Maladaptive Daydreaming and Obsessive-Compulsive Symptoms: A confirmatory and exploratory investigation of shared mechanisms

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ARTICLE INFO

ABSTRACT

Maladaptive Daydreaming (MD) is a newly proposed mental disorder characterized by excessive, vivid fantasy activity impairing functioning. There is a high comorbidity of MD with Obsessive-Compulsive Spectrum Symptoms (OCSS), yet the mechanisms responsible for this relationship are still unclear. The present study set out to explore the relationship between MD and OCSS by: (1) examining dissociation, trauma, sense of control, and mind-wandering as potential mediators; (2) exploring whether MD is more strongly related to obsessions or compulsions; and (3) identifying patterns of specific obsessions and/or compulsions common in an MD sample. A group of 510 participants with self-identified MD completed a battery of online questionnaires. Dissociation and sense of control significantly mediated the MD-OCSS association. MD was moderately related to both obsessions and compulsions but was significantly more strongly related to the former. Frequently endorsed obsessions and compulsions among MD participants included checking and repetition compulsions, intrusive obsessions, and body-related obsessions and compulsions. We conclude that dissociative mechanisms, including dissociative absorption, play a major role in the relationship between MD and OCSS and may lead to consequent checking when transitioning back to reality, altered embodiment, intrusive images, and thoughts, and an impaired sense of mental control. Clinicians working with OCSS should be aware of the possible role of MD in the development or maintenance of symptoms. Future work should develop useful interventions for this type of shared psychopathology.

1. Introduction

Daydreaming Disorder, also known as Maladaptive Daydreaming (MD), is a newly proposed mental disorder characterized by excessive, vivid fantasy activity, following developed plots and storylines (Bigelsen and Schupak, 2011; Somer, 2018). MD fantasies evoke strong sensory and emotional sensations and are experienced as pleasurable (Somer et al., 2016a). As these individuals often experience shame or embarrassment regarding their daydreaming (Somer et al., 2016b) and habitually experience functional impairment due to time spent in fantasy, daydreaming is further reinforced as an escape from an increasingly distressing reality. Thus, although these individuals can differentiate between reality and fantasy and can enter into daydreaming states voluntarily (Bigelsen and Schupak, 2011), there is an addictive, compulsive element to MD that may be experienced as involuntary (Somer and Herscu, 2017).

Individuals with MD are a decidedly pathological population, frequently meeting criteria for several DSM-5 mental disorders (Somer et al., 2017a) and generally experiencing elevated mental health symptoms (Bigelsen et al., 2016) including high rates of suicidality (Somer et al., 2017a). Recently, high co-occurrence (Somer et al., 2016c) and comorbidity rates (53.9%; Somer et al., 2017a, using diagnostic interviews) were observed between MD and Obsessive-Compulsive (OC) related disorders, including Obsessive-Compulsive Disorder (OCD), excoriation disorder, trichotillomania, and body dysmorphic disorder (hereafter referred to collectively as Obsessive-Compulsive Spectrum Symptoms; OCSS, American Psychological Association, 2013). Although OCD is phenomenologically distinct from these OCD-related disorders (these disorders' compulsions often induce positive feelings in addition to stress reduction, while OCD compulsions are direct attempts to relieve distress in reaction to specific obsessions), they share certain similarities, such as obsessive

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preoccupation and repetitive behaviors (Stein et al., 2016; Van Ameringen et al., 2014), which along with significant co-occurrence, lead to their inclusion as one chapter in the DSM-5 (APA, 2013). In fact, several central assessment measures of OCD include some items of OCSS, like the one used in this study (see Methods section). We chose to address OCSS rather than OCD alone in this study because these additional symptoms are highly co-morbid with MD, as mentioned above (Somer et al., 2017a). A longitudinal study examining the relationship of MD and relevant psychopathological symptoms demonstrated a cycle in which OC symptoms both precede and follow temporal increases in MD symptoms, which points to the existence of as yet unidentified shared mechanisms (Soffer-Dudek and Somer, 2018).

One potential common mechanism in this relationship could be dissociation. Dissociation has been strongly and consistently correlated with MD (Bigelsen et al., 2016; Ross, 2018; Soffer-Dudek and Somer, 2018; Somer et al., 2016c). Specifically, dissociative absorption, the involuntary narrowing of attention at the expense of other internal and external surroundings, strongly characterizes MD fantasy (Bigelsen et al., 2016; Somer and Herscu, 2017; Somer et al., 2016c), and was also recently demonstrated to be a unique predictor of OC symptoms (Pozza and Dèttore, 2019; Soffer-Dudek, 2017). Indeed, OCD has also been robustly associated with dissociation (e.g., Belli et al., 2012; Rufer et al., 2006; Watson et al., 2004), while absorption has been specifically hypothesized to increase inferential confusion, a central facet of OCD (Aardema and Wu, 2011). Given the suggested centrality of absorption and the co-occurrence of a variety of dissociative symptoms with both of these disorders (Belli et al., 2012; Merckelbach and Wessel, 2000; Soffer-Dudek and Somer, 2018), dissociation may well be a shared mechanism in the development and maintenance of co-morbid MD and OCSS.

