A similar picture is evident for correlational research with children and adolescents. Studies using healthy control samples have reported significant positive relationships between OCD-like symptoms and responsibility appraisals (Magnusdottir and Smari 2004, Matthews et al. 2007). Although studies examining OCD-related cognitions in clinical paediatric samples are limited, results are generally consistent in supporting the role of responsibility appraisals in OCD (e.g., Libby et al. 2004). Mixed findings are evident, however, with some studies finding no difference between OCD and anxious controls on responsibility appraisals (e.g., Barrett and Healy 2003). In combination, these studies provide initial support for a responsibility bias in young people with OCD, yet highlight the need for further investigations.

Experimental studies using in vivo manipulations are useful in establishing a causal relationship between appraisals and OCD symptomatology. A small number of such studies have been conducted in OCD, with the majority focused on exploring responsibility appraisals with adult samples. For example, Arntz et al. (2007) manipulated responsibility in an experiment conducted with OCD patients, anxious controls and nonclinical controls and found a significant increase in subjective OCD-like experiences and checking behaviours for OCD participants in the high responsibility condition (sorting pills of different colours without errors for medical use) compared to most other conditions. They concluded that responsibility plays a causal role in OCD. This contrasts, however, with other studies that found little impact of the responsibility manipulation on adult participants (e.g., Ladouceur et al. 1995, 1997). Two studies have implemented experimental in vivo manipulations with children and adolescents investigating the role of enhanced responsibility in OCD. The first found that although ratings of perceived responsibility were significantly greater in the high compared to moderate and low responsibility conditions with an OCD sample, no effect was found for avoidance behaviours or ritualising, leading authors to conclude that inflated responsibility may not be an important cognitive process in childhood OCD (Barrett and Healy-Farrell 2003). In contrast, a more recent study with nonclinical children found a significant increase in perceived responsibility as well as neutralising, hesitations, and overall time taken for the high compared to low responsibility condition, supporting an impact of responsibility biases on OCD-like behaviours (Reeves et al. 2010). Overall, results assessing the role of responsibility in child and adolescent OCD are inconclusive. This conclusion is further supported by a recent systematic review assessing the available experimental research on responsibility appraisals with an in vivo manipulation that has reported mixed results, and suggests that further research is needed to clarify the

role of different appraisal types in OCD, particularly with paediatric samples (Mantz and Abbott 2016b). Moreover, the experimental literature implicates both responsibility and threat appraisals in OCD-like experiences, with some studies finding an enhanced effect for danger cognitions (e.g., Jones and Menzies 1997a; Ladouceur et al. 1997).

Methodological shortcomings have also been highlighted and are relevant to both the adult and child literature. Most notably, there is a paucity of experimental studies assessing the role of inflated responsibility in OCD, with the majority of studies being correlational and/or reliant on self-report measures (Julien et al. 2007; Mantz and Abbott 2016b). This proves problematic when making the assertion that cognitive beliefs are important factors in the onset and maintenance of OCD. Further, most studies are conducted on nonclinical populations without control groups, posing difficulties for the generalisation of results to clinical populations with OCD (Mantz and Abbott 2016b). Experimental studies have also tended to focus on a specific belief domain (e.g., responsibility), often employing measures designed for their particular study, without assessing other belief domains (e.g., perfectionism; threat). To this end, experimental studies assessing multiple belief domains in clinical OCD samples with control conditions are warranted (Mantz and Abbott 2016b). This appears particularly important for paediatric samples, for which there is a dearth of research in comparison to adult populations.

Thus the current study seeks to explore the role of multiple cognitive processes (e.g., responsibility beliefs, perceived threat, intolerance of uncertainty) in young people with OCD, and to assess whether particular cognitive appraisals (e.g., intolerance of uncertainty) explain unique variance in anxiety and compulsive behaviours. In this respect, we are assessing predictions of both the inflated responsibility model (Salkovskis 1985), as well as the OCCWG (1997) cognitive model. Although there is heterogeneity in individual belief and symptom profiles for young people diagnosed with OCD, there may nonetheless be common cognitive appraisal types that feature across most cases. The current study also aims to extend findings of previous research by using an experimental design, a clinical OCD group, a nonclinical control group and a clinical-control comparison group to assess whether key cognitive processes are distinct to OCD or anxiety disorders more generally. An experimental sorting task was conducted that included two conditions (high and low responsibility/threat). By using an experimental manipulation to directly observe the role of cognitive processes in producing anxiety and compulsive behaviours in young people with OCD, this research will help expand the current literature and contribute to the further development of cognitive models of OCD in young people. We made the following hypotheses in relation to the sorting task based on cognitive models of OCD:

(1) We expected that the OCD and clinical control group would show significantly higher scores indicative of greater psychopathology on trait symptom measures relative to the non-clinical group. However, on trait OCD measures and subscales we expected the OCD group to have higher scores than the other two groups. Parent report on a measure of general distress (DASS-21) was expected to be equivalent across the three groups.

(2) A main effect of group was hypothesised, such that the OCD group would demonstrate significantly higher scores than the nonclinical group on observed behavioural variables as well as state anxiety and cognitive ratings. Comparisons between the OCD group and the other anxiety disorder (OAD) group were exploratory, although greater responsibility appraisals for the OCD group, relative to both control groups, would support the inflated responsibility model of OCD.

(3) A main effect of condition was also expected with significantly higher scores anticipated for observed behaviours, state anxiety and cognitive ratings for the high versus low responsibility/threat conditions.

(4) A group by condition interaction was also hypothesised such that OCD participants in the high responsibility/threat group would demonstrate significantly stronger ratings on observed behaviours, state anxiety and cognitive variables, relative to the other groups. Additionally, we expected that the OAD group in the high responsibility/threat condition would demonstrate higher ratings across all variables relative to the nonclinical group, but to a lesser extent than the OCD group.

(5) We also anticipated that at least one cognitive variable (threat, responsibility, perfectionism) would explain unique variance in state anxiety during the task and observed behavioural variables such as time taken to sort and time spent checking during the task.

Method

Participants

A total of 84 participants aged 8–17 years were recruited to one of three groups: (1) participants who met Diagnostic and Statistical Manual of Mental Disorders 4th Ed (DSM-IV; American Psychiatric Association 1994) criteria for a principal diagnosis of OCD ($n=29$; 45% female), (2) participants in the clinical-control group (OADs) who met DSM-IV criteria for a principal diagnosis of an anxiety disorder (other than OCD) ($n=30$; 50% female), and (3) participants in the nonclinical control group who met no diagnostic criteria and had not received psychological treatment previously

($n = 25$; 48% female). Participants were included in the study if they were fluent in English, had intact (or corrected) vision and met diagnostic and age requirements as outlined above. Additionally, clinical participants were excluded if they experienced symptoms of psychosis or if they were suicidal. Clinical participants were recruited from specialist clinical psychology private practices or tertiary referral specialist services in the public sector for children and adolescents with OCD and other anxiety disorders. Control participants were recruited from an independent primary school, and research participation advertising via the internet.

