



Metacognition in obsessive-compulsive disorder symptom dimensions: Role of fusion beliefs, beliefs about rituals and stop signals

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ABSTRACT

The role of OCD-specific metacognitions (thought fusion beliefs, beliefs about rituals, beliefs about stop signals) has been accentuated in Wells' (2001) Metacognitive Model. This study aimed at investigating the applicability of the model in OCD symptom dimensions. Participants completed a web-based survey comprising multiple questionnaires to assess their OCD symptom dimensions, OCD-specific metacognitions, and their general metacognitions and worries. Of the 276 total respondents who completed the survey, 227 met A- and B-self-rating-criteria of the DSM-5 (American Psychiatric Association, 2013) regarding OCD; these 227 participants made up the final sample. We analyzed the participants' responses using regression models on each OCD symptom dimension to determine how much of the variance in each model was accounted for by the different OCD-specific and general metacognitions. Results showed that when the OCD-specific metacognitive measures were added to the model, they did not explain additional variance for each OCD symptom dimension. Additionally, in the final equations we found that different patterns of OCD-specific and general metacognitive beliefs were significant predictors for different symptom dimensions. Overall, the results show that the hypothesized role of OCD-specific metacognitive beliefs as proposed by the Metacognitive Model might not be applicable to each OCD symptom dimension.

1. Introduction

Robust psychological research has shown that psychological disorders are linked to people's distorted metacognitions, meaning their beliefs about their own thinking, such that their distorted beliefs cause maladaptive coping styles that then lead to psychological symptoms (Wells, 2011). Such dysfunctional coping styles are particularly relevant in obsessive compulsive disorder (OCD), where patients cope with intrusive thoughts, images or urges (henceforth called obsessive thoughts) by performing rituals, worrying, suppressing and/or avoiding thoughts, and monitoring their thoughts, actions and threats (American Psychiatric Association, 2013; Wells, 2011). Several studies have confirmed that OCD-specific metacognitions (thought fusion beliefs, beliefs about rituals, beliefs about stop signals) as proposed by the Metacognitive Model of OCD (Wells, 2011) are linked to the severity of OCD (e.g., Myers, Fisher, & Wells, 2009). However, it is still unclear whether the hypothesized role of OCD-specific metacognitive beliefs as proposed by the Metacognitive Model is applicable for the different OCD symptom dimensions, too.

The way in which metacognitions are linked to psychological disorders was introduced in a model by Wells and Matthews (1996) called the Self-Regulatory Executive Function Model (S-REF model), such that psychological disorders are linked to the activation of distorted general metacognitions that comprise “positive and negative beliefs about thinking” as well as “plans or programs for guiding cognition and action” (Wells & Cartwright-Hatton, 2004, p.386). In a later study, Wells and Cartwright-Hatton (2004; p. 385) identified five general domains of metacognition – “positive beliefs about worry”, “negative beliefs about the controllability of thoughts and danger”, “beliefs about the need to control thoughts”, “cognitive self-consciousness”, which refers to the extent that a person's attention is aimed at their own thoughts, and “cognitive confidence”, which describes a person's trust in “attention and memory” (Wells & Cartwright-Hatton, 2004, p.387) – that, when distorted, cause maladaptive coping styles and lead to psychological symptoms (Wells & Matthews, 1996).

To more closely relate distorted metacognitions with the psychological disorder of OCD, Wells (2011) developed the more specific Metacognitive Model of OCD, which assumes that obsessive thoughts

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lead to an activation of OCD-specific dysfunctional metacognitive beliefs. Specifically, these metacognitive beliefs center around the following “thought fusion beliefs”: 1) *thought event fusion* (TEF), the belief that “having a thought can cause an event or means that an event has happened” (Myers et al., 2009, p.436); 2) *thought action fusion* (TAF), the belief that “a thought alone can cause a person to carry out an action, or that a thought is equivalent to an action” (Solem, Myers, Fisher, Vogel, & Wells, 2010, p.80); and 3) *thought object fusion* (TOF), the belief that “thoughts and/or feelings can pass into objects” (Myers et al., 2017, p.1). Therefore, this model stipulates that in OCD, obsessive thoughts are perceived as a threat and, thereby, cause negative emotions (e.g., fear, distress).

When people with OCD experience these “thought fusion beliefs”, this triggers further metacognitive beliefs about performing behaviors that counteract the negative effect of the thoughts (Solem et al., 2010). These “beliefs about rituals” (Myers et al., 2009, p. 436; e.g., “I need to control my emotions, otherwise I’m making mistakes”) are made up of “declarative beliefs about the need to carry out rituals” (Myers et al., 2009, p.436) and beliefs about carrying out “neutralizing behavior in response to intrusions” (Solem et al., 2010, p. 80; e.g., compulsions, worrying). In performing rituals and neutralizing behavior, people with OCD intend to reduce the perceived threat of the thoughts and the corresponding emotions (Wells, 2011); however, they are unaware of the incorrect assumptions they have made regarding their obsessive thoughts in the first place.

Because OCD patients appraise their obsessive thoughts on the basis of their metacognitive beliefs and not on objective signals of danger (Wells, 2011), they need to rely on intrinsic signals about when to stop performing the rituals (Myers et al., 2009). Thus, according to the Metacognitive Model of OCD, the next metacognitive belief activated in OCD is the “beliefs about stop signals” (Solem et al., 2010, p.80, e.g., “I can stop my rituals if I feel satisfied”); namely, the subjective rules about when to stop performing a ritual. Unfortunately, these “stop” criteria are rarely met, causing OCD patients experience an increase in intrusions which, thereby, help maintain their OCD (Myers et al., 2017).