Trauma is another factor that has been strongly implicated in dissociation (e.g., Dalenberg et al., 2014), and it may represent a potential pathway to MD. It has been theorized that traumatized children with high fantasy and dissociative tendencies immerse themselves in extensive daydreaming as a defense mechanism to escape painful experiences, setting the ground for the development of MD (Somer, 2002; Somer and Herscu, 2017). Indeed, qualitative research in the field identified childhood abuse and neglect as an important antecedent of MD (Somer, 2002; Somer et al., 2016c). However, other findings have demonstrated that many individuals presenting with MD do not have significant trauma histories (Bigelsen and Schupak, 2011; Bigelsen et al., 2016), indicating the presence of other potential pathways leading to MD development in which trauma is not a key ingredient. Similarly, while there is a significant body of knowledge linking exposure to traumatic events to the development of OCSS (e.g., Brander et al., 2016), other sources failed to observe a consistent association of OCSS and trauma (e.g., Grabe et al., 2008; Ivarsson et al., 2016; Selvi et al., 2012; Visser et al., 2014). Thus, if trauma were to act as a mediator in the MD-OCSS association, it would indicate the overlap of a trauma-specific pathway to the development of co-occurring MD and OCSS.

Although the role of trauma as a mediator in the MD-OCSS relationship is uncertain, both OCSS and MD involve a deficient sense of control. A large degree of distress experienced by individuals with MD stems from a failure to control their craving to daydream and the amount of time spent daydreaming (Bigelsen and Schupak, 2011; Bigelsen et al., 2016). Struggle for control is also a central facet of OCSS; individuals with OCD demonstrate decreased levels of experienced control (e.g., Gillan et al., 2014; McLaren and Crowe, 2003; Rachman and Shafran, 1998). One role of compulsions may be an attempt to regain an illusory sense of control over life events (Reuven-Magril et al., 2008; Moulding and Kyrios, 2007). Thus, sense of control is also a potential mediator.

Finally, a fourth possible mediator in the MD-OCSS relationship is mind-wandering. Mind-wandering is a state in which attention shifts from current task-related thoughts to off-task mental content. Indeed, the research literature has long established the link of mind-wandering with daydreaming (e.g., Stawarczyk, et al., 2012). Mind-wandering can manifest as unintentional intrusive or ruminative thoughts (Smallwood and Schooler, 2015) reminiscent of obsessive thoughts observed in OC-related disorders. It has been suggested that there may be a significant overlap between these two constructs (Seli et al., 2017). Therefore, mind-wandering may be a mediator of MD and OCSS, as it may spark both MD daydreams and obsessive thoughts.

In addition to identifying central mechanisms that may underlie the relationship between the investigated constructs, another important question is whether MD is more obsessive-like or more compulsive-like. Specifically, the perceived intrusiveness of MD symptoms shares a strong similarity with the invasive, uncontrollable nature of obsessions. In addition to shared invasive elements, both MD and obsessions are characterized by an all-consuming focus on mental activities that are associated with vivid, sensorial imagery (Moritz et al., 2018; Somer et al., 2016c). Thus, MD seems similar to an obsession. There are, however, notable differences between MD and obsessions: MD fantasy is often purposefully induced, and some forms of MD fantasy are associated with intense enjoyment, while obsessive thoughts are often reported as unwanted, unintentional and unpleasant (Starcevic et al., 2011). As MD has been conceptualized as a behavioral addiction (Pietkiewicz et al., 2018; Somer and Herscu, 2017), in which repeated purposeful and pleasurable fantasizing can lead to lessened perceived control over the choice to daydream, the voluntary nature of MD may fall on a spectrum — increased bouts of MD may thus lead to uncontrolled, intrusive fantasizing more similar to obsessive thoughts.

MD's repetitive, addictive, and compulsive elements, along with its associated kinesthetic activity, may more closely resemble compulsions. For example, MD is highly comorbid with excoriation (Somer et al., 2017a), and individuals with MD have been known to carry out repetitive, compulsive motor functions while immersed in MD daydreams (Bigelsen and Schupak, 2011; Somer, 2002; Somer et al., 2017b). Thus, one could argue that MD is more similar to a mental compulsion. A deeper understanding of MD's relative association with obsessions and compulsions could further our understanding of the nature of MD and the key mechanisms defining it.

Finally, the specific types of obsessions and compulsions most commonly observed in individuals with MD could provide further insight into the shared mechanisms behind MD and OCSS, particularly if distinct patterns are observed. For example, a few studies demonstrating specific relationships between obsessive checking and dissociation (Goff et al., 1992; Rufer et al., 2006; Watson et al., 2004) have influenced the ongoing conceptualization of dissociative and OCSS co-occurrence: obsessive checking could be a response to losing touch with surroundings during bouts of dissociation (Soffer-Dudek, 2014).

As MD is a fairly new conceptualization, there are few studies to date investigating its relationship with OCSS. The goal of this research is, therefore, to explore the relationship between MD and OCSS and to enrich the existing information on this association, in three ways:

1) By investigating potential mediation pathways of dissociation, trauma, sense of control, and mind-wandering.
2) By examining whether MD is more strongly related to OCD-related obsessions or compulsions.
3) By conducting an exploratory examination of the types of obsessions and compulsions that individuals with MD experience the most.