As per inclusion/exclusion criteria, the nonclinical control group had no previous psychological treatment. However, all (100%) of the OCD group had previously, or were currently, accessing psychological treatment, compared to 73% of the OAD group, indicating a significant difference, $\chi^2(1, N = 59) = 8.95$, $p = .003$. No young people in the nonclinical control group were taking any prescribed anxiolytics, antidepressants, antipsychotics, mood stabilizers or AD/HD related medications. There were no significant differences between rates of prescribed medication use for the OCD and OAD groups, all p's > .21. Across the clinical groups, 58% ($n = 34$) and 25% ($n = 15$) of participants were currently prescribed antidepressant and antipsychotic (typically low doses of Seroquel) medications, respectively.

A Chi square analysis revealed no significant gender differences between the three groups, $\chi^2(2, N = 84) = 0.16$, $p = .92$. A one-way ANOVA also indicated no significant differences in age between the three groups, $F(2,83) = 2.32$, $p = .11$. Mean ages for the OCD, OAD and nonclinical groups were 14.3 ($SD = 2.38$), 13.5 ($SD = 2.46$) and 13.0 ($SD = 2.05$) years of age, respectively. One-way ANOVAs were used to compare the three groups on a range of other demographic variables showing no significant differences between the three groups for number of siblings, $p = .53$, mother's age, $p = .88$, or father's age, $p = .70$. Chi square analyses compared the three groups on mother's and father's marital status, education level attained, employment level and family income, all p's > .07. Descriptively, the majority of families were married or de facto, with parents who had attained university level education, who were currently working in paid employment and with family incomes in excess of $80,000 per annum.

Experimental Sorting Task

The experimental task was based on a sorting task developed to manipulate responsibility in nonclinical adults (Ladouceur et al. 1995) and implemented with nonclinical children (Reeves et al. 2010). Instructions in the present study were modified from these studies. Participants in both conditions were given the sorting task instructions, and were then presented with a container of 120 sweets in wrappings of six different colours (20 per colour). Each participant was told that the orange and purple lollies contained an ingredient that makes some children sick, the pink and yellow lollies might contain this ingredient, and the white and blue lollies did not contain this ingredient. This information was summarised on a chart for participants should they need to refer to it during the task. All participants were asked to sort the sweets into three opaque tins (two coloured sweets per tin): (1) those that contained the ingredient, (2) those that might contain the ingredient, and (3) those that didn't contain the ingredient. Danger expectancies were induced by telling participants that the sweets would subsequently be given to a group of children in hospital, where some of the children have allergies. In the high responsibility/threat condition, participants were told that the sweets would not be checked after they had sorted them and they should therefore sort them as correctly as possible to ensure they don't make errors. In the low responsibility/threat condition, participants were told that the sweets would be checked again, after they had sorted them, and to simply do the best they could at the task.[1] The researcher then left the room, reluctantly in the high responsibility/threat condition, due to an "urgent phone call", or calmly in the low responsibility/threat condition. Finally, participants were asked to come out of the room when they were finished the sorting task and reminded that the task would be video-recorded for research purposes. The task instruction script for the two conditions is available on request.

Measures

The Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Versions (ADIS-IV-C/P; Silverman and Albano 1996)

The ADIS-IV-C/P is a semi-structured clinical interview designed specifically to diagnose anxiety disorders and other related disorders in children and adolescents. Parents and young people are interviewed separately, allowing for diagnoses based on child/adolescent and parent report, as well as combined diagnosis based on both reports. Clinician Severity Ratings based on combined reports were utilised in the present study, where interference/severity is rated on a scale from 0 (*no interference in daily life*) to 8 (*extreme interference in daily life*), with ratings of 4 or greater indicating

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[1] Eleven percent ($n = 9$) of participants experienced food allergies. In order to assess whether the presence of such allergies for participants may disproportionately impact group and condition effects, a Chi square analysis was conducted to assess the frequency of food allergies across the three groups and two conditions, indicating no significant group differences, $p = .37$, or significant differences across conditions, $p = .67$.

clinical status. In the current study, the mean clinician severity rating (CSR) for the OCD group was 6.2 (*SD* = 1.1) on a scale from 0 to 8, where a higher score represented greater severity and interference. Comorbid diagnoses observed in the OCD group included generalised anxiety disorder (GAD, 48%), social anxiety disorder (SAD, 34%), attention deficit/hyperactivity disorder (AD/HD 31%), unipolar mood disorders (21%), other anxiety disorders (7%) and oppositional defiant disorder (ODD, 3%). Participants in the clinical control group met the principal diagnostic criteria for a range of anxiety disorders including SAD (50%), GAD (43%), separation anxiety disorder (3%) and PTSD (3%). None of these young people had a diagnosis of OCD. The mean CSR for OAD group principal diagnoses was 5.8 (*SD* = 1.2). Co-morbid diagnoses for the OAD group included, unipolar mood disorders (33%), GAD (30%), SAD (20%), AD/HD (13%) and other disorders (47%). There were no significant differences between the OCD and OAD groups in terms of the ADIS-IV-C/P principal diagnosis CSR, $F(1,58) = 2.18$, $p = .15$, or number of comorbid diagnoses, $F(1,58) = 0.02$, $p = .88$.

Studies have shown excellent inter-rater reliability for deriving combined diagnoses (e.g., $\kappa = 0.80$–0.92) (Silverman et al. 2001). Excellent inter-rater reliability has also been shown with an Australian sample (Lyneham et al. 2007). Both parents and young people were administered the ADIS-IV separately in the current study. The majority of parent interviews were conducted over the phone, whereas child interviews were conducted face-to-face. The validity of telephone administration of the ADIS-Parent version was supported by Lyneham and Rapee (2005) who found good to excellent agreement between telephone and standard administration.

Child Depression Inventory: Short Form (CDI-S; Kovacs 1992)

The CDI-S is a 10-item questionnaire that measures symptoms of depression in children and adolescents aged 7–17 years. The long and short forms of the CDI provide comparable results, with a correlation of $r = .89$ (Kovacs 1992). Items are based on how participants have been feeling over the past 2 weeks, and are scored on a scale of 0 (the symptom is not present), 1 (the symptom is present and mild), and 2 (the symptom is present and marked). Total scores range from 0 to 20, with higher scores indicating higher levels of depressive symptoms. A recent analysis of the English version of the CDI (long and short forms) found an average alpha of 0.84, suggesting good internal consistency and test reliability (Sun and Wang 2015). Scores obtained from the unmodified short form showed acceptable reliability, with an alpha estimate of 0.77 (Sun and Wang

2015). Internal consistency in the current study was excellent ($\alpha = 0.90$).

The Spence Children's Anxiety Scale: Child and Parent Versions (SCAS-C/P; Spence 1998)

The SCAS is a 44- (SCAS-C) or 38-item (SCAS-P) self-report measure used to assess symptoms of anxiety in children aged between 8 and 17 years, comprising six anxiety disorder specific subscales (e.g., separation anxiety, obsessions/compulsions, social anxiety). The child or parent rates each item on a 4-point scale ranging from 0 (*never*) to 3 (*always*), with higher scores reflecting greater anxiety symptoms (Spence 1998). The results of a recent meta-analysis of SCAS-C alpha coefficients showed excellent reliability for the total score ($\alpha = 0.92$) (Orgilés et al. 2016). Similarly, studies report excellent reliability for the SCAS-P total score ($\alpha = 0.90$) (Whiteside and Brown 2008), as well as strong correlations between child and parent reports (Nauta et al. 2004), indicating that the both the SCAS-C and SCAS-P are reliable measures for assessing anxiety symptoms in young people. Further, all subscales and total scores of both versions have been shown to discriminate children with anxiety from healthy controls (Nauta et al. 2004). Internal consistency in the current study for child ($\alpha = 0.89$) and parent ($\alpha = 0.94$) total scores was excellent.

