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The price of love: an investigation into the relationship between romantic love and the expression of obsessive–compulsive disorder

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Abstract

Background. The present study explored the influence of romantic love on the expression of several obsessive–compulsive disorder (OCD) characteristics, including symptom severity, symptom dimensions, age at onset, sensory phenomena (SP), and developmental course, as well as other related comorbid disorders. It was hypothesized that love-precipitated OCD would be associated with a set of distinct characteristics and exhibit greater rates of comorbid disorders.
Methods. The analyses were performed using a large sample (n = 981) of clinical patients with a primary diagnosis of OCD (Females = 67.3%, *M* age = 35.31).
Results. Love-precipitated OCD was associated with greater severity of SP and later age at onset of obsessions. However, symptom severity, symptom dimension, developmental course, and psychiatric comorbidities were not associated with love-precipitated OCD.
Conclusion. It was concluded that romantic love does shape the expression of OCD, especially with regard to SP and onset age. These findings encourage further exploration to determine its clinical significance as a phenotype.

Introduction

Obsessive–compulsive disorder (OCD) is a heterogeneous mental illness marked by intrusive, time-consuming thoughts, images, or urges experienced by sufferers as involuntary and distressing (ie, obsessions), and/or repetitive, ritualistic behaviors or mental acts (ie, compulsions).[1] The lifetime prevalence of OCD ranges between 1.1% and 3.5%,[2] and it is frequently associated with significant comorbidity and disability.[3] Despite the advances made in research, prognosis for individuals with of OCD remain variable, with 59% eventually relapsing after receiving either cognitive behavioral therapy or pharmacological intervention (e.g., serotonin reuptake inhibitors) or combination thereof.[4] Due to its heterogeneity, a dominant view among clinical researchers is that phenotype research might play an important role in better understanding OCD etiology and improving therapeutic intervention.[5,6] Recently, some observational studies highlighted the possibility that romantic love state might act as a precipitant for OCD and influence certain phenotypic expressions.[7,8] However, whether OCD precipitated by romantic love represents a distinct phenotype is yet to be empirically tested. This study aims to bridge this gap in OCD domain by further examining the effects of romantic love on the expression of OCD characteristics.

Since no study hitherto has systematically explored the role of romantic love in the development or expression of OCD, Some researchers have theorized about a potential relationship between the two. Leckman and Mayes[9] were one of the first to articulate the similar features between some characteristics of romantic love and the symptoms of OCD. From a subjective level, they opined these two phenomena both exhibit prominent and largely involuntary features, including intrusive thoughts or images, heightened awareness of a loved one, exclusivity of focus, and the tendency to obsess over trivial details of an experience.[10,11] Here, it should be noted that the type of love described here refers to the early phase of being in love and should not be conflated with the latter stages of committed love that is characteristic of long-term, committed relationships.[15]

A parallel can also be drawn between the thoughts frequently associated with romantic love and specific OCD symptom dimensions. It is well understood, for instance, that people in love often report an increased sense of responsibility and excessive fears for the safety of their lovers.[29]

The central theme of these thoughts (ie, fear of harm) bears close resemblance to the obsessions in the aggressive dimension.[12] In addition to concerns for the other person's well-being, those in love commonly report being inundated by sexual thoughts, desires, and fantasies.[13] Again, these thoughts resemble symptoms in the sexual-religious dimension, which entails sexually charged obsessions and improper thoughts or impulses. Therefore, while the features typical of romantic love are not inherently pathological, they do share similar elements with OCD symptoms in the aggression and sexual-religious dimensions.

Pope's[14] definition of romantic love highlights another phenomena commonly associated with this emotion: the feelings of incompleteness. This ineffable sensation lies at the core of some prominent theories, such as the triangular theory of love,[15,16] that posits the feelings of incompleteness as a central mechanism underlying romantic pursuits. Interestingly, people with OCD are no strangers to these feelings[17,18], and recent evidence showed that they are a common motivator of compulsions.[19] Feelings of incompleteness are described among the subjective experiences reported by those with symptoms of OCD driving the performing of the repetitive behaviors, most of the time, in the absence of obsessions, which are prevalent in almost half of individuals with this disorder.[20,21] This, in concert with other evidence presented so far, highlights the several phenomenological parallels between romantic love and OCD, indicating a much deeper connection than previously conceptualized.

The striking parallels between OCD and romantic love raise an important question: how are these two phenomena connected? According to Leckman and Mayes,[9] the answer might be tied to the evolution of love and its shared neurobiological mechanism with OCD. Love, from an evolutionary perspective, is a highly conserved behavior which has evolved for the purpose of pair bonding.[22] While necessary for securing a desirable partner, love, as described previously, does come at a cost. Hence, a reasonable expectation would be that the neurobiological systems responsible for love must be under stringent regulation throughout one's life. There will be times when love needs to be switched off or turned down, as failing to do so would result in an excess of obsessional, intrusive thoughts. Much like repetitive negative thinking seems to exacerbate depression, Leckman and Mayes[9] suspected that it is the dysfunction of these mechanisms and the resultant uncontrollable thoughts that are implicated in the pathogenesis of OCD.

Consistent with Leckman and Mayes' prediction,[27] a preliminary study found evidence indicating an overlap between romantic love and OCD at a neurobiological level. Marazziti et al.[23] performed a study comparing three groups of participants: those who had recently fallen in love, individuals diagnosed with OCD and not in love, and healthy controls. They chose to analyze their platelet serotonin (5-HT) transporter levels through the binding of ^{3}Hparoxetine, which is often considered as a reliable biological marker for OCD.[24] Surprisingly, people with OCD and individuals who were in love both had significantly lower 5-HT transporter densities, compared to normal controls, but did not differ from each other. When some of the participants who were in love were retested again in 12 to 18 months, the previously noted 5-HT abnormality had dissipated and their transporter levels were indistinguishable from the normal controls. This investigation suggests that love operates similarly to OCD on a neurobiological level, but did not measure obsessive–compulsive behaviors, so whether these abnormalities translated to the manifestation of OCD remains inconclusive.