The model’s proposed order in which metacognitive beliefs are activated (1st: thought fusion beliefs, 2nd: beliefs about rituals, 3rd: beliefs about stop signals) has been investigated in several studies. In one study of a non-clinical student sample, Myers et al. (2009) found that in regression analyses predicting the severity of OCD using either the Obsessive-Compulsive Inventory (OCI; Foa, Kozak, Salkovskis, Coles, & Amir, 1998) or the Yale-Brown Obsessive Compulsive Scale Self-Report (Y-BOCSSR; Baer, Brown-Beasley, Sorce, & Henriques, 1993), each type of metacognitive belief incrementally added to the models’ amount of explained variance when they were added in the order of activation described above (and after controlling for worry). In the final model, all three types of metacognitive beliefs emerged as significant predictors of the total distress score on the OCI, whereas only the “beliefs about rituals” and “beliefs about stop signals” emerged as significant predictors of the total score for the Y-BOCSSR.

In a subsequent study using an OCD sample, Myers et al. (2017) controlled for both worry and non-metacognitive beliefs, and they found that when the OCD-specific metacognitive beliefs were added to the regressions in the same order as above, all three types of beliefs explained additional variance in the OCI Revised (OCI-R; Foa et al., 2002) and Y-BOCSSR total scores. In the final equation, only “beliefs about stop signals” emerged as a significant predictor of OCI-R and Y-BOCSSR.

Solem et al. (2010) also conducted regression analyses to predict the OCI-R and the Y-BOCSSR total score in a non-clinical sample. When the OCD-specific metacognitive beliefs were added in the above-mentioned sequence after controlling for worry and non-metacognitive beliefs, “thought fusion beliefs” and “beliefs about rituals” significantly explained additional variance of the OCI-R total score and emerged as significant predictors in the final equation, too. In the regression

predicting the Y-BOCSSR total score, “beliefs about rituals” significantly explained additional variance when added to the model and emerged as the only significant predictor in the final model, too.

In another study Hansmeier, Exner, Rief, and Glombiewski (2016) conducted regression analyses to predict the total score of the German Palatine Revision of the Padua Inventory (PI-PR; Gönner, Ecker, & Leonhart, 2007) that reflects OCD symptom severity. They added the three types of OCD-specific metacognitive beliefs in the above-defined order. After controlling for anxiety and cognitions, the researchers found that all three types of metacognitive beliefs significantly explained variance of the PI-PR total score when added to the model sequentially. In the final equation, the “thought fusion beliefs” and “beliefs about stop signals” were significant predictors of OCD severity. When general metacognitions, as measured by the Meta-Cognitions Questionnaire (MCQ; Cartwright-Hatton & Wells, 1997), were added to the model before the OCD-specific metacognitions, only “thought fusion beliefs” and “beliefs about rituals” significantly added to the variance of the regression model. In the final equation, only “thought fusion beliefs” emerged as a significant predictor of OCD severity.

The aforementioned studies support the Metacognitive Model of OCD, but they focus on OCD as a homogenous disorder, as all studies mentioned above examined how adding OCD-related metacognitions to the models affected the variance of scores related to the general severity of OCD. Thus, these studies do not elucidate how OCD-specific metacognitive beliefs affect the different OCD symptom dimensions and whether the Metacognitive Model is applicable for each OCD symptom dimension.

As OCD symptoms are heterogeneous, many studies have tried to differentiate between various symptom dimensions using a taxonomy approach. Studies using this approach have found approximately 3–5 dimensions (e.g.; Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008; Mataix-Cols, Rosario-Campos, & Leckman, 2005), including 1) *contamination/washing*, characterized by fears of getting contaminated or contaminating others and washing rituals to prevent this assumed danger (Sookman, Abramowitz, Calamari, Wilhelm, & McKay, 2005); 2) *harming/checking*, which comprises fears of endangering oneself or others and checking rituals to prevent harm (Sookman et al., 2005); 3) *hoarding*, which refers to a pathological degree of collecting things (Samuels et al., 2007); 4) *symmetry/ordering* which is characterized by compulsions to ensure that objects in the environment are in a “correct” order (Radomsky & Rachman, 2004); 5) and *obsessions*, in which one harbors certain obsessions but does not show overt compulsive behaviors (Sookman et al., 2005). As Leckman et al. (2010) pointed out, it is useful to consider symptom dimensions when making treatment choices, since they appear to have an impact on treatment outcome. Several studies have explored the relationship between general metacognitions and OCD symptom dimensions. A summary of the results of these studies is shown in Table 1.

Additionally, other significant correlations between general metacognitions and OCD symptom dimensions have been found on particular measures. Specifically, Wells and Cartwright-Hatton (2004) found significant correlations between the short form of the MCQ (MCQ-30) subscales of *Cognitive Confidence/Positive Beliefs About Worry* and the Padua Inventory – Washington State University Revision (PI-WSUR; Burns, Keortge, Formea, & Sternberger, 1996) subscales of *Contamination Obsessions and Washing Compulsions* as well as *Checking and Dressing/Grooming Compulsions*. Further, the MCQ-30 subscales of *Cognitive Self-Consciousness and Negative Beliefs About The Uncontrollability And Danger* correlated significantly with PI-WSUR subscale *Obsessional Impulses*. Finally, the MCQ-30 subscale *Need To Control Thoughts* was found to correlate significantly with PI-WSUR subscales *Obsessional Impulses, Contamination Obsessions and Washing Compulsions* as well as *Checking Compulsions*. In a later study, Timpano, Rasmussen, Exner, Rief, and Wilhelm (2014) found that each subscale of the MCQ correlated significantly with OCI-R subscales of *Obsessions, Ordering and Checking*. Moreover, the MCQ subscales of *Positive Beliefs About Worry*

Table 1
Summary of significant metacognitive predictors of OCD symptom dimensions in previous studies.