The Obsessive Beliefs Questionnaire: Child Version (OBQ-CV; Coles et al. 2010)

The OBQ-CV is a 44-item youth version of the widely used adult OBQ-44, designed to comprehensively assess OCD-related beliefs. The measure has three subscales: responsibility and threat estimation (RT), perfectionism and intolerance for uncertainty (PC), and importance and control of thoughts (ICT). The OBQ-CV has been demonstrated to have strong internal consistency for the total score ($\alpha = 0.96$) as well as the subscales (RT = 0.91, PC = 0.94, ICT = 0.91) (Coles et al. 2010). Similarly, significant and strong retest correlations were found for the total score ($r = .88$) and subscales (RT = 0.84, PC = 0.81, ICT = 0.85) (Coles et al. 2010). In the current study, good to excellent internal consistency was found for the total score ($\alpha = 0.93$) and subscales (RT = 0.86, PC = 0.88, ICT = 0.85).

The Children's Obsessional Compulsive Inventory: Revised—Child and Parent Versions (ChOCI-R-C/P; Uher et al. 2008)

The ChOCI is a self-report measure designed to assess the content and severity (including impairment) of obsessive–compulsive symptoms in children and adolescents aged 7–17 years. Ten items assess obsessions and ten assess

compulsions, with each item rated on a three-point scale. After the symptom lists, respondents are asked to write in their three most upsetting obsessions and compulsions and subsequently answer six questions assessing severity of obsessions and six items assessing severity of compulsions which are rated on a five-point scale. The ChOCI has been shown to have good internal consistency ($\alpha > 0.8$), and discriminates between young people with OCD and healthy controls (Shafran et al. 2003), as well as strong correlations between child and parent reports (Uher et al. 2008). Internal consistency in the current study for total scores was excellent for both child ($\alpha = 0.93$) and parent ($\alpha = 0.94$) report.

Depression Anxiety Stress Scales: Short Form (DASS-21; Lovibond and Lovibond 1995)

The DASS-21 was designed to assess depressive, anxious, and stress symptoms in adults. Participants rate self-statements (e.g., I found it hard to wind down) based on the previous week 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*). The DASS-21 has been shown to have good to excellent internal consistency (Antony et al. 1998; Henry and Crawford 2005) and distinguishes well between features of depression, physical arousal, and psychological tension (Antony et al. 1998). In the present study, the DASS-21 was administered to both parents to assess whether parents showed comparable self-reported symptom levels for depression, anxiety and stress across the three groups. Internal consistency was acceptable to excellent, with Cronbach's alpha's for mother and father subscale scores ranging from 0.69 to 0.91.

State Anxiety Ratings

Participants rated anxiety on an 11-point scale from 0 (*very relaxed*) to 10 (*extremely worried*). Subjective units of distress (SUDs) ratings were given at two time points: prior to completing the sorting task (baseline) and promptly after the task in relation to anxiety experienced during the sorting task.

State Cognitive Appraisals

This measure was developed for the present study in order to assess the primary cognitive appraisal domains linked to OCD, but phrased in relation to the state based sorting task. Young people rated 16 statements on a 6-point Likert scale ranging from 1 (*completely disagree*) to 6 (*completely agree*) after the experimental task. Two statements related to perception of responsibility (e.g., It was my job to make sure that nothing bad happened), six related to threat perceptions, specifically probability of harm (e.g., It is likely that something bad will happen), severity/cost of harm (e.g., It

would be very bad if I made a mistake), control (I felt like I was able to sort the lollies correctly) and coping (I will be able to cope if a child gets sick), two related to intolerance of uncertainty (e.g., Not knowing what will happen makes me feel bad), two related to perfectionism (e.g., I had to keep sorting the lollies until it was done exactly right), two related to perception of overimportance of thoughts (e.g., A child was more likely to get sick if I thought about it happening), and two related to need to control thoughts (e.g., I needed to have a clear head while I sorted the lollies). The state cognitive measure was administered after participants had completed the task. Subscale scores for each appraisal type were derived. Internal consistency in the current study was good, $\alpha = 0.85$. Convergent validity was supported by the correlation between the (trait) OBQ-CV total score and the state cognitive appraisals questionnaire total score, $r = .35$, $p < .001$. In addition, the state cognitive appraisals questionnaire subscales assessing threat, perfectionism, and intolerance of uncertainty demonstrated significant moderate correlations with the OBQ-CV total score; however, the responsibility, need to control thoughts and overimportance of thoughts subscales did not. Only threat, perfectionism and intolerance of uncertainty State Cognitive Appraisal Questionnaire subscales showed significant correlations with their OBQ-CV counterparts.

Observed Behaviours

Six observable behaviours were calculated by blind raters using videotaped recordings of the sorting task for each participant, and included: (1) the time taken to complete the sorting task in seconds; (2) the number of checks made by the child, defined as: stopping the gaze or looking inside a particular container for at least 1 s; picking up the container in the participants hand to look at or inside it for at least 1 s; emptying the content of a container in the participant's hand or on the table; looking at the colour key regarding what ingredient a sweet contains; or asking the researcher a relevant question; (3) the time spent checking (as above) in seconds; (4) the number of hesitations during the task, defined as: close examination of a sweet for at least 1 s; or movement of the participant's hand between two different containers for at least 1 s; (5) the number of modifications during the task, defined as: changing one or more lollies from one to another container; and (6) the number of errors made.

Manipulation Check

In order to assess the experimental manipulation, participants were asked to endorse 'whether they were solely responsible for making sure that the lollies were sorted correctly', or to endorse 'whether others would also be checking'. This item

was administered immediately following the sorting task instructions.

Believability Measure

Participants were asked how much they believed the task instructions, ranging from "not at all" to "completely". Participants that did not endorse "completely" were also asked whether they still sorted the lollies as if they believed the instructions ("Yes" or "No"), and whether they would have sorted them differently if they had completely believed the instructions ("Yes" or "No"). Believability ratings were assessed at the end of the session.

Procedure

The University of Sydney Human Research Ethics Committee approved all aspects of the study (Protocol No. 14197), which was also approved by the Sydney Local Health District Human Research Ethics Committee—Concord Repatriation General Hospital (SSWAHS-CRGH) (Project No.: HREC/11/CRGH/277). The ADIS-IV-C/P (Silverman and Albano 1996) was administered to young people and their primary caregiver to determine clinical status by doctoral level clinical psychologists experienced in the administration of the ADIS-IV-C/P, under the supervision of clinicians experienced in the administration of the ADIS-IV-C/P. Before the experimental task, participants were given demographic and trait questionnaires to complete (CDI-S, SCAS-C/P, OBQ-CV, ChOCI-R-C/P, DASS-21). Children and adolescents were then taken into a designated room and asked to sit at a table, while their parent(s) waited outside the room. Each participant was randomly assigned to one of two experimental conditions (high or low responsibility/threat) based on a computerised random number generator. Sorting task condition was specified in sequentially numbered sealed opaque envelopes so the experimenter remained blind to each participant's condition until administration of the sorting task, with either high or low responsibility/threat instructions. Participants were then given instructions for the assigned condition and completed the sorting task (described earlier), with main variables assessed being state anxiety, cognitive appraisals, and subjective and objective OCD-related behaviours. They were then debriefed after the task to inform them of the real aims of the study and to address any residual anxieties. ADIS-IV-C/P interviews and sorting tasks were recorded using a digital camera.