If Leckman and Mayes'[9] theory is supported by empirical evidence, then a corollary would be that the occurrence of romantic love might herald or exacerbate OCD symptoms in those predisposed to the disorder. Marazziti and Stahl's[8] case study on a young law student with a family history of OCD provides preliminary support for this notion. Their study described a male law student patient who saw the first occurrence of OCD and clinical levels of symmetry and contamination obsessions immediately after he had fallen in love at 18 years of age. Overwhelming as they were, those symptoms disappeared after that relationship had ended and remained dormant until he was in love with another person a year later. This intimate, cyclic relationship observed between romantic love and the onset of obsessive–compulsive symptoms does suggest a strong correlation, but this has never been empirically examined. This study, therefore, aims to examine whether OCD precipitated by romantic love (from herein referred to as love-precipitated OCD) differs significantly from non-love precipitated OCD in certain phenotypic expressions. Specifically, it was predicted that love-precipitated OCD would be associated with more sexual/religious symptom and aggressive symptoms (eg, fear of harm); sensory phenomena (SP; eg, feelings of incompleteness); episodic onset; increased severity of depression and anxiety symptoms; and increased comorbidities with major depressive disorder, bipolar I and II disorder, generalized anxiety disorder, agoraphobia without panic, and separation anxiety disorder.

Methods

Participants

The current study was a secondary investigation of an initial sample of 1001 OCD patients from seven universities across Brazil as a part of the Brazilian Research Consortium on Obsessive–Compulsive Spectrum Disorder (CTOC).[25] Patients were referred from outpatient and inpatient clinics, clinicians in primary health care units, private psychiatric services in São Paulo, or website and media advertisements. The recruitment period began in 2005 and ended in 2009. To be included, participants had to meet DSM-IV OCD diagnostic criteria (American Psychiatric Association[26]), confirmed by the Structured Clinical Interview for Diagnosis of Axis I DSM-IV disorders (SCID-I; [27]), and had the capacity to provide consent as well as to understand research protocols. Patients incapable of understanding the assessment instruments and those with psychotic disorders were excluded during data collection phase. Given the aims of the current study were to investigate romantic love (ie, limerence), and since adolescents under the age of 15 are unlikely to pursue romantic feelings,[28] only those over 15 were included in the final analyses. A final sample of 981 (M age = 35.31, SD = 12.71, Range = 15-82) patients was included in this study. A detailed sociodemographic summary has been described elsewhere.[25]

Ethics approval

The CTOC was approved by ethic committees at each participating university in Brazil (Process: USP-968/05; UNIFESP-302/2006; UFRJ-0024.0.249.000-06; UFRGS-06/171; and IPA-6600023).[25] Every participant included in the database has provided written informed consent, and in instances in which they could not, such as the case for underage subjects, parents' or legal representatives' consent was sought. Ethics approval for the present study was also

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obtained from the Monash University Human Research Ethics Committee (project ID: 21842).

Materials

Psychiatric comorbidities

The SCID-I is a clinician-administered, semistructured interview designed to ascertain the presence of Axis I psychiatric diagnosis according to the DSM-IV [27,29]. A Brazilian Portuguese version of the SCID-I,[30] which has demonstrated strong inter-rater agreement (weighted Kappa = 0.83) for most Axis I psychiatric disorders was used in this study. The SCID-I was used to identify the presence of OCD and six psychiatric comorbidities related to the hypotheses. Only *current* diagnoses were used in this study.

Love as a precipitant, age at onset, and developmental course

The Yale OCD Natural History Questionnaire[31] is a self-report questionnaire that explores the events, circumstances, and other potential contributing factors that may have influenced a patient's OCD symptoms. A Portuguese version was translated specifically for this study.[25] This questionnaire was used to determine love as a precipitant, age at onset for obsessions and compulsions (separately), and developmental course. Participants were considered *in love* if they responded "yes" to "I was in love when I first experienced compulsions/obsessions."

Obsessions and compulsions

The Yale–Brown Obsessive–Compulsive Scale (Y-BOCS)[32] was used to evaluate the severity of obsessions and compulsions. This 10-item, self-report scale has demonstrated strong internal consistency (Cronbach's alpha = 0.76-0.90),[33] and good convergent validity (r = 0.74) with the National Institutes of Mental Health Global Obsessive–Compulsive Scale.[34] The Y-BOCS has previously been translated to Brazilian Portuguese.[35] Each item is rated on a 5-point Likert scale, ranging from 0 (no symptom) to 4 (extreme symptoms), adding up to a maximum subtotal score of 20 each for obsessions and compulsions.

OCD symptom dimensions

The Dimensional Yale–Brown Obsessive–Compulsive Scale (DY-BOCS)[12] is a well-known measure used to assess the presence and severity of OCD symptom dimensions. This self-report instrument contains 88 questions designed to assess the following six dimensions: (a) aggression, (b) sexual-religious, (c) symmetry, (d) contamination, (e) hoarding, and (f) miscellaneous. The severity of each of these dimensions in the previous week is scored on a 6-point Likert scale, from 0 (no symptom) to 5 (symptoms are extremely troublesome), based on the frequency, distress level, and interference. It also provides a global score, ranging from 0 to 30 to evaluate the overall impairment of these symptoms, which can be obtained by aggregating the scores from each dimension. The developers for the DY-BOCS have demonstrated that the scale has high internal consistency (Cronbach's alpha = 0.94-0.96), and good convergent validity with the Y-BOCS (r = 0.82).[12] Initially developed at Yale University, this scale has been standardized in Brazilian Portuguese in the validation study.[12]

Sensory phenomena

The severity of SP was assessed by the University of São Paulo Sensory Phenomena Scale (USP-SPS), a self-report scale[21] used to measure five different forms of SP, their age of onset, and clinical severity.[21] In the validation study, the self-report version was shown to have high reliability (Kappa = 0.84) and convergent validity with the DY-BOCS (χ^2 = 14.23, P < .001). The five different types of SP described in this instrument are physical sensations (generally tactile and/or muscle joint), "just right" perceptions, feelings of incompleteness, energy release, and urge only. Their ratings vary from 0 (no symptom) to 5 (severe) for each of these, adding up to a maximum of a total score of 15. Keeping in line with other measures, only the *current* total scores were analyzed.