Study	measures	OCD symptom dimensions						
		contamination/washing	checking	responsibility for harm	obsessional/unacceptable thoughts	doubting	symmetry/the need for things to be “just right	
Cartwright-Hatton and Wells (1997)	Padua Inventory, <i>Checking Behaviors</i> MCQ	–	Positive Beliefs About Worry Cognitive confidence	–	–	–	–	
Wells and Papageorgiou (1998)	Padua Inventory – Washington State University Revision (PI-WSUR) MCQ	Negative Beliefs About The Uncontrollability And Danger	Positive Beliefs About Worry	–	Positive Beliefs About Worry Negative Beliefs About The Uncontrollability And Danger	–	–	
Hermans et al. (2008)	Padua Inventory Revised (Padua-R) MCQ	No significant metacognitive predictor	Cognitive Confidence	–	–	–	–	
Irak and Tosun (2008)	Maudsley Obsessional-Compulsive Inventory (MOCI) MCQ-30	Negative Beliefs About The Uncontrollability And Danger Need to control thoughts	Positive Beliefs About Worry Negative Beliefs About The Uncontrollability And Danger Need To Control Thoughts	–	–	Uncontrollability And Danger Cognitive Self-Consciousness Need To Control Thoughts	–	
Nance, Abramowitz, Blakey, Reuman, and Buchholz (2018)	Dimensional Obsessive-Compulsive Scale (DOCS) MCQ-30	No significant metacognitive predictor	–	Cognitive Confidence	Cognitive Confidence Need To Control Thoughts	–	No significant metacognitive predictor	

Note. MCQ = Metacognitions Questionnaire; MCQ-30 = Metacognitions Questionnaire 30-items version.

Table 2

Intercorrelations, sample scores and internal consistency of the questionnaires employed in the survey.

		2	3	4	5	6	7	8	9	10	11	12	13	14	mean	SD	α
1	Washing	.22	.25*	.09	.23	.14	.15	.16	.12	.06	.14	.29*	.28*	.32*	4.67	4.58	.94
2	Checking	–	.47*	.11	.40*	.27*	.15	.19	.32*	.12	.30*	.24*	.42*	.54*	5.57	3.90	.89
3	Ordering		–	.03	.52*	.16	.04	.26*	.16	.15*	.35*	.32*	.35*	.38*	5.01	4.11	.94
4	Obsessions			–	.11	.43*	.49*	.11	.23	.47*	.44*	.41*	.34*	.21	8.38	3.06	.83
5	Neutralizing				–	.13	.08	.23*	.14	.14	.37*	.37*	.38*	.43*	3.40	3.77	.85
6	PSWQ					–	.74*	.38*	.28*	.44*	.41*	.36*	.35*	.29*	62.33	11.38	.90
7	MCQ-UD						–	.36*	.28*	.49*	.48*	.42*	.35*	.29*	17.06	4.12	.79
8	MCQ-PB							–	.29*	.35*	.47*	.49*	.40*	.28*	12.14	4.88	.89
9	MCQ-CC								–	.20*	.45*	.32*	.39*	.31*	12.53	4.88	.87
10	MCQ-CS									–	.43*	.38*	.25*	.26*	16.89	3.91	.77
11	MCQ-NC										–	.65*	.61*	.45*	14.59	4.35	.78
12	TFI											–	.58*	.47*	379.96	296.06	.91
13	BARI												–	.72*	28.70	8.94	.89
14	SSQ													–	24.93	11.63	.87

Note. PSWQ = Penn State Worry Questionnaire; MCQ-UD = MCQ-30 subscale *Negative Beliefs About Uncontrollability Of Thoughts And Danger*; MCQ-PB = MCQ-30 subscale *Positive Beliefs About Worry*; MCQ-CC = MCQ-30 subscale *Cognitive Confidence*; MCQ-CS = MCQ-30 subscale *Cognitive self-consciousness*; MCQ-NC = MCQ-30 subscale *Beliefs About Need To Control Thoughts*; TFI = Thought-Fusion Instrument; BARI = Beliefs About Rituals Inventory; SSQ = Stop Signals Questionnaire; α = Cronbach's α .

* $p < .0005$.

and *Beliefs About The Need to Control Thoughts* were found to correlate significantly with the OCI-R subscale *Washing*.

Though these studies hint that differences in general metacognitions are related to different OCD symptom dimensions and research supports the Metacognitive Model of OCD, no conclusions can be drawn regarding the applicability of the Metacognitive Model and differences regarding OCD-specific and general metacognitions in the different OCD symptom dimensions.

1.1. Hypotheses of the current study

We examined the following hypothesis:

1. Consistent with the Metacognitive Model of OCD we expect that in regressions predicting OCD symptom dimensions while controlling for worry, each OCD-specific metacognitive domain will explain additional variance on its associated step when entered hierarchically based on the assumed order of activation (thought fusion beliefs → beliefs about rituals → beliefs about stop signals).