2. Method

2.1. Participants and procedure

Participants from around the world who self-identified as having MD were recruited via advertisements posted in online MD forums. Additionally, individuals who had expressed interest in participating in future studies on MD, or who had participated in past studies through the International Consortium for Maladaptive Daydreaming Research (ICMDR), were invited to join the study via email. Interested

respondents gave virtual informed consent and proceeded to complete a 20-30-min battery of online, English questionnaires. The investigation was carried out following the latest version of the Declaration of Helsinki. The study was approved in advance by the institutional review board of the University of Haifa.

Of 572 total responders, 62 were excluded from the final study: 42 responders who completed less than half of any one questionnaire, and 20 respondents under the age of 18. Of the 510-person final sample [mean age = 26.17; SD = 9.04; Range = 18–72], the majority were female (76.9%) and unmarried (84.7%), with no children (90.9%). The sample included a wide range of socioeconomic backgrounds, education levels, and 57 different countries of origin. The highest number of participants were from English-speaking countries (full demographic statistics and countries of origin are reported in Table 1 and Table 2, respectively). Most (96.3%) of the sample demonstrated MD scores that exceeded an evidence-based cut-off score of 40 (Somer et al., 2017b)[1], suggesting suspected clinical-level MD. The other 3.7% showed significant MD symptomatology (mean MD score for the whole sample = 69.74; SD = 14.44). A large percent (55.7%) of participants showed OC symptom levels indicative of suspected clinical-level OCD (>16; Baer et al., 1992; Federici et al., 2010; mean YBOCS sample score = 16.21; SD = 7.66; Range = 0–35.0), which is similar to prevalence of OC symptoms demonstrated in previous studies on MD populations (Somer et al., 2017a). According to accepted clinical cut-off scores for significant childhood trauma (Jansen et al., 2016), 53.3% of the sample reported significant childhood emotional abuse, 17.2% physical abuse, 25.2% sexual abuse, 53.2% emotional neglect, and 56.6% physical neglect, supporting characterization of this sample as highly

Table 1
Demographic variables of the final sample (N = 510).

Variable	n (%)
Age M (SD)	26.17 (9.04)
Gender	
Female	392 (76.9%)
Male	99 (19.4%)
Other	19 (3.7%)
Marital Status	
Single	429 (84.1%)
Married	61 (12%)
Divorced/Separated	17 (3.3%)
Unidentified	3 (0.6%)
Number of Children	
0	463 (90.8%)
1	18 (3.5%)
2	12 (2.4%)
3+	8 (1.6%)
Unidentified	9 (1.8%)
Education	
No high school degree	34 (6.7%)
High school degree or equivalent (e.g., GED)	93 (18.2%)
College, no degree	125 (24.5%)
College degree	54 (10.6%)
Bachelor degree (B.A.)	126 (24.7%)
Graduate degree or higher	75 (14.7%)
Unidentified	3 (0.6%)
Income	
Low	158 (31%)
Lower Middle	153 (30%)
Middle	133 (26.1%)
Upper Middle	48 (9.4%)
High	2 (0.4%)

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[1] In that article a cutoff of 50 was reported, but this was recently found to be mistaken due to a technical error, whereas the correct number was supposed to be 40. A corrigendum is issued at this time but we do not yet have a reference for it. When using a cutoff of 50, 90% of the sample of the present study is over the cutoff.

Table 2
Distribution of participants by country.

Country of Origin	n (%)
USA	205 (40.2%)
UK	63 (12.4%)
Canada	31 (6.1%)
France	25 (4.9%)
Germany	18 (3.5%)
India	15 (2.9%)
Australia	14 (2.7%)
Italy	11 (2.2%)
Brazil	9 (8%)
Israel	9 (8%)
Philippines	7 (1.4%)
Portugal	6 (1.2%)
Poland	5 (1%)
The Netherlands	5 (1%)
Belgium, Romania, Russia, Spain, Turkey	4 (0.8%) each
Argentina, Bulgaria, China, Croatia, Czech Republic, Denmark, Greece, Japan, New Zealand, Norway, Switzerland, Ukraine	2 (0.4%) each
Armenia, Austria, Bahrain, Bangladesh, Chile, Cyprus, Ecuador, Egypt, Eswatini, Finland, Hong Kong, Hungary, Iran, Ireland, Lebanon, Malaysia, Mauritania, Mauritius, Mexico, North Macedonia, Peru, Scotland, Sierra Leone, Somalia, Tunisia	1 (0.2%) each

psychopathological (Devi et al., 2019; Full descriptive statistics of the study variables are reported in Table 3). Missing data in the final sample were less than 5%, and Little MCAR's test was non-significant (x^2 = 5309.14, ns) suggesting that data were missing completely at random. All study variables demonstrated normal distribution, and there were no outliers requiring correction (defining outliers as a Z-score of >3.29 or < −3.29, corresponding to 99.9% of the distribution).