Depressive symptoms

The Beck Depression Inventory (BDI)[36] was used to evaluate the severity of depressive symptoms. It is comprised of 21 self-report items, each containing four descriptions rated on a 4-point Likert scale (0-3) to denote the intensity of symptoms in the previous week. Together, they make up a total depressive symptom score, ranging from 0 (no symptom) to 63 (severe). The authors have also provided a cutoff score for each category to denote symptoms within the "normal ranges" (1-10), "mild mood disturbances" (11-16) to the more severe end of the spectrum, and "extreme depression" (over 40). It is psychometrically sound, with strong test–retest reliability (r = 0.72),[37] internal consistency (Cronbach's alpha = .86), and criterion validity.[38] A Brazilian Portuguese version, which has previously demonstrated similar results,[39] was used.[40]

Anxiety symptoms

The Beck Anxiety Inventory (BAI)[41] was used to assess the severity of anxiety symptoms. Similar to the BDI, the BAI has 21 items that contain four descriptions each, covering cognitive and physical aspects of anxiety. These descriptions are each rated on a 4-point Likert scale (0-3), reflecting the level of anxiety over the previous week. Possible total scores for the BAI ranges from 0 (low) to 63 (high); depending on the score, the anxiety level can be interpreted as "minimal" (0-7), "mild" (8-15), "moderate" (16-25), or "severe" (26-63). This scale has shown high internal consistency (Cronbach's alpha = .88), strong convergent validity with hospital anxiety and depression scale (r = 0.62)[42], and excellent discriminant validity.[43] This scale has also been validated in Brazilian Portuguese.[40]

Statistical analyses

To test the research hypotheses, the authors conducted multiple univariate analyses to compare participants who reported love as a precipitant of their OCD and those who did not (coded as 1 and 0, respectively) for categorical variables (eg, comorbid psychiatric disorders) using chi-square tests, and for continuous variables (eg, severity score for obsessive–compulsive symptoms) using Mann–Whitney U tests. Nonparametric tests were used because of the slight positive skew in distribution across nearly all continuous data.

Next, all variables that showed a statistically significant association (P < .05) in the univariate tests were entered as independent variables into a generalized linear model with a binomial distribution (ie, logistic regression). This logistic regression model was conducted using maximum likelihood to evaluate whether and the degree to which the independent variables can predict those with love-precipitated OCD. Confidence intervals (CI) and odds ratios (OR) were calculated for the model. Given the lack of data in this specific area, no statistical correction was applied, and the significance level was set to .05. All the analyses were performed using the R statistic programming environment.

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Results

Descriptive analyses

Descriptive characteristics of the independent and dependent variables are shown in Table 1. Out of a sample of 981 patients, 89 (9.1%) reported love as a precipitant of their OCD diagnosis. Of those, love precipitated obsessive symptoms in 79 (88.8%) participants and compulsive symptoms in 68 (76.4.9%) participants. Of the 89 patients who had reported love-precipitated OCD, 51 (57.3%) were females. The mean ages of onset for obsessions and compulsions in the love-precipitated OCD group were 16.7 (SD = 6.53) and 15.3 (SD = 6.54) years. By contrast, the mean age at onset was slightly lower in the nonlove-precipitated OCD group, for both obsessions [M = 13.1, SD = 7.99; t = 4.12, P < .001 (Cohen's d = 0.457 SDs [SE = 0.112])] and compulsions [M = 12.9, SD = 7.78; t = 2.81, P = .005 (Cohen's d = 0.313 SDs [SE = 0.111])].

As shown in Table 1, participants with love-precipitated OCD generally reported higher severity of symptoms with respect to all six OCD dimensions and, on average, had more severe symptoms on each dimension compared to clinical samples reported in other studies (e.g., 12 and 43). According to the severity threshold proposed by Storch et al[45] for the Y-BOCS, patients with love-precipitated OCD were more likely to report "moderate–severe" OCD symptoms, whereas those without were likely to report "moderate" symptoms.

Univariate analyses

Table 2 summarizes the results of Mann–Whitney U tests performed in the present study. Love-precipitated OCD was significantly associated (P < .05) with the following DY-BOCS dimensions' severity: aggressive-violence and miscellaneous, as well as with the Y-BOCS obsession severity, SP severity, age at onset of obsessions and compulsions, and BAI anxiety severity. All the above-cited variables, except for miscellaneous dimension, were entered in the multivariate analysis as independent variables. The miscellaneous dimension was excluded, because it was unrelated to the research hypotheses and too heterogeneous to provide meaningful interpretations.