We further examined three additional exploratory questions:

1. In the final model, do different OCD-specific metacognitions emerge as significant predictors for different OCD symptom dimensions?
2. When entered into the model, will general metacognitive beliefs explain additional variance beyond the variance explained by OCD-specific metacognitive beliefs?
3. In the final model, are there different patterns of general metacognitive predictors for each symptom dimension?

2. Materials and methods

2.1. Study design and procedure

The study protocol was reviewed and approved of by the ethics committee of the Department of Psychology and Sports at the University of Münster, Germany. The survey was conducted online from April 2016 until April 2018, using a web-based online-survey software (www.unipark.de). Participants were recruited via posts on OCD-related German online platforms (e.g. *zwaenge.de*; *zwangserkrankungen.de*) and Facebook, flyers distributed in psychotherapeutic outpatient clinics and practices, advertisements in local newspapers and a press release via the University of Münster. Additionally, participants who had taken part in previous studies conducted by the psychotherapy

outpatient department of the University of Münster were contacted via e-mail if they had given their consent to be contacted for research purposes. After providing informed consent, participants completed the questionnaires described below. At the end of the survey, participants were asked again for their consent to use their data for research purposes. In addition, participants were able to participate in a 50 € prize draw. Inclusion criterion was a minimum age of 18 years.

2.2. Participants

The sample consisted of $N = 457$ participants who started the survey, of which 276 completed the entire survey and gave consent to use their data for research purposes. Only participants meeting DSM-5 (Falkai et al., 2015) A- and B-Self-Rating-criteria (see section *Instruments*) were included. As ratings concerning the origin of OCD symptoms and differential diagnoses require expert knowledge in the field of psychological disorders, we did not assess DSM-5 C- and D-criteria in our study. The final sample consisted of $n = 227$ participants, of which 169 (74.40%) participants were female, and the mean age was 32.47 years ($SD = 12.19$). Of the final sample, 132 (58.15%) participants were currently receiving psychotherapy and 99 (43.61%) were currently receiving psychopharmacological treatment. Mean symptom severity, measured by OCI-R, was $M = 30.29$ ($SD = 13.91$). The mean scores of the other instruments are displayed in Table 2.

2.3. Instruments

Self-Rating of the diagnostic criteria for OCD. A self-rating of the diagnostic criteria for OCD based on the German version of the Diagnostic and Statistical Manual of Mental Disorders 5 (DSM-5; Falkai et al., 2015) served to diagnose OCD. Therefore, we converted the diagnostic criteria (A & B) for OCD described in the DSM-5 into statements (e.g., “I experience repetitive and persistent thoughts, urges or images and at times I perceive them as intrusive or unwanted. These thoughts usually cause strong fear and discomfort.”). The participants then had to determine whether they agreed or disagreed with the statement (*I agree/I disagree*).

Obsessive-Compulsive Inventory-Revised (OCI-R). The OCI-R (Foa et al., 2002) is an 18-item self-rating scale to assess the severity and symptom dimensions of OCD (washing, checking, ordering, obsessions, hoarding, mental neutralizing). Items are rated on a four-point rating scale from 0 (*not at all*) to 4 (*extremely*). In the current study, the German version (Gönnner, Leonhart, & Ecker, 2007) was used. Internal consistency of the German version ranges from 0.76 to 0.95 (Cronbach's

Table 3
Regression statistics for each block of variables and predictors of final equation predicting OCI-R Washing.

Variable	R ²	ΔR ²	Incremental change			Model parameters final step of the equation		
			f ²	ΔF	p	Beta	t	p
Step 1	.021	.021		4.767	.030			
PSWQ						.144	2.183	0.30
Step 2	.084	.063	.069	15.411	< .001			
PSWQ						.048	.705	.482
TFI						.269	3.926	< .001
Step 3	.102	.019	.020	4.622	.033			
PSWQ						.021	.300	.764
TFI						.179	2.244	.026
BARI						.171	2.150	.033
Step 4	.126	.024	.027	5.990	.015			
PSWQ						.013	.197	.844
TFI						.164	2.072	.039
BARI						.021	.211	.833
SSQ						.223	2.447	.015
Step 5	.148	.022	.026	1.117	.352			
PSWQ						.020	.213	.831
TFI						.239	2.626	.009
BARI						.065	.609	.543
SSQ						.227	2.466	.014
MCQ-UD						.061	.610	.542
MCQ-PB						.034	.445	.657
MCQ-CC						.015	.209	.834
MCQ-CS						-.080	-1.044	.298
MCQ-NC						-.186	-1.905	.058

Note. OCI-R = Obsessive-Compulsive Inventory-Revised; PSWQ = Penn State Worry Questionnaire; TFI = Thought-Fusion Instrument; BARI = Beliefs About Rituals Inventory; SSQ = Stop Signals Questionnaire; MCQ-UD = MCQ-30 subscale *Negative Beliefs About Uncontrollability Of Thoughts And Danger*; MCQ-PB = MCQ-30 subscale *Positive Beliefs About Worry*; MCQ-CC = MCQ-30 subscale *Cognitive Confidence*; MCQ-CS = MCQ-30 subscale *Cognitive Self-Consciousness*; MCQ-NC = MCQ-30 subscale *Beliefs About Need To Control Thoughts*.

α), with $\alpha = 0.85$ for the total score (Gönner, Leonhart et al., 2007).

Thought-Fusion Instrument (TFI). The TFI (Wells, Gwilliam, & Cartwright-Hatton, 2002) is a 14-item self-report questionnaire assessing TAF, TEF and TOF on a scale ranging from 0 (*I do not believe this at all*) to 100 (*I am completely convinced this is true*). Wells et al. (2002) reported a Cronbach's $\alpha = 0.89$ regarding the total score.