Results

All statistical analyses were conducted using SPSS, version 21.0 for PCs (IBM Corp, 2012). Power calculations were completed using GPOWER, Version 2 (Faul and Erdfelder

1992). Data for missing items on self-report questionnaires was substituted with participant's mean score on the relevant scale or subscale. This method was used to manage missing data across all self-report measures when at least 80% of scale items had been completed. The family-wise error rate was controlled for main effects and interactions in all MANOVA analyses. Additionally, Bonferroni corrections were applied to individual follow-up tests in MANOVA analyses in order to avoid inflation of the Type 1 error rate. No other statistical corrections were applied to analyses. Effect sizes were reported as partial eta squared values for significant effects for the main analyses.

Manipulation Check

In order to assess the condition manipulation, participants were asked whether they were solely responsible for making sure that the lollies were sorted correctly, or whether others would also be checking. A Chi square analysis showed significant differences in responses for the high and low responsibility/threat conditions, such that all participants in the low responsibility/threat condition endorsed that 'others would also be checking', whereas all participants in the high responsibility/threat condition endorsed that 'they were solely responsible for checking', $\chi^2(1, N=82)=82.0$, $p < .001$.

Believability Ratings

Participants also rated the extent of their belief in the sorting instructions on a Likert scale from 1 to 5, with 5 indicating that instructions were 'completely believable'. An ANOVA was conducted to assess the effects of group, condition and their interaction on believability scores. There were no significant effects of group, $F(1,71)=0.28$, $p = .75$, condition, $F(1,71)=0.07$, $p = .80$, or their interaction, $F(2,71)=0.2.65$, $p = .08$. Mean believability scores and (standard deviations) for the three groups were 3.90 (1.30), 4.11 (1.13) and 3.86 (1.39) for the OCD, OAD and control groups, respectively, indicating that participants across groups "mostly" believed the task instructions. Additionally, all participants who did not endorse that they "completely believed" the instructions were asked whether they behaved as if they did, with 100% of these participants indicating that they did so.

Trait Symptom Measures

Table 1 reports the means and standard deviations on trait symptom measures for the three groups. One-way analyses of variance (ANOVAs) were conducted assessing group differences across trait symptom measures. The results indicated no significant differences across the three groups for mother or father DASS scores, all p's > .14. However, results

Table 1 Means and standard deviations for trait symptom measures across groups

	OCD	OAD	Non-clinical	OCD versus non-clinical F(sig)	OCD versus OAD F(sig)	OAD versus non-clinical F(sig)
Child trait measures						
CDI	5.46 (4.58)	5.86 (4.79)	1.38 (1.56)	17.45***	0.11	19.34***
SCAS-panic/agoraphobia	5.81 (5.69)	7.50 (4.51)	0.58 (1.28)	19.37***	1.49	52.68***
SCAS-separation	5.22 (3.23)	5.57 (3.14)	1.75 (1.51)	23.23***	0.170	29.55***
SCAS-social	7.75 (3.98)	9.86 (3.36)	3.96 (2.51)	16.24***	4.71*	50.70***
SCAS-physical injury	3.67 (2.88)	4.38 (2.18)	3.17 (2.60)	0.42	1.10	3.42
SCAS-obsessive–compulsive	9.30 (3.91)	5.45 (3.45)	2.75 (2.58)	48.50***	15.30***	10.04**
SCAS-generalised anxiety	8.61 (4.37)	9.75 (3.28)	4.54 (2.27)	16.88***	1.23	42.83***
OBQ responsibility/threat	45.86 (12.94)	47.48 (11.68)	41.96 (10.20)	1.44	0.25	3.29
OBQ perfectionism/certainty	46.41 (11.85)	48.62 (11.46)	37.29 (7.78)	10.48**	0.52	16.97***
OBQ importance/control of thoughts	27.82 (9.26)	28.45 (9.54)	23.67 (6.00)	3.55	0.06	4.54*
ChOCI total	25.00 (9.71)	NA	NA	NA	NA	NA
Parent trait measures						
DASS depression mother	8.07 (10.78)	8.44 (8.18)	6.27 (6.71)	0.47	0.02	1.00
DASS anxiety mother	6.00 (8.52)	5.56 (7.24)	2.82 (2.87)	2.81	0.04	2.78
DASS stress mother	12.86 (9.77)	14.30 (8.96)	9.64 (6.13)	1.82	0.32	4.30*
DASS depression father	6.11 (7.47)	5.69 (6.92)	4.00 (4.32)	0.84	0.03	0.56
DASS anxiety father	4.21 (5.65)	1.54 (2.60)	3.69 (3.04)	0.09	2.52	3.77
DASS stress father	12.42 (9.37)	9.08 (5.92)	7.23 (4.36)	3.45	1.29	0.82
SCAS-panic/agoraphobia	4.19 (3.48)	5.12 (4.94)	0.48 (0.73)	25.14***	0.63	19.82***
SCAS-separation	5.93 (2.84)	5.64 (3.29)	1.48 (1.34)	47.88***	0.12	31.87***
SCAS-social	7.42 (3.80)	9.23 (3.27)	4.00 (2.51)	13.49**	3.39	38.79***
SCAS-physical injury	3.15 (2.32)	3.31 (2.21)	2.74 (2.01)	0.44	0.07	0.88
SCAS-obsessive–compulsive	9.08 (5.14)	3.12 (2.46)	0.50 (0.86)	59.71***	27.55***	22.57***
SCAS-generalised anxiety	8.31 (3.06)	7.38 (2.43)	2.57 (1.59)	66.60***	1.47	63.92***
ChOCI total	28.93 (7.78)	NA	NA	NA	NA	NA

*p < .05; **p < .01; ***p < .001

indicated group differences on the CDI, and for parent and child report on the SCAS, all p's < .001, with the exception of the physical injury subscale, SCAS-C-PI, $p = .23$; SCAS-P-PI: $p = .65$. Of the OBQ subscales, only the OBQ perfectionism/uncertainty scale score showed significant between-group differences on an overall test, $p = .001$.

Three sets of follow-up one-way ANOVAs were conducted: (1) comparing the OCD and nonclinical group, (2) comparing the OCD and OAD groups and (3) comparing the OAD and nonclinical group. Results showed that the OCD group scored significantly higher on most trait symptom measures relative to the control group, p's < .05, with the exception of Mother and Father DASS scores and the SCAS-C-PI and SCAS-P-PI physical injury scores, p's > .05. The results for comparisons of the OAD and nonclinical groups were similar with the exception of marginally, though significantly, higher scores for the OAD group on the OBQ importance/control of thoughts subscale and the DASS stress subscale mother report. Comparisons of the three

groups on the OBQ responsibility/threat subscale demonstrated no significant differences.