2.2. Measures

The *Yale-Brown Obsessive-Compulsive Scale (YBOCS)* (Baer et al., 1993) is a 68-item self-report questionnaire, assessing the range and severity of obsessions and compulsions. In the first section of the YBOCS (the "YBOCS checklist"), responders report which obsessions and compulsions they have experienced, from a list of 37 obsessions and 20 compulsions, including, among others, items measuring symptoms of dysmorphophobia, hoarding, and trichotillomania (hair-pulling), which are each considered to be OCD-related disorders (APA, 2013). We added one additional item assessing excoriation (skin-picking), another OCD-related disorder, in light of findings reporting high levels of excoriation in individuals with MD (Somer et al., 2017a). Part two of the YBOCS, consisting of 10 self-report questions, assesses the frequency and severity of the 4 most problematic obsessions and compulsions experienced in the past week, on a Likert scale of 0–4. The self-report version of the YBOCS has demonstrated excellent psychometric properties (Steketee et al., 1996). Cronbach's alpha for this study was α = 0.82.

The *Maladaptive Daydreaming Scale (MDS-16)* is a 16-item self-report questionnaire (Somer et al., 2017a) assessing the frequency and extent of various MD symptoms, on a Likert scale of 0–100. The final score is the average of the 16 items. A cut-off score of 40 has been demonstrated to optimally identify functionally impairing or distressing clinical-level MD and has shown near perfect sensitivity when compared to clinical-level MD diagnosed using a clinical interview (SCIMD; Somer et al., 2017b)[1]. The MDS-16 assesses 3 key characteristics of MD: strength of urge to daydream, degree of vocational, social, or functional impairment, and kinesthetic activity during daydreaming. The MDS-16 is based on the original 14-item scale, (Somer et al., 2016c), with two additional items assessing the use of music to trigger daydreaming (Somer et al., 2017b). The questionnaire has demonstrated high internal consistency and reliability (Somer et al., 2016a). Cronbach's alpha for the MDS-16 total score was α = 0.83.

The *Revised Dissociative Experiences Scale (DES-II*; Carlson and

Table 3
Descriptive statistics of study variables.

Questionnaire	Possible range	Sample minimum	Sample maximum	Mean	SD	Skewness	Kurtosis
MDS-16	0–100	19.38	97.50	69.74	14.44	−0.64	0.12
YBOCS-total	0–40	0	35	16.20	7.66	−0.18	−0.82
YBOCS-COMP	0–20	0	18	8.01	4.62	−0.04	−1.07
YBOCS-OBS	0–20	0	19	8.18	4.12	−0.09	−0.61
CTQ	28–140	32	127	65.11	18.90	0.64	0.28
DES-R	0–100	0	97.14	34.40	19.19	0.55	−0.29
SCI	16–96	16	96	55.27	14.41	0.06	−0.35
MWS	5–30	9	30	23.65	4.56	0.79	0.49

Note. SD=Standard Deviation; MDS-16 = Maladaptive Daydreaming Scale, 16-item version; YBOCS=Yale-Brown Obsessive-Compulsive Scale; COMP=Compulsions; OBS=Obsessions; CTQ=Childhood Trauma Questionnaire; DES-R = Dissociative Experiences Scale-Revised; SCI=Sense of Control Inventory; MWS = Mind-Wandering Scale.

Putnam, 1993), a 28-item self-report questionnaire, assesses the frequency of individuals' dissociative experiences, including three empirically-derived dissociative subscales: depersonalization/derealization, amnesia, and absorption and imaginative involvement. The questionnaire measures the frequency of dissociative experiences on a scale of 0 (Never) - 100 (Always), in increments of 10%, and has good reliability and validity (Carlson and Putnam, 1993). Cronbach's alpha was α = 0.94.

The *Childhood Trauma Questionnaire (CTQ)* (Bernstein et al., 1994) is an 18-item, self-report questionnaire that evaluates the severity of childhood abuse and neglect, on a 5-point Likert scale of 1 (Never true) to 5 (Very often true). The CTQ assesses five categories of childhood trauma: emotional, sexual, and physical abuse, and emotional and physical neglect (Bernstein et al., 1997). It has demonstrated excellent internal consistency and good reliability (Bernstein et al., 1994, 1997; Bernstein and Fink, 1998). Cronbach's alpha was α = 0.93.

The *Shapiro Control Inventory* (*SCI*; Shapiro, 1994) is a comprehensive, 187-item questionnaire measuring various aspects of one's sense of control. We employed one of this questionnaire's 16-item subscales, measuring the frequency of positive and negative sense of control using 6-point Likert questions, scoring 1 (Never) - 6 (Very often). This scale has demonstrated good psychometric properties (Shapiro, 1994). Cronbach's alpha was α = 0.89.

The *Mind-Wandering Scale* (*MWS*; Mrazek et al., 2013) is a 5-item, self-report questionnaire assessing the frequency and degree of mind wandering, reported on a Likert Scale of 1 (Almost Never) – 6 (Almost Always). This scale has demonstrated high internal reliability and consistency (Mrazek et al., 2013). Cronbach's alpha was α = 0.82.

To report *demographics*, participants were asked to indicate their

gender, age, religion and level of religious observance, socioeconomic level, marital status, number of children, level of education, and income.