Beliefs About Rituals Inventory (BARI). The BARI (Wells & McNicol, 2004) is a 12-item self-report scale measuring positive beliefs about rituals. Items are rated on a four-point scale ranging from 1 (*do not agree*) to 4 (*agree very much*). Wells and McNicol (2004) reported an internal consistency of $\alpha = 0.86$.

Stop Signals Questionnaire (SSQ). The SSQ (Myers et al., 2009) is a 12-item self-report questionnaire to rate the relevance of various signals in deciding when to stop OC rituals. Items are rated on a five-point scale ranging from 0 (*not at all important*) to 4 (*extremely important*). Myers et al. (2009) reported an internal consistency of $\alpha = 0.89$. In the current study, the TFI, BARI and SSQ were translated into German by psychologists experienced in the field of OCD. A back-translation method was used to guarantee a correct German adaption of the questionnaires.

Short form of the Metacognitions Questionnaire (MCQ-30). The MCQ-30 (Wells & Cartwright-Hatton, 2004) assesses general metacognitions via 30 items that are assigned to five subscales (*Negative Beliefs About Uncontrollability Of Thoughts And Danger*, *Positive Beliefs About Worry*, *Cognitive Confidence*, *Cognitive Self-Consciousness*, *Beliefs About Need To Control Thoughts*). In the current study, the German Version (Arndt, Patzelt, Andor, Hoyer, & Gerlach, 2011) was applied. Arndt et al. (2011) reported an acceptable internal consistency of the German version ranging from 0.76 to 0.83 (Cronbach's α), except for the subscale *Beliefs About Need To Control Thoughts* ($\alpha = 0.63$).

Penn State Worry Questionnaire (PSWQ). As worry seems to overlap with OCD (e.g. Tallis & de Silva, 1992) and is involved in some metacognitive beliefs that are linked with OCD (e.g., Cartwright-Hatton & Wells, 1997), the German version (Glöckner-Rist & Rist, 2014) of the PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990) was used to control for worry. It is a 16-item self-report questionnaire measuring the extent

of worries on a five-point rating scale ranging from 1 (*not at all typical of me*) to 5 (*very typical of me*). Meyer et al. (1990) reported a high internal consistency ranging from $\alpha = 0.91$ to $\alpha = 0.95$ in their validation study.

Table 2 outlines Cronbach's α of the instruments for the current sample.

2.4. Statistical analysis

Data were analyzed using *IBM SPSS Statistics (SPSS) 25.0*. To ensure that OCI-R and MCQ-30 met the proposed factor structure, exploratory and confirmatory factor analyses were conducted, and Pearson correlations were computed for OCI-R subscales, metacognitive belief measures and worry. Five hierarchical regression analyses with OCI-R subscales as dependent variables (except for *hoarding*, since the DSM-5 refers to it as a separate diagnosis from OCD) examined the relationships between metacognitions and OCD dimensions. The PSWQ (worry severity) was entered at Step 1. Next, with regard to the hypothetical order of activation proposed by Wells (2011) and corresponding to previous research examining the Metacognitive Model of OCD (e.g., Myers et al., 2009; Myers et al., 2017; Solem et al., 2010), OCD-specific metacognitions measured by TFI (Step 2), BARI (Step 3) and SSQ (Step 4) were entered in hierarchical steps. Finally, all MCQ-30 subscales were entered at Step 5. Due to multiple testing, the Bonferroni correction was used in conjunction with a conservative significance level of 1% for the regression analyses and 0.05% for the correlational analyses.

3. Results

3.1. Overview of data analysis

There were no missing values in the final sample. Exploratory and confirmatory factor analysis was used to investigate the factor structure of OCI-R subscales, metacognitive belief measures as well as worry. Detailed results are omitted for brevity.

Table 4
Regression statistics for each block of variables and predictors of final equation predicting OCI-R Checking.

Variable	R ²	ΔR ²	Incremental change			Model parameters final step of the equation		
			f ²	ΔF	p	Beta	t	p
Step 1	.074	.074		18.013	< .001			
PSWQ						.272	4.244	< .001
Step 2	.096	.022	.024	5.475	.020			
PSWQ						.216	3.170	.002
TFI						.159	2.340	.020
Step 3	.194	.098	.122	27.070	< .001			
PSWQ						.152	2.329	.021
TFI						-.047	-.621	.535
BARI						.392	5.203	< .001
Step 4	.312	.118	.172	38.225	< .001			
PSWQ						.136	2.244	.026
TFI						-.081	-1.149	.252
BARI						.056	.634	.527
SSQ						.500	6.183	< .001
Step 5	.353	.041	.063	2.737	.020			
PSWQ						.252	3.014	.003
TFI						-.084	-1.063	.289
BARI						-.014	-.155	.877
SSQ						.505	6.307	< .001
MCQ-UD						-.192	-2.205	.029
MCQ-PB						.011	.173	.863
MCQ-CC						.148	2.371	.019
MCQ-CS						-.065	-.977	.330
MCQ-NC						.081	.960	.338

Note. OCI-R = Obsessive-Compulsive Inventory-Revised; PSWQ = Penn State Worry Questionnaire; TFI = Thought-Fusion Instrument; BARI = Beliefs About Rituals Inventory; SSQ = Stop Signals Questionnaire; MCQ-UD = MCQ-30 subscale *Negative Beliefs About Uncontrollability Of Thoughts And Danger*; MCQ-PB = MCQ-30 subscale *Positive Beliefs About Worry*; MCQ-CC = MCQ-30 subscale *Cognitive Confidence*; MCQ-CS = MCQ-30 subscale *Cognitive Self-Consciousness*; MCQ-NC = MCQ-30 subscale *Beliefs About Need To Control Thoughts*.