Chi-square analyses revealed a marginal association (P < .1) between higher rates of major depressive (χ^2 = 2.76, df = 1, P = .097) and bipolar II disorders (χ^2 = 3.14, df = 1, P = .0.76) among those with love-precipitated OCD. No significant difference was found between love-precipitated OCD and the four other Axis I

Table 1. A Summary of Patients' Clinical Characteristics Grouped by Love-Precipitated OCD

	Love-Precipitated OCD (n = 89) Median (IQR)	Nonlove-Precipitated OCD (n = 892) Median (IQR)
DY-BOCS (*severity—current*)		
Aggression	8 (11)	5 (10)
Sexual-religious	4 (10)	1 (9)
Symmetry	8 (8)	8 (8)
Contamination	8 (12)	6 (11)
Hoarding	3 (7)	0 (6)
Miscellaneous	9 (7)	8 (8)
Y-BOCS scores (*severity—current*)		
Obsessions	14 (5)	13 (5)
Compulsions	14 (4)	13 (6)
SP (*severity—current*)	6.5 (10)	4 (9)
Age at onset of obsessions	16 (7)	11 (8)
Age at onset of compulsions	15 (6)	10.5 (8)
Anxiety severity	17 (16)	14 (17)
Depressive severity	17 (18)	15 (15)
Axis I comorbidity diagnosis (*current*) *n* (%)		
Major depressive disorder	37 (41.6%)	293 (32.8%)
Generalized anxiety disorder	36 (40.4%)	296 (33.2%)
Separation anxiety disorder	6 (6.7%)	40 (4.5%)
Agoraphobia	5 (5.6%)	41 (4.6%)
Bipolar I disorder	3 (3.4%)	20 (2.2%)
Bipolar II disorder	6 (6.7%)	28 (3.1%)

Notes: Continuous variables are reported using median and IQR, whereas categorical variables are reported using whole numbers and relative values (ie, percentage). Aggressive-violence, sexual-religious, symmetry, contamination, hoarding, and miscellaneous dimension severity scores were taken from the DY-BOCS subscale current severity scores. Severity of obsessions and compulsions scores were taken from the Y-BOCS current severity scores. SP scores correspond to the USP-SPS current severity scores. Ages at obsession and compulsion onset were derived from the Yale OCD Natural History Questionnaire. Anxiety and depression severity scores correspond to BAI and BDI scores, respectively.
Abbreviations: BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; DY-BOCS, Dimensional Yale–Brown Obsessive–Compulsive Scale; IQR, interquartile range; OCD, obsessive–compulsive disorder; SP, sensory phenomena; USP-SPS, University of São Paulo Sensory Phenomena Scale; Y-BOCS, Yale–Brown Obsessive-Compulsive Scale.

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Table 2. Association Between Love-Precipitated OCD and Clinical Characteristics (Mann–Whitney *U* Tests)

	Median Love-Precipitated OCD (IQR)		
	Yes	No	*P*
DY-BOCS (*severity—current*)			
Aggression	8 (11)	5 (10)	.042
Sexual/religious	4 (10)	1 (9)	.133
Symmetry	8 (8)	8 (8)	.849
Contamination	8 (12)	6 (11)	.072
Hoarding	3 (7)	0 (6)	.052
Miscellaneous	9 (7)	8 (8)	.001
Y-BOCS scores (*severity—current*)			
Obsessions	14 (5)	13 (5)	.017
Compulsions	14(4)	13 (6)	.084
SP (*severity—current*)	6.5 (10)	4 (9)	.03
Age at onset of obsessions	16 (6)	11 (8)	<.001
Age at onset of compulsions	15 (7)	10.5 (8)	<.001
Age at onset of distressing OCD symptoms	20 (9)	19 (12)	.421
BAI	17 (16)	14 (17)	.049
BDI	17 (18)	15 (15)	.274

Notes: Aggressive-violence, sexual-religious, symmetry, contamination, hoarding, and miscellaneous dimension severity scores were taken from the DY-BOCS subscale current severity scores. Severity scores of obsessions and compulsions were taken from the Y-BOCS current severity scores. SP scores correspond to the USP-SPS current severity scores. Age at onset of obsessions, age at symptom distress, and age at onset of compulsions were derived from the Yale OCD Natural History Questionnaire. Anxiety and depression severity scores correspond to BAI and BDI scores, respectively. *P* = level of statistical significance.

Abbreviations: BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; DY-BOCS, Dimensional Yale–Brown Obsessive–Compulsive Scale; IQR, interquartile range; OCD, obsessive–compulsive disorder; SP, sensory phenomena; USP-SPS, University of São Paulo Sensory Phenomena Scale; Y-BOCS, Yale–Brown Obsessive–Compulsive Scale.

Table 3. Results of Logistic Regression Model with Love-Precipitated OCD as Dependent Variable

			95% CI for OR		
	b (SE)	OR	Lower	Upper	*P*
Intercept	−4.42 (0.55)***	0.01	0.01	0.03	<.001
Aggression	0.01 (0.03)	1.02	0.97	1.07	.562
Obsessions	0.06 (0.04)	1.06	0.99	1.15	.089
SP	0.06 (0.03)*	1.05	1.01	1.11	.031*
Age at onset of obsessions	0.06 (0.03)*	1.06	1.01	1.11	.023*
Age at onset of compulsions	−0.01 (0.03)	0.99	0.94	1.05	.73
BAI	0.01 (0.01)	1.01	0.99	1.03	.465

Notes: Aggressive-violence dimension severity score was taken from the DY-BOCS subscale current severity scores. Severity of obsessions was taken from the Y-BOCS current severity scores. SP scores correspond to the USP-SPS current severity scores. Ages at obsession and compulsion onset were derived from the Yale OCD Natural History Questionnaire. Anxiety severity scores correspond to BAI scores. *P* = level of significance.

Abbreviations: BAI, Beck Anxiety Inventory; DY-BOCS, Dimensional Yale–Brown Obsessive–Compulsive Scale; OCD, obsessive–compulsive disorder; OR, odds ratio; SP, sensory phenomena; USP-SPS, University of São Paulo Sensory Phenomena Scale; Y-BOCS, Yale–Brown Obsessive–Compulsive Scale.

*$P < .05$.
**$P < .01$.
***$P < .0001$.

disorders: separation anxiety disorder ($\chi^2 = 0.92$ $df = 1$, $P = .337$), generalized anxiety disorder ($\chi^2 = 1.91$, $df = 1$, $P = .167$), bipolar I disorder ($\chi^2 = 0.45$, $df = 1$, $P = .502$), agoraphobia without panic disorder ($\chi^2 = 0.19$, $df = 1$, $P = .664$), and episodic onset ($\chi^2 = 0.02$, $df = 1$, $P = .886$).