One-way ANOVA comparisons between the OCD and OAD groups were all non significant, with the exception of significantly higher SCAS-P and SCAS-C obsessive–compulsive subscale scores for the OCD group, p's < .001 and significantly higher SCAS-C social phobia subscale scores for the OAD group, $p < .05$.

Child and parent report for the ChOCI total severity/impairment score for the OCD group were similar to means for comparable groups reported in the literature (Shafran et al. 2003; Uher et al. 2008).

Inter-Rater Agreement Analyses

ADIS-IV-C/P

A second independent doctoral level clinical psychologist rated the principal diagnosis, based on child and parent

Table 2 Means and standard deviations for observed behaviours and self-rated variables

	OCD		OAD		Non-clinical		OCD versus non-clinical	OCD versus OAD	OAD versus non-clinical
	Low R/T	High R/T	Low R/T	High R/T	Low R/T	High R/T	F(sig)	F(sig)	F(sig)
Overall time	242.60 (92.15)	332.14 (94.84)	210.56 (52.56)	225.79 (66.29)	196.17 (54.4)	234.54 (55.83)	11.37**	11.58**	0.03
Time spent checking	46.80 (44.64)	94.71 (54.67)	27.88 (21.93)	53.64 (51.61)	28.33 (16.51)	50.08 (44.79)	7.11*	6.70*	0.02
Number of checks	16.80 (8.45)	24.14 (12.10)	12.81 (6.31)	17.64 (11.55)	14.50 (5.95)	15.62 (6.95)	5.08*	4.25*	0.01
Number of hesitations	6.87 (5.63)	16.50 (19.61)	9.13 (6.33)	6.71 (6.85)	7.33 (5.38)	10.77 (11.21)	0.64	1.72	0.29
Number of modifications	0.27 (0.59)	0.00 (0.00)	0.13 (0.50)	0.29 (0.83)	0.00 (0.00)	0.08 (0.28)	NA	NA	NA
Errors made	0.07 (0.26)	0.07 (0.27)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	NA	NA	NA
Baseline anxiety	2.13 (2.26)	2.71 (1.94)	3.06 (2.54)	2.93 (1.27)	1.75 (1.54)	1.46 (1.51)	2.58	1.11	7.82**
Anxiety during task	1.47 (1.73)	3.57 (1.91)	2.19 (2.34)	2.43 (2.21)	1.08 (1.31)	1.23 (1.64)	8.86**	0.15	4.66*
Probability	4.40 (2.03)	3.71 (1.68)	5.06 (2.17)	4.57 (2.10)	3.58 (1.31)	4.15 (3.00)	0.11	2.10	2.45
Cost	7.13 (2.26)	10.00 (2.72)	8.19 (1.97)	10.86 (2.38)	7.67 (1.83)	10.31 (3.12)	0.37	2.46	0.70
Coping/control	4.80 (1.82)	5.36 (2.10)	4.56 (1.71)	5.93 (2.56)	4.42 (1.88)	5.46 (2.47)	0.06	0.10	0.27
Responsibility	4.33 (2.02)	10.29 (1.73)	4.94 (3.07)	10.43 (2.10)	3.92 (2.31)	10.85 (2.82)	0.01	0.38	0.18
Intolerance of uncertainty	5.73 (2.76)	8.14 (2.45)	6.31 (2.50)	8.07 (2.23)	4.50 (1.73)	8.85 (2.27)	0.17	0.15	0.74
Need to control thoughts	5.33 (1.63)	6.93 (1.27)	6.06 (1.53)	6.86 (1.29)	5.08 (1.83)	7.23 (1.79)	0.00	0.76	0.48
Overimportance of thoughts	5.00 (2.70)	4.79 (2.64)	5.38 (2.47)	5.07 (2.09)	4.58 (2.11)	5.77 (3.39)	0.14	0.26	0.01
Perfectionism	5.27 (2.76)	7.29 (3.47)	5.56 (2.45)	7.86 (2.35)	3.50 (1.57)	8.46 (2.60)	0.16	0.36	1.37

R/T responsibility/threat

*p < .05; **p < .01; ***p < .001

report, for a randomly generated 24% of ADIS-IV-C/P videos. An intra-class kappa coefficient was calculated for principal diagnoses, showing excellent agreement, κ = 0.85, p < .001, 90% agreement. Two discrepancies were discussed between the raters, who reached agreement following discussion.

Observed Behaviours

Two doctoral level clinical psychologists coded each of the behavioural variables from participant videos and were blind to the group and condition status of participants. The first rater coded all participant videos, and the second rater coded a computer generated random set of 20% of videos.

Intraclass kappa co-efficients were calculated for each of the observed behavioural variables between the two raters for 20% of participant videos, showing excellent agreement across variables: total time to sort (κ = 1.0), time spent checking (κ = 0.95), number of checks (κ = 0.94), number of hesitations (κ = 0.83) and number of modifications (κ not calculated; too few items).

State Anxiety

Means and standard deviations for state anxiety before and during the sorting task are included in Table 2, summarised by group and condition.

Univariate Analyses of Variance: Baseline Anxiety

The first ANOVA comparing nonclinical and OCD groups found no significant effects of group, condition, or group by condition interaction effects for anxiety experienced at baseline. The second ANOVA comparing OCD and OAD groups similarly showed no significant effects. The third ANOVA comparing nonclinical and OAD groups showed a significant effect of group only, $F(3,55) = 7.82$, $p = .007$, $\eta^2 = 0.13$, indicating higher anxiety at baseline for OAD compared to nonclinical participants.

Univariate Analyses of Variance: Anxiety During the Task

The first ANOVA comparing nonclinical and OCD groups found significant effects of group $F(3,54) = 8.86$, $p = .004$, $\eta^2 = 0.15$, condition, $F(3,54) = 6.06$, $p = .02$, $\eta^2 = 0.11$, and group by condition interaction effects, $F(3,54) = 4.57$, $p = .04$, $\eta^2 = 0.08$. The significant interaction for state anxiety ratings during the sorting task indicated that OCD participants in the high responsibility/threat condition reported significantly greater anxiety compared to the low responsibility/threat condition, $p = .004$, $\eta^2 = 0.27$, whereas the nonclinical group showed comparable levels of anxiety irrespective of condition, $p = .81$.

The second ANOVA comparing OCD and OAD groups showed significant effects of condition only, $F(3,59) = 4.73$, $p = .03$, $\eta^2 = 0.08$, indicating significantly higher scores for those in the high compared to low responsibility/threat conditions. The third ANOVA comparing nonclinical and OAD groups showed a significant effect of group only, $F(3,55) = 4.66$, $p = .04$, $\eta^2 = 0.08$, indicating higher anxiety during the task for OAD compared to nonclinical participants.

In order to further qualify these results, one-way ANOVAs were conducted for each of the three groups separately comparing state anxiety scores at baseline and during the task (time) by condition. A significant time by condition effect was found for the OCD group, $p = .02$, $\eta^2 = 0.20$, such that OCD participants in the high responsibility/threat condition showed a significant increase in state anxiety scores from baseline to during the task, $p = .05$, $\eta^2 = 0.26$, whereas OCD participants in the low responsibility/threat condition showed no significant change in state anxiety scores across time, $p = .14$. No time by condition effects were significant for the nonclinical or OAD groups.