2.3. Data analyses

All data analyses were carried out using SPSS version 26. First, cross-sectional regression analyses of mediation pathways were carried out, with bootstrapping, using the macro process for SPSS (Hayes, 2013). Correlation matrices and descriptive statistics were then examined to assess the association of MD with YBOCS obsessions and compulsions and the frequencies of each obsession and compulsion type in our sample. Correlation coefficients were formally compared using a test for dependent samples (Lenhard and Lenhard, 2014).

3. Results

As demonstrated in Table 4, MD was significantly correlated with OCSS ($r = 0.29$, $p < 0.01$). MD and OCSS were both significantly correlated with all of the potential mediators: trauma, dissociation, sense of control, and mind-wandering. An examination of the mediational model suggested that sense of control and dissociation had statistically significant unique contributions in mediating the relationship of MD and OCSS, whereas trauma and mind-wandering did not significantly add to the explanation of the MD-OCSS shared variance (see Table 5 and Fig. 1). When examining the domain of obsessions versus that of compulsions, MD was significantly correlated to both (see Table 4). A correlational comparison test for dependent samples established that MD is significantly more strongly related to obsessions than to compulsions ($z = 2.147$, $p = 0.016$).

Table 4
Pearson correlation matrix of study variables.

	MDS-16	YBOCS	OBS	COMP	CTQ	DES-II	SCI	MWS
MDS-16	1	0.29** [0.22–0.37]	0.30** [0.23–0.38]	0.22** [[0.14–0.30]	0.20** [0.13–0.28]	0.30** [0.23–0.37]	−0.40** [-0.46-0.32]	0.34** [0.27–0.42]
YBOCS		1	0.86** [0.84–0.88]	0.89** [0.87–0.91]	0.24** [0.16–0.32]	0.34** [0.26–0.42]	−0.37** [-0.44-0.29]	0.21** [0.13–0.29]
YBOCS-OBS			1	0.54** [0.47–0.60]	0.24** [0.15–0.32]	0.33** [0.25–0.41]	−0.37** [-0.45-0.29]	0.22** [0.13–0.30]
YBOCS-COMP				1	0.18** [0.10–0.26]	0.27** [0.18–0.35]	−0.28** [-0.36-0.20]	0.16** [0.07–0.24]
CTQ					1	0.37** [0.27–0.46]	−0.31** [-0.38-0.22]	0.12* [0.02–0.20]
DES-II						1	−0.35** [-0.42-0.27]	0.32** [0.24–0.40]
SCI							1	−0.29** [-0.38-0.21]
MWS								1

*Note. MDS = Maladaptive Daydreaming Scale; YBOCS=Yale-Brown Obsessive-Compulsive Scale; OBS=Obsessions; COMP=Compulsions; CTQ=Childhood Trauma Questionnaire; DES-II = Dissociative Experiences Scale II; SCI=Sense of Control Inventory; MWS = Mind-Wandering Scale.
*$p < 0.01$.
**$p < 0.001$.

Table 5
Direct and indirect standardized effects of mediation pathways between MD and OCSS.

Mediation/Direct Effect Pathways	Normalized Pathway Effects		
	Coefficient	SE (Standard Error)	[95% CI]
MD→CTQ→OCSS	0.02	0.01	[-0.00, −0.04]
MD→DES-II→OCSS	*0.06*	*0.02*	*[0.03, 0.09]*
MD→SCI→OCSS	*0.09*	*0.02*	*[0.05, 0.13]*
MD→MWS→OCSS	0.01	0.01	[-0.01, 0.04]
MD→OCSS (direct effect)	*0.12*	*0.05*	*[0.03, 0.21]*
MD→OCSS (total effect)	*0.29*		

*Note: CI=Confidence Interval; MD = Maladaptive Daydreaming; OCSS=Obsessive-compulsive spectrum symptoms; CTQ=Childhood Trauma Questionnaire; DES-II = Dissociative Experiences Scale-II; SCI=Sense of Control Inventory; MWS = Mind-Wandering Scale.
**Statistically significant pathways (according to the 95% CI) are presented in italics.

A variety of specific obsessions and compulsions were endorsed in our MD sample with a high frequency, with certain patterns appearing to stand out. As can be seen in Table 6, being bothered by intrusions such as certain sounds or noises (49.80%), neutral mental images (47.45%), or mental nonsense (42.35%) was particularly highly endorsed. Other prevalent themes included a high endorsement of body-related obsessions (obsessive concern with a body part (dysmorphophobia) – 48.82%) and compulsions (excessive skin-picking – 38.82%; the need to check some aspect of a physical condition tied to body obsessions – 33.92%) and compulsions of checking (checking that you didn't make a mistake – 47.84%) and repetition (rereading or rewriting things – 42.35%). Additionally, a total of 75.29% of the sample reported a current or lifetime prevalence of an obsessive fear of doing something embarrassing, which, as will be discussed below, we believe to be a confound of their MD. Full frequencies of obsessions and compulsions endorsed are included in supplementary materials.