Multivariate analyses

Results of the logistic regression are presented in Table 3. Briefly, two predictors remain independently associated with love-precipitated OCD ($P < .05$) after performing the logistic regression (Nagelkerke's $R^2 = .064$). Love-precipitated OCD was associated with SP and age at onset of obsessions. Interpreted in terms of OR, this model predicted that patients with love-precipitated OCD had 1.05 higher odds of reporting higher severity of SP [95% CI 1.01-1.11] and 1.06 times the odds of experiencing symptom onset, particularly obsessions, at an older age [95% CI 1.06-1.01]. In addition, there was a lower trend between love-precipitated OCD and higher severity of obsessions ($P = .089$, OR = 1.06), although the association was not statistically significant.

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Discussion

The aim of this study was to investigate the influence of romantic love on the expression of OCD characteristics. This secondary investigation included a large sample of OCD patients (n = 981) and was the first to perform this type of analysis on a relatively unexplored area. In the present study, love-precipitated OCD was associated with two specific clinical characteristics: greater severity of SP and later age at onset of obsessions. However, love-precipitated OCD was not associated with symptom severity, symptom dimensions, episodic onset, or comorbid mood or anxiety disorders. These findings, therefore, lend partial support for the first hypothesis, in that patients with love-precipitated OCD do present with different clinical characteristics. Nevertheless, the second hypothesis that predicted a greater rate of psychiatric comorbidities among those with love-precipitated OCD was not supported by the current study. Drawn together, the preliminary evidence indicates that romantic love might influence the expression of OCD, reinforcing the possibility that love-precipitated OCD may be a clinically meaningful phenotype. These findings might be useful in guiding future research to determine the clinical utility of this potential phenotype and, more importantly, whether it might be associated with a different treatment profile.

The significant association between love-precipitated OCD and more severe symptoms of SP would indicate that romantic love might have a particularly negative impact on feelings of incompleteness in OCD. This was largely consistent with the research hypothesis, as one of the features of romantic love, feelings of incompleteness, is also a core component of SP.[21] As such, the emergence of the romantic love, accompanied by a rise in the feelings of incompleteness, may serve as a trigger for those vulnerable to developing these symptoms. The observed relationship between romantic love and SP in the present study is in line with Leckman and Mayes'[9] hypothesis, which envisaged a shared neurobiological pathway between the two phenomena. Given that SP can cause more distress than obsessions and compulsions,[20] it is conceivable that patients with love-precipitated OCD experience greater levels of distress than those without. Hence, it might be useful to conduct further research to better understand the mechanisms involved in love-precipitated OCD and devise interventions to help patients manage not only their OC symptoms, but also SP.

In this study, later age at onset of obsessions was strongly associated with love-precipitated OCD, which contrasts with earlier evidence showing that SP are associated with early onset OCD. This finding is consistent with the modern understanding that strong, romantic feelings generally do not emerge before the maturation of certain emotional and cognitive processes that takes place in mid-puberty.[46] What this also highlights is the possibility that romantic love may have acted as a precipitant for obsessive–compulsive symptoms in these people who would have, otherwise, not developed OCD. This novel finding is supported by Marazziti and Stahl's[8] results in recent case report, which described a young adult who experienced sudden onset of OCD on every occasion he fell in love. While some could argue that patients with love-precipitated OCD might be similar to those with late-onset OCD (ie, typically defined as patients whose symptoms started after age 17), this might not be the case. In a recent meta-analysis, Taylor[47] found that both clinical and nonclinical populations with early onset OCD were significantly more likely to be associated with SP compared to their late onset counterparts. The opposite, however, was observed in the current study. That is, SP were much higher in the love-precipitated OCD group, drawing a distinction between them and those with the typical late onset OCD. The more uncommon combination of late onset and higher SP lends some initial support to the notion of love-precipitated OCD as autonomous OCD phenotype.

Love-precipitated OCD was not associated with the severity of compulsions in this sample. This seems slightly counterintuitive given patients with love-precipitated OCD reported greater symptoms of SP, a known driver of compulsions.[19,48] In a recent cross-sectional study, Ferrão et al[20] described that 65% (n = 651) of the OCD patients included in their investigation reported SP preceding their repetitive rituals. Another more recent investigation also found that the feelings of incompleteness tended to predict more symptoms of compulsions, especially for ordering and cleaning rituals.[19] That said, it should be acknowledged that this study was not intended to assess the connection between SP and compulsions, so only limited inferences can be drawn at this point.

Similarly, love-precipitated OCD was not associated with greater severity of obsessions. Although there was a trend toward significance ($P < .09$) for obsessions, this nonsignificant relationship seems to indicate that the obsessive thoughts characteristic of romantic love might have a lesser impact on the severity of obsessions than previously hypothesized.[9] Moreover, there was no association between love-precipitated OCD and symptoms in the aggression and sexual-religious dimensions. It is possible that the nonsignificant findings were due to the way obsessions are currently conceptualized. In the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5),[1] obsessions are described exclusively as ego-dystonic thoughts (i.e. thoughts that considered intrusive and inconsistent with who that person is), with no mentions of ego-syntonic thoughts (ie, thoughts that are acceptable and in harmony with who that person is), which could have been equally time-consuming or obsessive. Since ego-syntonic thoughts are rarely viewed as obsessions, these symptoms could have been missed during data collection, leading to underestimating the severity of certain OCD symptoms.

Likewise, there was no association between love-precipitated OCD with episodic onset. This was, again, unexpected since Thompson et al[7] demonstrated that patients who reported being romantically involved when they started exhibiting compulsions experienced a faster progression from subclinical to clinical symptoms compared to other OCD patients. One of the reasons for the observed discrepancy could be related to the different criteria used to group the participants. That is, the present study only included patients who were in love, whereas Thompson et al[7] included even participants who reported being in love, starting an intimate relationship, about to wed all collapsed into one group. Nevertheless, the evidence currently available shows that patients with love-precipitated OCD do not differ from those without with regard to OCD symptom severity, symptom dimensions, and course of onset.