3.2. Correlational analyses

Correlations between OCI-R subscales, metacognitive belief measures as well as worry are shown in Table 2.

3.3. Metacognitive predictors of OCD symptom dimensions

Regression analyses were conducted as described above. Statistics for each step are presented in Tables 3–7. Tolerance values ranged from 0.35 to 0.87, indicating no problem with collinearity (Menard, 1995). Data were screened for outliers. The highest score for Cook's distance was 0.086, indicating no influential cases (Cook & Weisberg, 1982). According to Field (2018), 99.9% of standardized residual scores should lie between ± 3.29. The given sample exhibited only one standardized residual > 3.29 concerning the regression predicting OCI-R Obsessions.

In an effort to ensure a normal distribution of residuals, we examined histograms and Q-Q plots. Residuals of regressions predicting OCI-R Ordering and Neutralizing appeared to be positively skewed, whereas residuals of the regression predicting OCI-R Obsessions seemed negatively skewed, and residuals of the regression predicting OCI-R Washing could be categorized as platykurtic. Linearity and homoscedasticity were examined using plots of standardized predicted values against standardized residuals. Plots indicated linearity but suggested ceiling/floor effects. Therefore, and with regard to the deviations from normal distribution, robustness of linear regression results remained uncertain.

Consequently, and with regard to ordinal questionnaire data, we conducted five ordinal regression analyses based on a proportional odds assumption with the same pattern of dependent variables and predictors as described above to ensure robustness of results. Comparison of results indicated no differences concerning the sign pattern of the coefficients, with only one exception in the regression predicting Checking: standardized coefficient Beta for TFI was negative compared to a positive estimator of TFI in the ordinal regression. No differences concerning significance were found in the regression analysis predicting

Checking. In the ordinal regression analysis predicting Washing, SSQ emerged as significant predictor (p = .006), whereas it did not reach significance in the linear regression model (p = .014). Concerning the ordinal regression predicting Ordering, the MCQ subscale Beliefs About Need to Control Thoughts emerged as a significant predictor (p = .005), whereas it did not reach significance in the linear regression model (p = .015). Moreover, TFI (p = .003) and SSQ (p = .007) resulted as significant predictors in the ordinal regression model predicting Obsessions, but missed significance in the linear regression model (TFI: p = .012; SSQ: p = .025). In the ordinal regression analysis predicting Neutralizing, the MCQ subscale Negative Beliefs About Uncontrollability Of Thoughts And Danger emerged as significant predictor (p = .004), whereas it did not reach significance in the linear regression model (p = .016). Instead, Beliefs About Need to Control Thoughts emerged as a significant predictor (p = .008) in the linear regression model, whereas it did not reach significance in the ordinal regression analysis (p = .017). Thus, results of linear regression models predicting OCI-R subscales Washing, Ordering, Obsessions and Neutralizing must be interpreted with care.

4. Discussion

The present study aimed at investigating the applicability of the Metacognitive Model in the different OCD symptom dimensions. Our results extend previous findings, as Hypothesis 1 was partly confirmed: When all the OCD-specific metacognitive beliefs were entered to the model in the hypothesized order of activation, they explained additional variance only for the regressions predicting Ordering and Neutralizing. Regarding our three exploratory questions, we found that when general metacognitive beliefs were added to the model, they explained significant additional variance only in the regressions predicting Ordering and Obsessions. With regard to the final equations, we found different patterns of metacognitive beliefs, such that OCD-specific metacognitions did not emerge as significant predictors in each final equation.

Table 5
Regression statistics for each block of variables and predictors of final equation predicting OCI-R Ordering.

Variable	R ²	ΔR ²	Incremental change			Model parameters final step of the equation		
			f ²	ΔF	p	Beta	t	p
Step 1	.026	.026		5.904	.016			
PSWQ						.160	2.430	.016
Step 2	.106	.080	.089	20.238	< .001			
PSWQ						.051	.762	.447
TFI						.304	4.499	< .001
Step 3	.143	.037	.043	9.467	.002			
PSWQ						.013	.193	.847
TFI						.178	2.291	.023
BARI						.239	3.077	.002
Step 4	.175	.032	.039	8.645	.004			
PSWQ						.005	.068	.946
TFI						.161	2.094	.037
BARI						.064	.661	.509
SSQ						.260	2.940	.004
Step 5	.247	.072	.096	4.150	.001			
PSWQ						.183	2.030	.044
TFI						.094	1.104	.271
BARI						-.015	-.155	.877
SSQ						.276	3.193	.002
MCQ-UD						-.352	-3.754	< .001
MCQ-PB						.095	1.321	.188
MCQ-CC						-.031	-.465	.643
MCQ-CS						.020	.280	.780
MCQ-NC						.225	2.454	.015

Note. OCI-R = Obsessive-Compulsive Inventory-Revised; PSWQ = Penn State Worry Questionnaire; TFI = Thought-Fusion Instrument; BARI = Beliefs About Rituals Inventory; SSQ = Stop Signals Questionnaire; MCQ-UD = MCQ-30 subscale *Negative Beliefs About Uncontrollability Of Thoughts And Danger*; MCQ-PB = MCQ-30 subscale *Positive Beliefs About Worry*; MCQ-CC = MCQ-30 subscale *Cognitive Confidence*; MCQ-CS = MCQ-30 subscale *Cognitive Self-Consciousness*; MCQ-NC = MCQ-30 subscale *Beliefs About Need To Control Thoughts*.