4. Discussion

The goal of this research was to explore the relationship between MD and OCSS in three ways: by investigating potential mediation pathways; by examining whether MD is more strongly related to OCD-related obsessions or compulsions; and by conducting an exploratory examination of the types of obsessions and compulsions that individuals with MD experience. The MD sample was highly pathological, as could be inferred from MD scores (96.3% above cutoff), OCD scores (55.7% above cutoff), and childhood trauma scores (detailed in method). This supports previous studies (e.g., Somer et al., 2017a) showing the highly clinical

nature of MD individuals, and highlights the need for research and development of useful interventions for this suffering population. MD and OCSS were significantly correlated, as expected. Dissociation and sense of control significantly mediated the MD-OCSS relationship, indicating dissociative absorption and intrusiveness as potential shared mechanisms. MD was also significantly associated with both obsessions and compulsions, but demonstrated a significantly stronger association with obsessions, which reinforces the possible role of impaired control in MD. Two patterns of specific obsessions and compulsions that were reported with particularly high frequency were those relating to repeating and checking, and those relating to the body, which may implicate interplay of dissociative mechanisms and altered embodiment in pathways of developing MD and OCSS. These possibilities are discussed below in further detail.

The study's first aim was to examine four possible mediators to better understand the sources of the MD-OCSS association. Dissociation was a significant mediator, whereas trauma was not. This is perhaps not surprising given the mixed findings regarding trauma's role in the development of both MD and OCSS (e.g., Bigelsen and Schupak, 2011, for MD; Grabe et al., 2008, for OCSS), and further indicates the presence of non-trauma dependent pathways to MD. Indeed, it is becoming evident that certain types of dissociative experiences may not necessarily stem from early trauma, for example, depersonalization/derealization (Marshall et al., 2000; Michal et al., 2016). Similarly, dissociative absorption has been indicated in a non-trauma-dependent pathway of MD development (Somer and Herscu, 2017), and absorption may be the potential dissociative mechanism associating MD with OCSS. Indeed, dissociative absorption has recently been associated with OCSS (Soffer-Dudek, 2014, 2017, 2019; Soffer-Dudek et al., 2015). Possibly, some absorbers immersed in a daydream do not accurately notice the events happening in the present, and when their awareness returns to focus on their surroundings, they experience uncertainty and feel an urge to reduce their doubts by checking (Soffer-Dudek, 2019) or repeating. An impaired sense of control was also a significant mediator. This may stem from the overlapping characteristics of MD with addiction, or experiences of intrusiveness associated with MD fantasy and OCSS obsessions. Indeed, individuals with high OC symptomatology have demonstrated a low sense of control over invasive thoughts compared to controls (Fradkin et al., 2019), and MD was closely associated with OC obsessions in this study. In contrast, mind-wandering was not a significant mediator of the MD-OCSS relationship. This is somewhat compatible with findings showing that the construct of dissociative absorption (a central characteristic of MD) was separate from the construct of mind-wandering, and the former contributed significantly over and above mind-wandering to the prediction of OCSS (Soffer-Dudek, 2019); it seems that the relationship between intense immersion in fantasy and OCSS cannot be explained by a general tendency for the mind to wander away from present-moment actions. In light of our cross-sectional
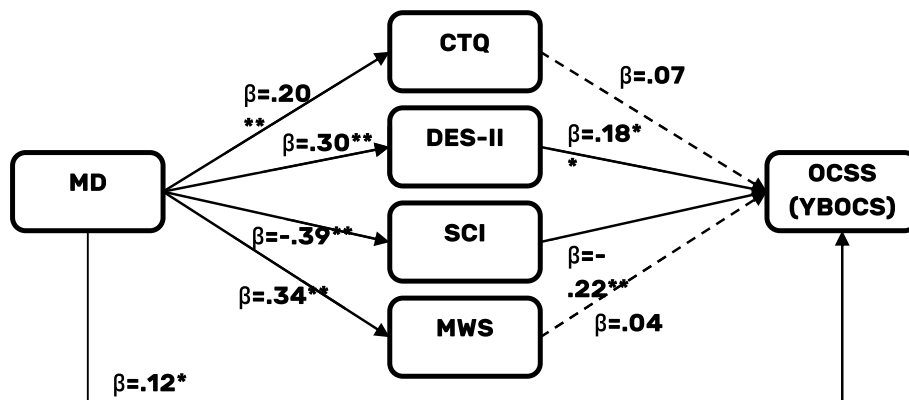

Fig. 1. The results of the mediation pathway model.

Table 6

Percent of specific obsessions and compulsions endorsed as present currently, in the past, and combined (lifetime) prevalence.