The analyses did not find any difference in relation to the severity of depressive and anxiety symptoms between those with and without love-precipitated OCD. Upon first glance, these results might seem inconsistent with previous research, as romantic love has been shown to correlate strongly with greater rates of depressive symptoms, although only in adolescent girls,[49] and state anxiety.[50] However, this discrepancy might be due to the drastic differences in sample characteristics. For instance, both above-cited studies had included teenage, healthy participants, whereas the current sample was comprised of treatment-seeking patients of different ages ranging from 15 to 82 with severe OCD symptoms. Hence, it is possible that the negative impacts of romantic love, at

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least on depression and anxiety, are experienced much differently for those with preexisting psychopathological symptoms compared to healthy individuals.

Finally, although patients with love-precipitated OCD did exhibit slightly higher rates of psychiatric comorbidities overall, no significant association was obtained for major depressive disorder, generalized anxiety disorder, agoraphobia without panic disorder, separation anxiety disorder, and bipolar disorder. Despite the large sample included in the present study, it is likely that there was insufficient power to detect meaningful differences, since some diagnoses were infrequent in the love-precipitated OCD group (eg, only 3 patients with love-precipitated OCD presented with bipolar I disorder compared to 20 in those without). In terms of comorbid depression and anxiety disorders, these inconsistent findings might be partly attributable to the fact that comorbidities with these disorders are almost the rule, rather than the exception, in people with OCD.[51,52] Having a sample most likely with preexisting psychiatric comorbidities would, in theory, complicate the process of detecting subtle increases in the prevalence of comorbid disorders.

Our findings must be interpreted in light of the limitations. First, the cross-sectional design only provides information about the association between the independent and dependent variables, which precludes any inferences to be drawn about causality. Relatedly, this also implies that reverse causality between the observed relationships cannot be completed ruled out. Moreover, this study only included help-seeking patients who were receiving treatment at the outpatient clinic, suggesting the sample may have been overrepresented by participants with more severe cases of OCD, limiting the generalizability of these results. In addition, some of the responses collected, such as those in the Yale OCD Natural History Questionnaire, were retrospective and, hence, could have been affected by recall bias. Another limitation of this study is that the presence of love-precipitated OCD was assessed based on whether participants had responded "yes" to "I was in love" at the onset of OCD. As this was not a measure designed specifically to measure love, it lacked information that might have been useful in determining if love did precede OCD symptoms as opposed to occurring in a similar time frame. Finally, these results are also limited by the broad age distribution of the participants in our study.

Given these preliminary findings, the next logical steps should be to investigate whether love-precipitated OCD is a clinically meaningful phenotype using a larger sample of people with this type of OCD. This might involve comparing its etiological features and treatment responses against other forms of OCD. The findings could prove to be beneficial, particularly considering a core characteristic of love-precipitated OCD, SP, is generally associated with higher levels of distress. Of note, choosing more reliable and valid instruments devised to measure romantic love, such as the passionate love scale,[53,54] could also help further improve the study quality.

In addition, future studies should consider a different study design to further explicate the relationship between OCD and romantic love. For instance, evidence from longitudinal designs on this subject matter could be useful in describing the direction of association between romantic love and the onset of OCD. This is necessary to determine if the results observed in the current study were confounded by backward causation or a third unknown factor.

Conclusion

This was the first study to systematically explore the connection between romantic love and OCD as well as its clinical characteristics. The results provided preliminary evidence in partial support of our first hypothesis, showing that love-precipitated OCD is characterized by greater severity of SP and a later age at onset of obsessions. They also indicated that, contrary to the second hypothesis, romantic love did not influence the rates of other psychiatric comorbidities. Together, these findings, as well as those of recent literature, underscore the potential importance in conducting further research to understand the mechanisms shared by the natural features of romantic love and obsessive–compulsive symptoms. Finally, they also shed light on the potential difficulties people predisposed to OCD might experience when they do fall in love, providing a glimpse into a different side of this normal human experience.

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References

1. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*. Arlington, VA: American Psychiatric Publishing; 2013.
2. Fawcett EJ, Power H, Fawcett JM. Women are at greater risk of OCD than men: a meta-analytic review of OCD prevalence worldwide. *J. Clin Psychiatry.* 2020;**81**(4):19r13085. doi:10.4088/JCP.19r13085.
3. Lochner C, Fineberg NA, Zohar J, *et al.* Comorbidity in obsessive–compulsive disorder (OCD): a report from the International College of Obsessive–Compulsive Spectrum Disorders (ICOCS). *Compr Psychiatry.* 2014;**55**(7):1513–1519. doi:10.1016/j.comppsych.2014.05.020.
4. Eisen JL, Sibrava NJ, Boisseau CL, *et al.* Five-year course of obsessive–compulsive disorder: predictors of remission and relapse. *J Clin Psychiatry.* 2013;**74**:233–239. doi:10.1016/j.comppsych.2014.05.020.
5. Dell'Osso B, Marazziti D, Albert U, *et al.* Parsing the phenotype of obsessive–compulsive tic disorder (OCTD): a multidisciplinary consensus. *Int J Psychiatry Clin Pract.* 2017;**21**(2):156–159. doi:10.1080/13651501.2017.1291822.
6. Miguel EC, Leckman JF, Rauch S, *et al.* Obsessive–compulsive disorder phenotypes: implications for genetic studies. *Mol Psychiatry.* 2005;**10**(3):258–275. doi:10.1038/sj.mp.4001617.
7. Thompson EM, Torres AR, Albertella L, *et al.* The speed of progression towards obsessive–compulsive disorder. *J. Affect Disord.* 2020;**264**:181–186. doi:10.1016/j.jad.2019.12.016.
8. Marazziti D, Stahl SM. Serotonin and love: supporting evidence from a patient suffering from obsessive–compulsive disorder. *J. Clin Psychopharmacol.* 2018;**38**(1):99–101. doi:10.1097/jcp.0000000000000808.
9. Leckman JF, Mayes LC. Preoccupations and behaviors associated with romantic and parental love: perspectives on the origin of obsessive–compulsive disorder. *Child Adolesc Psychiatr Clin.* 1999;**8**(3):635–665. doi:10.1016/S1056-4993(18)30172-X.
10. Gottschall J. Romantic love: a literary universal? In: Gottschall J, ed. *Literature, Science, and a New Humanities*. New York: Palgrave Macmillan; 2008:157–170.
11. Feygin DL, Swain JE, Leckman JF. The normalcy of neurosis: evolutionary origins of obsessive–compulsive disorder and related behaviors. *Prog Neuropsychopharmacol Biol Psychiatry.* 2006;**30**(5):854–864. doi:10.1016/j.pnpbp.2006.01.009.
12. Rosario-Campos MC, Miguel EC, Quatrano S, *et al.* The dimensional Yale–Brown Obsessive–Compulsive Scale (DY-BOCS): an instrument for assessing obsessive–compulsive symptom dimensions. *Mol Psychiatry.* 2006;**11**(5):495–504. doi:10.1o38/sj.mp.4001798.