Observed Behaviours and Cognitive Variables

Means and standard deviations for each of the observed behaviours and self-rated cognitive variables are included in Table 2, summarised by group and condition. Multivariate analyses of variance (MANOVA) were conducted to assess effects of group (OCD, OAD and control groups), condition, and group by condition interactions for the set of objective dependent variables measured in the sorting task (total time to sort, time spent checking, number of checks, number of hesitations). Four separate MANOVAs were conducted, with the primary difference between these analyses being the group comparison including either: (1) all three groups, (2) OCD and control groups, (3) OCD and OAD groups, or finally, (4) OAD and control groups. The results of each of these analyses are also reported in Table 2 and summarised below.

Observed Behaviours

Overall, multivariate effects using Wilk's criterion[2] as the omnibus test statistic, showed significant effects of group, $F(5,84) = 2.17$, $p = .03$, $\eta^2 = 0.10$, condition, $F(5,84) = 3.15$, $p = .02$, $\eta^2 = 0.14$, but not their interaction, $F(5,84) = 1.29$, $p = .25$. Univariate analyses indicated that group significantly impacted time taken, $p < .001$, $\eta^2 = 0.19$, and time spent checking, $p = .01$, $\eta^2 = 0.12$. Condition significantly impacted these variables also: time taken, $p = .003$, $\eta^2 = 0.11$, and time spent checking, $p = .001$, $\eta^2 = 0.13$.

The second MANOVA compared OCD and nonclinical groups on the observed behavioural variables, as well as condition effects and group by condition effects. Multivariate effects using Wilk's criterion as the omnibus test statistic, showed significant effects of group, $F(3,54) = 3.06$, $p = .03$, $\eta^2 = 0.21$, condition, $F(3,54) = 2.95$, $p = .03$, $\eta^2 = 0.20$, but no group by condition interaction, $F(3,54) = 0.48$, $p = .75$. Univariate analyses indicated that the OCD group spent significantly longer to complete the task, $p = .001$, $\eta^2 = 0.19$, and spent more time checking, $p = .01$, $\eta^2 = 0.13$, than the nonclinical group. Univariate effects for condition showed that OCD participants in the high responsibility/threat condition took longer, $p = .004$, $\eta^2 = 0.15$, and spent more time checking, $p = .01$, $\eta^2 = 0.15$, than those in the low responsibility/threat condition.

The third MANOVA compared OCD and OAD groups on the observed behavioural variables, as well as condition effects and group by condition effects. Multivariate effects using Wilk's criterion as the omnibus test statistic, showed significant effects of group, $F(3,59) = 2.74$, $p = .04$, $\eta^2 = 0.17$, a non-significant effect for condition,

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[2] The experimenter calculated the number of errors made by adding the number of lollies incorrectly sorted for each participant; the error rate was extremely low, with only two participants making a single error, incorrectly sorting one lolly each. Similarly, very few participants ($n = 7$) made a modification while sorting the lollies; of these, the majority made only one modification. Since modifications and the number of errors made were extremely rare, these variables were removed from further analyses.

$F(3,59) = 2.42$, $p = .06$, and no significant group by condition interaction, $F(3,59) = 1.96$, $p = .11$. Univariate analyses showed that the OCD group took significantly longer, $p = .001$, $\eta^2 = 0.17$, and spent more time checking during the sorting task, $p = .01$, $\eta^2 = 0.11$, than the OAD group.

The fourth MANOVA for the observed behavioural variables compared the OAD and control groups, main effects of condition and group by condition interactions. The results indicated no significant main effects of group or condition, and no group by condition interactions, all p's $> .20$.

Cognitive Variables

The first MANOVA analysis showed a significant overall effect of condition only using the Wilks' criterion, $F(5,84) = 19.56$, $p < .001$, $\eta^2 = 0.69$, but no significant effects of group, $p = .98$, or group by condition interactions emerged, $p = .51$. Follow-up tests indicated significantly elevated scores in the high responsibility/threat condition, relative to the low responsibility/threat condition, for cost, $p < .001$, $\eta^2 = 0.25$, responsibility, $p < .001$, $\eta^2 = 0.64$, intolerance of uncertainty, $p < .001$, $\eta^2 = 0.28$, need to control thoughts, $p < .001$, $\eta^2 = 0.20$, and perfectionism, $p < .001$, $\eta^2 = 0.27$.

The second MANOVA compared nonclinical and OCD groups, and found significant condition, $F(3,54) = 16.63$, $p < .001$, $\eta^2 = 0.76$, but no overall group, $p = .99$, or group by condition interaction effects, $p = .39$. Univariate effects for condition indicated significantly higher scores for participants in the high responsibility/threat condition, including cost ratings, $p < .001$, $\eta^2 = 0.24$, responsibility ratings, $p < .001$, $\eta^2 = 0.69$, intolerance of uncertainty, $p < .001$, $\eta^2 = 0.35$, need to control thoughts, $p < .001$, $\eta^2 = 0.26$, and perfectionism, $p < .001$, $\eta^2 = 0.31$.

The third MANOVA compared OCD and OAD groups, showing only a significant effect of condition, $F(3,59) = 13.47$, $p < .001$, $\eta^2 = 0.69$. Univariate analyses indicated significantly higher scores for those in the high compared to low responsibility/threat conditions for cost ratings, $p < .001$, $\eta^2 = 0.27$, responsibility ratings, $p < .001$, $\eta^2 = 0.62$, intolerance of uncertainty, $p = .002$, $\eta^2 = 0.16$, need to control thoughts, $p = .002$, $\eta^2 = 0.15$, and perfectionism, $p = .004$, $\eta^2 = 0.14$.

The fourth MANOVA compared nonclinical and OAD groups, again only showing significant condition effects, $F(3,55) = 10.9$, $p < .001$, $\eta^2 = 0.67$, indicating higher scores for those in the high responsibility/threat compared to the low responsibility/threat condition on cost, $p < .001$, $\eta^2 = 0.25$, responsibility, $p < .001$, $\eta^2 = 0.60$, intolerance of uncertainty, $p < .001$, $\eta^2 = 0.33$, need to control thoughts, $p = .001$, $\eta^2 = 0.18$, and perfectionism, $p < .001$, $\eta^2 = 0.40$.

Table 3 Results of the regression model for (1) state anxiety; (2) time taken to sort the lollies; and (3) time spent checking the lollies

Variable	R^2	$R^2\Delta$	β	t	p
State anxiety					
Model 1	0.09	0.09			
Responsibility appraisal			**0.30**	**2.85**	**0.01**
Model 2	0.18	0.09			
Responsibility appraisal			0.14	1.23	0.22
Threat appraisal			**0.34**	**3.00**	**0.00**
Model 3	0.19	0.00			
Responsibility appraisal			0.12	0.96	0.34
Threat appraisal			**0.31**	**2.50**	**0.02**
Perfectionism appraisal			0.07	0.56	0.57
Time taken to sort					
Model 1	0.05	0.05			
Responsibility appraisal			**0.23**	**2.10**	**0.04**
Model 2	0.10	0.05			
Responsibility appraisal			0.10	0.88	0.38
Threat appraisal			**0.26**	**2.17**	**0.03**
Model 3	0.14	0.04			
Responsibility appraisal			0.03	0.21	0.84
Threat appraisal			0.16	1.26	0.21
Perfectionism appraisal			0.24	1.82	0.07
Time spent checking					
Model 1	0.07	0.07			
Responsibility appraisal			**0.26**	**2.47**	**0.02**
Model 2	0.13	0.06			
Responsibility appraisal			0.13	1.13	0.26
Threat appraisal			**0.28**	**2.35**	**0.02**
Model 3	0.14	0.01			
Responsibility appraisal			0.10	0.76	0.45
Threat appraisal			0.23	1.78	0.08
Perfectionism appraisal			0.12	0.88	0.38