	Item	Current	Past	Lifetime	Category
Obsessions	YBOCS Obsession 5: Fear of doing something embarrassing	44.51%	30.78%	75.29%	Aggressive
	YBOCS Obsession 32: Bothered by certain sounds or noises	27.45%	22.35%	49.80%	Miscellaneous
	YBOCS Obsession 37: Concerned with body part or aspect of appearance (dysmorphophobia)	26.86%	21.96%	48.82%	Somatic
	YBOCS Obsession 30: Bothered by intrusive (neutral) mental images	27.06%	20.39%	47.45%	Miscellaneous
	YBOCS Obsession 28: Fear not saying just the right thing	24.31%	20.78%	45.10%	Miscellaneous
	YBOCS Obsession 18: Forbidden/perverse sexual thoughts, images or impulses	24.71%	19.80%	44.51%	Sexual
	YBOCS Obsession 31: Bothered by intrusive mental nonsense, sounds, words or music	22.75%	19.61%	42.35%	Miscellaneous
	YBOCS Obsession 8: Fear of harming others due to carelessness	22.94%	18.43%	41.37%	Aggressive
	YBOCS Obsession 24: Concerned with morality	20.59%	19.41%	40.00%	Religious
	YBOCS Obsession 9: Fear of being responsible for something terrible happening	21.37%	17.45%	38.82%	Aggressive
	YBOCS Obsession 3: Violent or horrific images	21.37%	13.73%	35.10%	Aggressive
	YBOCS obsession 29: Fear of losing things	18.43%	16.08%	34.51%	Miscellaneous
	YBOCS Obsession 6: Fear of acting on unwanted impulse	18.63%	15.69%	34.31%	Aggressive
	YBOCS Obsession 22: Obsessions with hoarding or saving things	16.67%	15.49%	32.16%	Hoarding
	YBOCS Obsession 2: Fear of harming others	15.10%	12.75%	27.84%	Aggressive
	YBOCS Obsession 36: concerned with illness or disease	12.94%	11.18%	24.12%	Somatic
	YBOCS Obsession 25: Obsessions about symmetry or exactness	11.76%	12.16%	23.92%	Symmetry or Exactness
	YBOCS Obsession 26: Needing to know or remember certain things	11.37%	10.78%	22.16%	Miscellaneous
Compulsions	Compulsion 45: Check that didn't make a mistake	23.92%	23.92%	47.84%	Checking
	Compulsion 47: Reread or rewrite things	20.78%	21.57%	42.35%	Repeating
	Compulsive 59: Excessive skin picking	18.63%	20.20%	38.82%	Miscellaneous
	Compulsion 46: Check some aspect of physical condition tied to obsessions with own body	18.24%	15.69%	33.92%	Checking
	Compulsion 52: Mental rituals (not counting/checking)	18.24%	13.92%	32.16%	Miscellaneous
	Compulsion 53: Need to tell, ask or confess	12.16%	9.80%	21.96%	Miscellaneous
	Compulsion 42: Check that didn't harm others	11.57%	9.80%	21.37%	Checking
	Compulsion 51: Hoarding/collecting compulsions	10.00%	10.00%	20.00%	Hoarding

Note. The table is organized by the percentage of lifetime frequency, from most frequently endorsed to least frequently, for items that had at least one category (current, past, or lifetime) greater than 20%.

design, alternative causal models may underlie the relationships. For example, the focus and vivid imaginative qualities associated with dissociative absorption may predispose individuals with absorptive tendencies to engage in vivid MD fantasy, and the resulting increased involvement with immersive, fantastical narrative may in turn develop into fixations on certain evocative obsessive thoughts.

The second study goal was to explore MD's relative relationship to OC-related obsessions and compulsions. MD was significantly associated with both obsessions and compulsions but demonstrated a significantly stronger association with obsessions. These results uphold previous findings established using the Obsessive-Compulsive Inventory-Revised (Foa et al., 2002) in MD studies (Bigelsen et al., 2016; Somer et al., 2016c), and broaden them by demonstrating the same findings using a different measure of OCSS, the YBOCS (Baer et al., 1993). MD's closer relationship to obsessions may indicate that a mechanism of impaired control and enhanced intrusiveness of thoughts and mental imagery underlies the MD-OCSS link. Indeed, observations of specific obsessions and compulsions in our sample demonstrated that obsessions consisting of invasive mental experiences such as neutral sounds and noises were some of the most highly endorsed by this MD sample, reinforcing the centrality of intrusiveness to the shared experience of MD and OCSS. Possibly, a hyperactive imagery system could act as the shared mechanism leading to this degree of intrusive sensory activity. This mechanism may occur via shared neurochemical pathways, as one case-study demonstrated successful treatment of MD with an SSRI that is often utilized in the treatment of OCD (Schupak and Rosenthal, 2009). The presence of a hyperactive imagery system associated with vivid MD fantasy could result in imagined possibilities being more easily confused with reality (also known as inferential confusion; Aardema et al., 2005; O'Connor and Robillard, 1995), leading to the development of obsessions. Indeed, obsessions have been known to begin as daydreams or imaginings which are then treated as realistic possibilities and develop into fixations (Aardema & O'Connor, 2003).

The third study goal was to conduct an exploratory examination of the types of obsessions and compulsions that individuals with MD experience the most. Looking at specific obsessions highly endorsed by

our MD sample raises the possibility that some of them are confounds representing MD, rather than "true" OCSS. Specifically, fear of embarrassing oneself, endorsed by 75.29% of participants, likely reflects a fear of accidentally acting out some aspect of MD daydreaming, such as a facial expression, verbalization, or body motion in the presence of others, as MD fantasizers often experience intense shame regarding their MD fantasizing and attempt to conceal it (Bigelsen and Schupak, 2011; Somer et al., 2016c). Furthermore, experiencing forbidden sexual or violent imagery are documented themes of MD fantasies (Somer et al., 2016b, 2020), and may therefore reflect the content of MD fantasy which respondents have difficulty inhibiting.