13. Gonzaga GC, Turner RA, Keltner D, *et al.* Romantic love and sexual desire in close relationships. *Emotion*. 2006;**6**(2):163–179. doi:10.1037/1528-3542.6.2.163.
14. Pope KS. *On Love and Loving*. San Franciscos Jossey-Bass; 1980.
15. Sternberg RJ. Construct validation of a triangular love scale. *Eur J Soc Psychol.* 1997;**27**(3):313–335. doi:10.1002/(SICI)1099-0992(199705)27:3<313::AID-EJSP824>3.0.CO;2-4.
16. Hatfield E, Bensman L, Rapson RL. A brief history of social scientists' attempts to measure passionate love. *J Soc Pers Relat*. 2011;**29**(2):143–164. doi:10.1177/0265407511431055.
17. Cougle JR, Fitch KE, Jacobson S, *et al.* A multi-method examination of the role of incompleteness in compulsive checking. *J Anxiety Disord.* 2013;**27**(2):231–239. doi:10.1016/j.janxdis.2013.02.003.
18. Ecker W, Gönner S. Incompleteness and harm avoidance in OCD symptom dimensions. *Behav Res Ther.* 2008;**46**(8):895–904. doi:10.1016/j.brat.2008.04.002.
19. Lee SR, Wu KD. Feelings of incompleteness explain symptoms of OCD and OCPD beyond harm avoidance. *J Obsessive Compuls Relat Disord.* 2019;**21**:151–157. doi:10.1016/j.jocrd.2019.04.002.
20. Ferrão YA, Shavitt RG, Prado H, *et al.* Sensory phenomena associated with repetitive behaviors in obsessive–compulsive disorder: an exploratory study of 1001 patients. *Psychiatry Res.* 2012;**197**(3):253–258. doi:10.1016/j.psychres.2011.09.017.
21. Rosário-Campos M, Prado H, Borcato S, *et al.* Validation of the University of Sao Paolo Sensory Phenomena Scale: initial psychometric properties. *CNS Spectr.* 2009;**14**:315–323. doi:10.1017/S1092852900020319.
22. Fletcher G, Simpson JA, Campbell L, *et al.* Pair-bonding, romantic love, and evolution: the curious case of Homo sapiens. *Perspect Psychol Sci.* 2015;**10**(1):20–36. doi:10.1177/1745691614561683.
23. Marazziti D, Akiskal HS, Rossi A, *et al.* Alteration of the platelet serotonin transporter in romantic love. *Psychol Med.* 1999;**29**(3):741–745. doi:10.1017/S0033291798007946.
24. Bandelow B, Baldwin D, Abelli M, *et al.* Biological markers for anxiety disorders, OCD and PTSD: a consensus statement. Part II: Neurochemistry, neurophysiology and neurocognition. *World J Biol Psychiatry*. 2017;**18**(3):162–214. doi:10.1080/15622975.2016.1190867.
25. Miguel EC, Ferrão YA, Rosário MC, *et al.* The Brazilian Research Consortium on Obsessive–Compulsive Spectrum Disorders: recruitment, assessment instruments, methods for the development of multicenter collaborative studies and preliminary results. *Braz J Psychiatry*. 2008;**30**:185–196. doi:10.1590/S1516-44462008000300003.
26. American Psychological Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: American Psychiatric Association; 2000.
27. First MB. *Structured Clinical Interview for DSM-IV Axis I Disorders*. Washington, D.C Biometrics Research Department; 1997.
28. Hagan JF, Shaw JS, Duncan PM. *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescence*. American Academy of Pediatrics; 2007.
29. First MB, Spitzer RL, Gibbon M, *et al. Structured Clinical Interview for DSM-IV-TR Axis I Disorders*. Patient ed. New York: Biometrics Research Department, Columbia University; 2003.
30. Del-Ben CM, Vilela JAA, Crippa JADS, *et al.* Confiabilidade da "Entrevista Clínica Estruturada para o DSM-IV—Versão Clínica" traduzida para o português. *Braz J Psychiatry.* 2001;**23**:156–159. doi:10.1590/S1516-44462001000300008.
31. Leckman JF, Cohen DJ *Tourette's syndrome-tics, obsessions, compulsions: Developmental psychopathology and clinical care*. John Wiley & Sons Inc.; 1998.
32. Goodman WK, Price LH, Rasmussen SA, *et al.* The Yale–Brown Obsessive–Compulsive Scale: I. Development, use, and reliability. *Arch Gen Psychiatry.* 1989;**46**(11):1006–1011. doi:10.1001/archpsyc.1989.01810110048007.
33. Woody SR, Steketee G, Chambless DL. Reliability and validity of the Yale–Brown Obsessive–Compulsive Scale. *Behav Res Ther.* 1995;**33**(5):597–605. doi:10.1016/0005-7967(94)00076-V.
34. Goodman WK, Price LH, Rasmussen SA, *et al.* The Yale–Brown Obsessive–Compulsive Scale: II. Validity. *Arch Gen Psychiatry.* 1989;**46**(11):1012–1016. doi:10.1001/archpsyc.1989.01810110054008.