Regarding the regression predicting *Washing*, the OCD-specific metacognitions “beliefs about rituals” and “beliefs about stop signals” lacked significance when entered to the regression, and all metacognitive beliefs only explained a moderate amount of variance (14.8%) in

this symptom dimension. Thus, further research regarding the *Washing* dimension might be particularly interesting, as these results indicate that metacognitive therapy (Wells, 2011) might not be equally effective in this symptom dimension as in other symptom dimensions. Further, as

Table 6
Regression statistics for each block of variables and predictors of final equation predicting OCI-R Obsessions.

Variable	R ²	ΔR ²	Incremental change			Model parameters final step of the equation		
			f ²	ΔF	p	Beta	t	p
Step1	.186	.186		51.315	< .001			
PSWQ						.431	7.163	< .001
Step 2	.260	.075	.10	22.591	< .001			
PSWQ						.327	5.312	< .001
TFI						.292	4.753	< .001
Step 3	.265	.005	.007	1.431	.233			
PSWQ						.247	5.004	< .001
TFI						.086	3.425	.001
BARI							1.196	.233
Step 4	.272	.007	.010	2.109	.148			
PSWQ						.317	3.536	< .001
TFI						.255	1.838	.067
BARI						.167	-1.452	.148
SSQ						-.121		
Step 5	.425	.153	.266	11.561	< .001			
PSWQ						.125	1.580	.115
TFI						.190	2.544	.012
BARI						.199	2.285	.023
SSQ						-.171	-2.261	.025
MCQ-UD						.202	2.458	.015
MCQ-PB						-.305	-4.876	< .001
MCQ-CC						.022	.376	.708
MCQ-CS						.278	4.419	< .001
MCQ-NC						.136	1.704	.090

Note. OCI-R = Obsessive-Compulsive Inventory-Revised; PSWQ = Penn State Worry Questionnaire; TFI = Thought-Fusion Instrument; BARI = Beliefs About Rituals Inventory; SSQ = Stop Signals Questionnaire; MCQ-UD = MCQ-30 subscale *Negative Beliefs About Uncontrollability Of Thoughts And Danger*; MCQ-PB = MCQ-30 subscale *Positive Beliefs About Worry*; MCQ-CC = MCQ-30 subscale *Cognitive Confidence*; MCQ-CS = MCQ-30 subscale *Cognitive Self-Consciousness*; MCQ-NC = MCQ-30 subscale *Beliefs About Need To Control Thoughts*.

Table 7
Regression statistics for each block of variables and predictors of final equation predicting OCI-R Neutralizing.

Variable	R ²	ΔR ²	Incremental change			Model parameters final step of the equation		
			f ²	ΔF	p	Beta	t	p
Step 1 PSWQ	.017	.017		3.850	.051			
Step 2	.135	.118	.136	30.552	< .001	.130	1.962	.051
PSWQ						-.001	-.021	.984
TFI						.368	5.527	< .001
Step 3	.175	.041	.048	10.995	.001			
PSWQ						-.042	-.635	.526
TFI						.235	3.074	.002
BARI						.253	3.316	.001
Step 4	.225	.050	.065	14.263	< .001			
PSWQ						-.053	-.817	.415
TFI						.213	2.861	.005
BARI						.035	.371	.711
SSQ						.324	3.777	< .001
Step 5	.269	.044	.060	2.590	.027			
PSWQ						.068	.771	.442
TFI						.149	1.766	.079
BARI						-.039	-.393	.695
SSQ						.343	4.033	< .001
MCQ-UD						-.225	-2.431	.016
MCQ-PB						.046	.659	.511
MCQ-CC						-.073	-1.097	.274
MCQ-CS						-.022	-.310	.757
MCQ-NC						.243	2.690	.008

Note. OCI-R = Obsessive-Compulsive Inventory-Revised; PSWQ = Penn State Worry Questionnaire; TFI = Thought-Fusion Instrument; BARI = Beliefs About Rituals Inventory; SSQ = Stop Signals Questionnaire; MCQ-UD = MCQ-30 subscale *Negative Beliefs About Uncontrollability Of Thoughts And Danger*; MCQ-PB = MCQ-30 subscale *Positive Beliefs About Worry*; MCQ-CC = MCQ-30 subscale *Cognitive Confidence*; MCQ-CS = MCQ-30 subscale *Cognitive Self-Consciousness*; MCQ-NC = MCQ-30 subscale *Beliefs About Need To Control Thoughts*.

“thought fusion beliefs” were the only significant predictor in the final equation, treatment approaches that target these types of OCD-specific metacognitions might be especially effective.

Regarding *Checking*, “thought fusion beliefs” did not make a significant contribution to the regression, whereas worrying, “beliefs about rituals” and “beliefs about stop signals” did when added to the model. This might suggest that beliefs about compulsive behavior are especially relevant in this symptom dimension. Concerning the final equation, worrying emerged as a significant predictor, which is not surprising, as worrying and checking share common features (Comer, Kendall, Franklin, Hudson, & Pimentel, 2004) and can be viewed as different coping strategies aiming to prevent future harm (Tallis & de Silva, 1992). “Beliefs about stop signals” also emerged as significant predictor in the final equation. This could be because repeated checking may cause someone to distrust their own memory (Radomsky & Alcolado, 2010; Van den Hout & Kindt, 2003), which means they will be less inclined to use their actual memories to decide when to stop checking; this would explain a person’s need to use stop signals in deciding to stop compulsions.