Other than these possible confounds, two patterns of interest emerged: First, MD participants demonstrated high frequencies of repeating and checking compulsions. As mentioned above, OCD-related checking has been posited to occur in an attempt to re-orient to the present moment in the wake of dissociative episodes (Soffer-Dudek, 2014, 2019), and this likely also holds for episodes of MD fantasy: particularly following bouts of dissociative absorption, during which people are deeply immersed in internal stimuli, individuals may feel a sense of uncertainty regarding their actions and may perform checking and repetitive rituals in an attempt to quell arising anxieties associated with troubling doubts. The high rate of checking and repetitive compulsions endorsed, combined with the above-mentioned role of dissociation as a significant mediator in the MD-OCSS association, supports the notion that perhaps the transition from extended episodes of immersive MD fantasy results in a period of detachment while re-orienting to the present that may also foster checking compulsions.

A second pattern worth noting is the high rate of obsessions and compulsions relating to the body in our sample, such as obsessing about specific body parts, touching those body parts, and excessive skin-picking. Notably, the high rate of skin-picking endorsement is compatible with previous literature showing high co-occurrence of excoriation disorder with MD (Somer et al., 2017a). High endorsement of body-oriented symptoms may reflect altered sensory thresholds or atypical interpretation of body signals and sensory input. For example, according to this conceptualization, stereotypical movements

characteristic of MD (including skin-picking) may play a role in maintaining a baseline level of sensory stimulation during MD fantasy, and OC obsessions over specific body parts could in part result from atypical experiences of sensory input.

Indeed, both MD and OCSS have been associated with occurrences of altered embodiment. Individuals have reported being unaware of bodily needs such as hunger or needing to use the bathroom while immersed in MD fantasy (Somer et al., 2016c), and individuals with OC symptoms more readily incorporate foreign objects into their sense of bodily self (Jalal and Ramachandran, 2017; Jalal et al., 2020). Furthermore, people with high OC symptoms tend to rely on external proxies rather than their internal sensations, indicating that they either have impaired perception or interpretation of these bodily signals (Ezrati et al., 2018; Liberman and Dar, 2018). As MD is characterized by vivid sensory experiences during fantasy, and OCSS are associated with strong sensory components (Grimaldi and Stern, 2017; Röhlinger et al., 2015), the disconnection from actual physical sensation in MD and OCSS may stem from absorptive, vivid sensory-laden nature of MD fantasy and obsessive imagery. Altered embodiment could function as a shared mechanism in the development and maintenance of co-occurring MD and OCSS, or may itself be a by-product of shared dissociative mechanisms.

As a side note, the OCSS category with the lowest endorsed frequency was that of contamination. This corresponds with two previous studies on OCD and dissociation, showing that dissociation was most strongly related to checking compulsions and was least related to contamination (Grabe et al., 1999; Rufer et al., 2006).

There are several limitations to the current study. The association between MD and total OCSS was significant, yet was only medium in effect size. Although this does support the conceptualization of MD and OCSS as separate and related constructs, and corroborates previous findings demonstrating a similar association in MD samples (Soffer-Dudek and Somer, 2018; Somer et al., 2016c), the correlation size would probably have been larger in a sample including healthy community participants in addition to MD participants, which would have provided more variance. Additionally, the self-selecting nature of the study population may exclude relevant populations without easy computer access or of higher severity levels, despite the fact that the average MD scores demonstrated that this study did capture a relevant participant pool with clinical MD levels. Furthermore, although the self-report tools have shown good validity and reliability, due to the international nature of the study population, cultural differences and nuances of language for non-native English speakers might affect interpretations of the self-report questions. Additionally, we did not collect data from a control group of either non-MD respondents or clinically-diagnosed OCSS respondents. Finally, the cross-sectional nature of the study limits our ability to interpret the mediational findings.

Further studies should explore the roles of dissociation and altered embodiment in the MD-OCSS relationship using a longitudinal study design, to better understand the temporal relations of these variables. Moreover, exploring MD in samples of OCD or OC-related disorders (such as excoriation disorder) would be an important next step to better understand these mechanisms.

In conclusion, high frequencies of checking and repetition compulsions were implicated as a key shared mechanism of MD and OCSS. We suggest that these compulsions might follow bouts of dissociation during the transition from internal to external attention. High endorsement of obsessions and compulsions relating to the body further suggests altered embodiment as a shared characteristic, which may also stem from dissociative mechanisms. An impaired sense of control emerged as another shared characteristic of MD and OCSS, which may be related to the intrusiveness associated with thoughts and images both in the context of MD fantasy and relating to obsessions. We suggest that clinicians working with OCSS be aware of the possible role of MD in the development or maintenance of symptoms. Future work should develop useful interventions for this type of shared psychopathology.

CRediT authorship contribution statement

Gabrielle Salomon-Small: Writing - original draft, Writing - review & editing, Visualization. **Eli Somer:** Conceptualization, Methodology, Writing - review & editing, Supervision. **Michal Harel-Schwarzmann:** Conceptualization, Methodology, Project administration, Data curation, Formal analysis, Visualization. **Nirit Soffer-Dudek:** Conceptualization, Methodology, Writing - review & editing, Supervision.

Declaration of competing interest

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2021.02.017.

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