35. Fontenelle L, Marques C, Figueira I, *et al.* Escala obsessivo–compulsiva de Yale–Brown (Y-BOCS): Crítica a suas características psicométricas: Série Psicofarmacologia-75. *J Bras Psiquiatr.* 1998;**47**(7):361–368.
36. Beck AT, Ward CH, Mendelson M, *et al.* An inventory for measuring depression. *Arch Gen Psychiatry.* 1961;**4**(6):561–571. doi:10.1001/archpsyc.1961.01710120031004.
37. Adewuya AO, Ola BA, Aloba OO. Prevalence of major depressive disorders and a validation of the beck depression inventory among Nigerian adolescents. *Eur Child Adolesc Psychiatry.* 2007;**16**(5):287–292. doi:10.1007/s00787-006-0557-0.
38. Aalto A-M, Elovainio M, Kivimäki M, *et al.* The Beck Depression Inventory and General Health Questionnaire as measures of depression in the general population: a validation study using the Composite International Diagnostic Interview as the gold standard. *Psychiatry Res.* 2012;**197**(1):163–171. doi:10.1016/j.psychres.2011.09.008.
39. Gorenstein C, Andrade LHSG. Validation of a Portuguese version of the Beck Depression Inventory and State-Trait Anxiety Inventory in Brazilian subjects. *Braz J Med Biol Res.* 1996;**29**(4):453–457. doi:10.1590/s0100-879x2001000300011.
40. Cunha JA. *Manual da versão em português das Escalas Beck*. São Paulo: Casa do Psicólogo; 2001.
41. Beck AT, Epstein N, Brown G, *et al.* An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol.* 1988;**56**(6):893–897. doi:10.1037/0022-006X.56.6.893.
42. Leentjens AFG, Dujardin K, Marsh L, *et al.* Anxiety rating scales in Parkinson's disease: a validation study of the Hamilton Anxiety Rating Scale, the Beck Anxiety Inventory, and the Hospital Anxiety and Depression Scale. *Mov Disord.* 2011;**26**(3):407–415. doi:10.1002/mds.23184.
43. de Lima Osório F, Crippa JAS, Loureiro SR. Further psychometric study of the Beck Anxiety Inventory including factorial analysis and social anxiety disorder screening. *Int J Psychiatry Clin Pract.* 2011;**15**(4):255–262. doi:10.3109/13651501.2011.605955.
44. Pertusa A, Fernández de la Cruz L, Alonso P, *et al.* Independent validation of the Dimensional Yale–Brown Obsessive–Compulsive Scale (DY-BOCS). *Eur Psychiatry.* 2012;**27**(8):598–604. doi:10.1016/j.eurpsy.2011.02.010.
45. Storch EA, De Nadai AS, Conceição do Rosário M, *et al.* Defining clinical severity in adults with obsessive–compulsive disorder. *Compr Psychiatry.* 2015;**63**:30–35. doi:10.1016/j.comppsych.2015.08.007.
46. Suleiman AB, Galván A, Harden KP, *et al.* Becoming a sexual being: the "elephant in the room" of adolescent brain development. *Dev Cogn Neurosci.* 2017;**25**:209–220. doi:10.1016/j.dcn.2016.09.004.
47. Taylor S. Early versus late onset obsessive–compulsive disorder: evidence for distinct subtypes. *Clin Psychol Rev.* 2011;**31**(7):1083–1100. doi:10.1016/j.cpr.2011.06.007.
48. Prado HS, Rosário MC, Lee J, *et al.* Sensory phenomena in obsessive–compulsive disorder and tic disorders: a review of the literature. *CNS Spectr.* 2008;**13**(5):425–432. doi:10.1017/S1092852900016606.
49. Davila J, Stroud CB, Starr LR, *et al.* Romantic and sexual activities, parent–adolescent stress, and depressive symptoms among early adolescent girls. *J Adolesc.* 2009;**32**(4):909–924. doi:10.1016/j.adolescence.2008.10.004.
50. Bajoghli H, Joshaghani N, Gerber M, *et al.* In Iranian female and male adolescents, romantic love is related to hypomania and low depressive symptoms, but also to higher state anxiety. *Int J Psychiatry Clin Pract.* 2013;**17**(2):98–109. doi:10.3109/13651501.2012.697564.
51. Brakoulias V, Starcevic V, Belloch A, *et al.* Comorbidity, age of onset and suicidality in obsessive–compulsive disorder (OCD): an international collaboration. *Compr Psychiatry.* 2017;**76**:79–86. doi:10.1016/j.comppsych.2017.04.002.
52. Adam Y, Meinlschmidt G, Gloster AT, Lieb R, *et al.* Obsessive–compulsive disorder in the community: 12-month prevalence, comorbidity and impairment. *Soc Psychiatry Psychiatr Epidemiol.* 2012;**47**(3):339–349. doi:10.1007/s00127-010-0337-5.
53. Hatfield E, Sprecher S. Measuring passionate love in intimate relationships. *J Adolesc.* 1986;**9**(4):383–410. doi:10.1016/S0140-1971(86)80043-4.
54. Graham J, Christiansen K. The reliability of romantic love: a reliability generalization meta-analysis. *Pers Relat.* 2009;**16**(1):49–66. doi:10.1111/j.1475-6811.2009.01209.x.