Bold values are statistically significant ($p < .05$)

Regression Analyses for Objective and Subjective Dependent Variables

Responsibility appraisals, threat appraisals (summed probability, cost and coping ratings) and perfectionism scores all showed significant positive correlations with time taken to sort and time spent checking, as well as state anxiety ratings. The literature also recognises these variables as key cognitive maintaining factors that have received a relatively large amount of empirical attention (see Mantz and Abbott 2016a for a review). Therefore, three regression analyses were conducted; the first with state anxiety ratings as the dependent variable, the second with overall time taken to sort as the dependent variable and the third with time spent checking as the dependent variable. In each regression model, responsibility appraisals were entered first in keeping with their

dominance in the literature, followed by threat appraisals and then perfectionism scores, allowing for the unique contribution by each variable to be assessed in explaining variance in the relevant dependent variable. Table 3 summarises the results of these regressions. A table of pairwise Pearson correlations between the state dependent variables and the state anxiety and cognition ratings for the sorting task is available from the authors on request.

State Anxiety

The state anxiety regression model including all three cognitive predictors, was significant, $F(3,83) = 6.0$, $p = .001$, explaining 18.5% of variance in state anxiety scores. The initial model with only responsibility appraisals was significant, $p = .005$; however, the addition of threat appraisal scores increased prediction of variance in state anxiety ratings, $F(2,83) = 9.0$, $p < .001$, leaving only threat appraisals to explain significant variance, $p = .004$. The addition of perfectionism scores to the model was significant in explaining overall variance in state anxiety ratings, although threat appraisals remained the only predictor in the final model that significantly explained unique variance in state anxiety ratings, $p = .02$.

Time Taken to Sort Lollies

The overall regression model explaining variance in the time taken to sort the lollies was significant, $F(3,83) = 4.29$, $p = .01$, explaining 13.8% of variance in latency scores. The initial model with only responsibility appraisals was significant, $p = .04$; however, the addition of threat appraisal scores increased the prediction of variance in latency scores, $F(2,83) = 4.65$, $p = .01$, leaving threat appraisals as the only significant predictor of variance in time taken to sort the lollies, $p = .03$. Finally, the addition of perfectionism scores significantly explained additional variance in the model; however, none of the individual predictors were significant, most likely due to the strong covariance between threat appraisal and perfectionism scores in predicting variance in time taken to sort the lollies.

Time Spent Checking

The same pattern of results was found when predicting variance in time spent checking, with the overall model significant and explaining 13.7% of variance in the dependent variable, $F(3,83) = 4.23$, $p = .01$. Again, responsibility appraisals significantly predicted variance when entered alone, $p = .02$. However, the addition of threat appraisals significantly contributed to the model in explaining further variance in time spent checking, $F(2,83) = 5.98$, $p = .004$, and remained the only significant cognitive predictor, $p = .02$. The final model

indicated that the addition of perfectionism scores added significantly to the model, although none of the individual predictors significantly explained unique variance, again, due to the strong covariance relationship between threat appraisals and perfectionism scores.

Discussion

Cognitive models of OCD are based on the assumption that dysfunctional appraisals are key factors in the development and maintenance of the disorder (e.g., Rachman 1997). Although there is consensus on six primary appraisal types, much of the research has focused on understanding the role of responsibility appraisals in OCD (e.g., Arntz et al. 2007; Ladouceur et al. 1995, 1997; Reeves et al. 2010), with little consideration of other appraisal types that may contribute to OCD symptomatology. The current study aimed to better elucidate the role of cognitive appraisals in young people with OCD and determine the relative contribution of these appraisals in provoking anxiety and delay behaviours, using an experimental design with both clinical and control groups. This study is one of the first to test the causal hypothesis that high personal responsibility for possible negative outcomes induces OC symptomatology both subjectively and behaviourally in young people with OCD, or whether other key appraisal types feature more prominently. The results largely support cognitive conceptualisations of OCD that include multiple appraisal types, particularly responsibility, threat and perfectionism beliefs.

In line with expectations, clinical and nonclinical groups differed on measures of depression and anxiety, with higher scores for clinical participants. Although clinical participants scored higher on the obsessive beliefs questionnaire (OBQ) perfectionism/certainty and importance/control subscales compared to nonclinical controls, there was no significant difference for the responsibility/threat subscale. Further, OCD and OAD participants did not differ on any OBQ subscales. This is perhaps not unusual when considering the relevant literature, with inconclusive findings as to whether OCD, OAD and nonclinical samples differ on the revised belief domains (Julien et al. 2007). Significant differences between OCD and OAD groups were found on the spence children's anxiety scale (SCAS), with OCD participants scoring significantly higher on the obsessive–compulsive subscale and OAD participants scoring significantly higher on the social phobia subscale. This was fitting given the prominent diagnoses comprising these samples.

As expected, the cognitive manipulation of responsibility/threat appraisals was successful and had a large effect on anxiety levels during the task across both group and condition with a significant interaction and condition effects specific to OCD. This OCD-specific effect showed that

anxiety during the task was elevated for OCD children and adolescents who experienced high as opposed to low levels of responsibility/threat, with no effects of the manipulation on state anxiety during the task for either of the two control groups. Importantly, state anxiety ratings significantly increased from baseline to those made during the sorting task for OCD participants in the high responsibility/threat condition only. These results are in line with expectations and studies with adult samples reporting either condition effects for discomfort with OCD groups (Lopatka and Rachman 1995; Shafran 1997) or no effects for non-patient adult (e.g., Ladouceur et al. 1997; Mancini et al. 2004) or child (Reeves et al. 2010) samples, yet differ from Barrett and Healy-Farrell's (2003) study which found no significant effects of perceived responsibility on state anxiety in a sample of paediatric OCD participants. This may be due to their use of a state anxiety scale (State Trait Anxiety Inventory for Children; Spielberger et al. 1973) to measure anxiety immediately after the behavioural avoidance tasks, as opposed to the SUDs rating that was used in the current study, which was based on how the participant felt during the task, which may provide a more accurate reflection of state anxiety related to the experimental manipulation.

When examining behavioural data, results revealed that the OCD group clearly differed from both the OAD and nonclinical groups in the degree to which they displayed obsessive–compulsive (OC) behaviours, taking significantly longer on the task and spending more time checking. This was irrespective of condition, indicating that OCD participants are likely impacted by both low and high responsibility/threat more so than other participants, although there was also a significant condition effect for the OCD group. Although significant interactions were not found for behavioural variables (e.g., time taken, time spent checking), this was likely due to variability across samples, demonstrated by mean scores in the expected direction for objective behavioural variables, but very large standard deviations (see Table 2). Interestingly, anxious children and adolescents did not differ from the nonclinical group, showing no effects on behavioural variables, supporting an effect that is not about anxiety in general but instead specific to individuals with OCD. These findings support the notion that there are disorder-specific beliefs and related behaviours.