Regarding the symptom dimension *Ordering*, each OCD-specific metacognition significantly added to the variance when added to the model. At the same time, only “beliefs about stop signals” emerged as a significant predictor in the final model. This might be explained the same way as in Myers et al. (2017): They proposed that “thought fusion beliefs” and “beliefs about rituals” might be rapidly triggered, whereas reaching “beliefs about stop signals” might be a demanding task that only develops over time. With regard to the final equation, another significant predictor was “negative beliefs about the uncontrollability and danger of thoughts”, but it was accompanied by a negative standardized beta value indicating a negative relationship with the outcome. This result corresponds to the study by Radomsky and Rachman (2004) who found that participants having an affinity to order were unable to specify a feared threat related to their ordering behavior. It is also in line with their report that no harm-related (meta)cognitions were found to be related to ordering and arranging compulsions.

Regarding the symptom dimension *Obsessions*, “beliefs about

rituals” and “beliefs about stop signals” did not significantly add to the variance when added to the model. According to Gönner, Leonhart, et al. (2007), the OCI-R subscale *Obsessions* assesses non-specific intrusive and bothersome thoughts, metacognitive beliefs concerning loss of control, and difficulties in getting rid of intrusive thoughts. As such, it does not focus on compulsive behavior, thus “beliefs about rituals” and “beliefs about stop signals” might not be relevant in this scale. However, the high amount of variance explained by all metacognitive beliefs suggest that metacognitive therapeutic approaches might be particularly useful for this symptom dimension, which has also been reported by Andouz, Dolatshahi, Moshtagh, and Dadkhah (2012) who confirmed the efficacy of metacognitive therapy in OCD patients suffering from pure obsessions. Regarding the final equation, “cognitive self-consciousness” appeared as a significant predictor on this dimension. According to the Metacognitive Model of OCD, “cognitive self-consciousness” might be regarded as threat monitoring resulting from thought fusion beliefs, thus being part of the *Cognitive Attentional Syndrome* of OCD (Wells, 2011). As a consequence, attention is focused on internal processing rather than external events, hence inhibiting perceptual flexibility and metacognitive experiences. “Positive beliefs about worrying” also emerged as a significant predictor, but it also had a negative standardized beta value, indicating a negative relationship with the outcome. This seems plausible, as the OCI-R *Obsessions* subscale assesses bothersome distressing thoughts, whereas the MCQ-30 *Positive Beliefs About Worry* subscale reflects the benefits of worries.

Regarding the OCD symptom dimension *Neutralizing*, “beliefs about stop signals” emerged as significant predictor in the final equation, whereas “thought fusion beliefs” and “beliefs about rituals” did not, yet they significantly added to the variance when added to the model. Again, “thought fusion beliefs” and “beliefs about rituals” might appear rapidly and automatically, whereas “beliefs about stop signals” might be relevant only as a long-term coping style (see Myers et al., 2017). As the OCI-R subscale *Neutralizing* refers to mental counting or repeating, it might also overlap with other compulsions where stop signals seem to be relevant (e.g., checking, ordering), which might also explain the importance of stop signals in this dimension. Another significant

predictor in the final equation was “beliefs about the need to control thoughts”; thus, attempts to control thoughts might be regarded as another long-term coping style in this symptom dimension.

4.1. Limitations

The present study has several limitations. Even though we tried to examine metacognitions in a clinical sample, the diagnosis of OCD was based only on self-report data and trimmed criteria (see section *Participants*). Therefore, the current sample may include individuals who suffer from OCD symptoms but do not fully meet OCD criteria. Besides, comorbidities were not captured, so the results could not be controlled for the influence of other psychological disorders. Hence, conclusions about the applicability of our results to the clinical population of OCD patients should be made with caution. Further, we did not control for symptom severity or burden due to OCD symptoms as predictors, which may also have an impact on OCD symptoms and should therefore be addressed in future studies. Taking into account the cross-sectional study design, assumptions concerning causation could not be addressed in this study. It remains unclear whether metacognitions lead to specific OCD symptom dimensions or vice versa.

5. Conclusion

Even considering the limitations, the current study indicates that OCD-specific metacognitions as proposed by Wells (2011) are relevant for different OCD symptom dimensions, but the activation of OCD-specific metacognitions as proposed by Wells' Metacognitive Model of OCD (2011) does not completely account for each symptom dimension, and metacognitive predictors differ between OCD symptom dimensions. To conclude, our findings underline the usefulness of a differentiated understanding of metacognitions in the different symptom dimensions of OCD, as this type of granular understanding may help psychotherapy professionals adapt and improve metacognitive therapy approaches for OCD (e.g., Andouz et al., 2012; Fisher & Wells, 2005; Rees & van Koesveld, 2008; Shareh, Gharraee, Atef-Vahid, & Eftekhar, 2010).

Contributors

C. Jürgens developed the initial study concept and planned the study design in cooperation with C. Rupp, F. Andor and U. Buhlmann. C. Jürgens conducted literature searches, prepared the questionnaire, conducted the survey and performed the data analyses. P. Doebler provided valuable advice concerning statistical analysis. U. Buhlmann and F. Andor oversaw study recruitment and data collection. C. Jürgens wrote the first draft of the manuscript and all authors critically revised the manuscript and approved of the final version of the manuscript for submission.

Conflicts of interest

All authors declare that they have no conflicts of interest.

Declarations of interest

None.

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