These are interesting and important findings within the OCD literature that build on a sparse experimental research base, particularly in discriminating OC-behaviours between individuals who suffer from OCD and those who experience other anxiety disorders. These findings are similar to those of Arntz et al. (2007), who found that checking behaviours were highest for OCD adults in the high responsibility condition compared to most other conditions and participant groups. Arntz et al. (2007) also found a significant effect for time taken, although this was not specific

to OCD participants as it was in the current study. Results differ from Barrett and Healy-Farrell (2003) who found that manipulating responsibility in young people with OCD did not affect ritualising behaviours, indicating the need for further replication with clinical samples; however, the present findings are more similar to those of Reeves et al. (2010) who found effects for ritualising behaviours in an unselected child sample. The lack of significant results for nonclinical participants in the current study fits with the majority of studies showing no overall effect of responsibility condition on checking behaviours and/or time taken to finish the task for non-patient participants (e.g., Ladouceur et al. 1995, 1997; Parrish and Radomsky 2006). Although, these results contrast with studies that induced OC-like behaviours in unselected adult and child samples with a similar manipulation perhaps because unselected samples would likely have greater variability in scores relative to nonclinical samples (e.g., Bouchard et al. 1999; Mancini et al. 2004; Reeves et al. 2010). Overall, the results of the present study support Rachman's (2002) cognitive theory emphasising both responsibility and threat appraisals in checking behaviours, and showing that young people with OCD are most vulnerable to the effects of a responsibility/threat manipulation, despite similar diagnostic severity and co-morbidity with the OAD group, and similar cognition ratings across groups.

As predicted, results revealed that children and adolescents who experienced high as opposed to low levels of responsibility/threat endorsed higher threat (cost) and responsibility beliefs, in line with other studies using both clinical and non-clinical samples (e.g., Arntz et al. 2007; Ladouceur et al. 1995; Lopatka and Rachman 1995; Shafran 1997). These beliefs were endorsed similarly across groups, replicating studies reporting no differences between OCD, nonclinical, or anxious-control groups on ratings of perceived danger and responsibility (i.e., Arntz et al. 2007; Boschen and Vuksanovic 2007). In line with expectations, other appraisal types were also endorsed for each of the groups in the high responsibility/threat conditions, including intolerance of uncertainty, perfectionism, and beliefs about the need to control thoughts. Although all groups should be impacted cognitively by the manipulation, a stronger effect was expected for the OCD group. The current findings could thus be representative of the strength of the manipulation. It is also possible that the state cognitive measure was not sensitive enough to detect group differences. Other findings may thus prove more helpful in demonstrating effects that are specific to OCD.

The study then sought to better understand the role of cognition in OC symptomatology with regression analyses, with results showing that (1) threat appraisals were the only belief domain that significantly predicted state anxiety ratings in the final model, supporting hypotheses regarding the important yet overlooked role of belief domains other than

responsibility in provoking OCD symptomatology; and (2) threat appraisals explained more unique variance in time taken and time spent checking than responsibility beliefs, thus indicating a more dominant role of threat appraisals in explaining these behaviours. These findings emphasise the need to consider the role of belief domains other than responsibility in both the onset and maintenance of the disorder, and that cognitive appraisals such as threat may have a more dominant, yet understudied, role. Similarly, Jones and Menzies (1997a) found that danger expectations, and not perceived responsibility, explained the anxiety and behaviours (i.e., time in dirt, time spent washing) of OCD-washers during a behavioural avoidance test. These similarities show that distorted danger expectancies can play a primary role in both (1) experimentally induced responsibility and non-experimental approaches; and (2) OCD checking (in particular, duration of checking) and washing behaviours. Further investigations are warranted, but at this stage the effect of danger expectancies on OCD checking does not seem any less significant than that of washing. Interestingly, the addition of perfectionism appraisals to the regression resulted in each appraisal type becoming non-significant, most likely due to the strong covariance between threat appraisal and perfectionism scores in predicting these behaviours. The role of perfectionism in predicting OC behaviours was similarly demonstrated by Fitch and Cougle (2013), who found that perfectionism/certainty beliefs were the only significant cognitive predictor of urge to check and post-task anxiety. Thus, of the cognitive variables assessed in the present study, threat appraisals and perfectionism appear to be the most likely mediators of checking-related behaviour in OCD.

The results of the current study thus provide promising preliminary support for a relationship between cognitive processes, namely threat and perfectionism appraisals, and the development of anxiety and OC delay behaviours in children and adolescents. Importantly, threat appraisals were associated with both self-reported and observer-rated behavioural symptoms that are prominent in OCD, ranging from subjective urges and anxiety to actual slowness and checking duration, thus providing substantial support for threat-based models of the disorder. In terms of theoretical significance, results are in line with models emphasising danger expectancies as a mediator of OCD symptomatology, such as Carr (1974) and Beck et al. (1985), and challenge models emphasising responsibility beliefs (e.g., Salkovskis 1985, 1989). These findings also add to the growing literature supporting the use of cognitive models in understanding and treating OCD in young people and have clinical implications for the formulation and treatment of paediatric OCD. The current results imply that if inflated danger appraisals are a key component of OCD, addressing them in therapy may assist the reduction of anxiety and delay behaviours and be necessary for both immediate and lasting change. Treatments such as Danger Ideation Reduction Therapy (DIRT) that are designed to reduce threat expectancies may prove particularly useful (Jones and Menzies 1997b, 1998; Vaccaro et al. 2010).

Strengths of the current study include the use of an experimental design with clinical and control samples, as well as the assessment of multiple cognitive appraisal types. Indeed, this study is one of the first to evaluate the relative contribution of competing appraisal types in anxiety and OC behaviours during an experimental manipulation, representing a major strength of this paper that can contribute to the theoretical and experimental literature. The use of a paediatric sample is also noteworthy given the lack of experimental studies within this population. This study was limited by the lack of a reliable and valid questionnaire to measure state cognitive domains in young people. The current study developed a new measure to assess the effect of the manipulation on cognitive domains, however, it had not been validated and thus poses an issue in drawing strong conclusions. Additionally, the present study did not include objective indices of anxiety and physiological arousal (e.g., GSR; heart rate), which could be included in future research. Future studies would also benefit from recruiting participants with "pure" diagnoses to lessen any impact that comorbidity may have had on the data for the OCD and clinical control groups.

Findings confirm the need for further experimental studies with clinical paediatric samples that assess the causal role of a range of cognitive appraisal types in the development and maintenance of OC symptoms. Ultimately, an empirically supported cognitive conceptualisation of the disorder in young people is needed. Consideration of the developmental trajectory in future studies will likely be helpful, given reported differences between children and adolescents on responsibility and threat appraisals, for example, which are typically endorsed more strongly by adolescents (Farrell and Barrett 2006; Pişgin and Özen 2010; Verhaak and De Haan 2007). As the sample in the current study was primarily adolescent (Mean age 13.6), studies using younger samples would likely prove useful in better understanding developmental differences in the cognitive processing of threat. This would ultimately be helpful in improving treatments and reducing the disorder's negative impact.

Compliance with Ethical Standards

Conflict of interest Sharlene Mantz, Margot O'Brien, Felicity Waters and Maree Abbott declare that they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Animal Rights This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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