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Obsessive-compulsive related disorders (OCRD) across the lifespan

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Published in
Frontiers in Psychiatry

ISSN 1664-8714
ISBN 978-2-8325-3751-0
DOI 10.3389/978-2-8325-3751-0

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Obsessive-compulsive related disorders (OCRD) across the lifespan

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Citation

Prochwicz, K., Lochner, C., Grünblatt, E., eds. (2023). *Obsessive-compulsive related disorders (OCRD) across the lifespan*. Lausanne: Frontiers Media SA.

doi: 10.3389/978-2-8325-3751-0

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frontiers | Frontiers in Psychiatry

TYPE Editorial
PUBLISHED 06 October 2023
DOI 10.3389/fpsyt.2023.1296074

OPEN ACCESS

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RECEIVED 18 September 2023
ACCEPTED 27 September 2023
PUBLISHED 06 October 2023

CITATION
Lochner C, Prochwicz K and Grünblatt E (2023) Editorial: Obsessive-compulsive related disorders (OCRD) across the lifespan. *Front. Psychiatry* 14:1296074. doi: 10.3389/fpsyt.2023.1296074

Editorial: Obsessive-compulsive related disorders (OCRD) across the lifespan

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KEYWORDS

obsessive-compulsive and related disorders, lifespan, compulsive-impulsive, therapeutic alliance, family accommodation, eHealth, underpinnings, qualitative approach

Editorial on the Research Topic
Obsessive-compulsive related disorders (OCRD) across the lifespan

Introduction

Obsessive-compulsive and related disorders (OCRDs) constitute a group of psychiatric conditions characterized by obsessive thoughts and/or compulsive behaviors. In DSM-5, the section on OCRDs is narrowly defined, including obsessive-compulsive disorder (OCD), body dysmorphic disorder (BDD), hoarding disorder (HD), trichotillomania (TTM) or hair-pulling disorder, and skin-picking (excoriation) disorder (SPD) (1). The ICD-11 section on OCRDs is broader, also listing other conditions such as olfactory reference syndrome, hypochondriasis, and Tourette syndrome (2). A wider spectrum of compulsive-impulsive disorders, such as buying-shopping disorder and eating disorders, has also been proposed as OCRDs (3). While many of these have been described in the medical literature for some time, some have only recently been recognized, and others have yet to receive recognition in official nomenclatures.

While significant progress has been made in understanding these underrecognized disorders, there are still aspects not yet fully understood. This Research Topic in Frontiers in Psychiatry aimed to shed light on the current state of knowledge on OCRDs in general community and clinical samples of all ages. This Research Topic presents nine manuscripts, including a brief research report, a clinical trial, several original research papers, and a systematic review, from experts worldwide.

Re OCD

Strappini et al. investigated the therapeutic alliance as a component of treatment in OCD. Their systematic review and meta-analysis provided evidence of an interactive effect between the therapeutic alliance and outcomes of cognitive behavior therapy (CBT) in patients with OCD. They recommended that future studies should focus on refinement of the temporal assessment of the alliance, in larger samples, and measurement of other interacting variables, to enrich the current understanding of therapeutic change factors that could benefit evidence-based treatment.

In addition to the therapeutic relationship, the relationship between OCD and family dynamics has also attracted increasing attention from researchers. The concept of family accommodation (FA) refers to family members' participation in patients' rituals and accommodating their compulsions to alleviate their anxiety. Addressing FA is an important part of the treatment plan. Liao et al. provided evidence of satisfactory psychometric properties of the Family Accommodation Scale Self-rated version (FAS-SR) in a large group of patients with OCD and relatives, suggesting that this scale can assist in the evaluation and treatment of OCD.

CBT including exposure exercises with response prevention (E/RP), is the established treatment of choice for OCD. However, there are many barriers to accessing CBT, including lack of availability, lack of experience of service providers, and financial and time constraints. Internet-based psychotherapy could help overcome some of these barriers and Hollmann et al. demonstrated the effectiveness of internet-based CBT in German children and adolescents with mild to moderate OCD.

Changing direction from investigations of treatment to the mechanisms underpinning OCD, Wang et al. explored the moderating effect of executive functioning on the relationship between anxiety and compulsive checking in adults with OCD. The study suggested that anxiety symptoms play a negligible role in explaining compulsive checking in individuals with OCD with relatively strong visuospatial working memory ability, but a substantial role in explaining compulsive checking in individuals with relatively weak visuospatial working memory. These findings encourage further research regarding how cognitive vulnerability factors of OCD and emotional factors interact to induce or maintain different OCD symptoms, providing additional insights into the mechanisms underpinning OCD.

Re BDD

Addressing the paucity of research on, and low treatment rates of, mental illnesses in men, Kang et al. used survey to investigate BDD and depression in male university students in Malaysia. The study found that a significant proportion exhibited symptoms of BDD and depression, with BDD concerns mainly related to dissatisfaction with their height, which significantly correlated with the severity of depressive symptoms. This study responds to the quest for more research on the epidemiology of mental disorders among male adolescents, and highlights the importance of better support services.

In another contribution to this Research Topic on OCRDs, Brennan et al. used a qualitative approach to explore the lived experiences of individuals with BDD (In press). Three themes were identified: being consumed by the disorder, the *flawed self*, and intolerance of uncertainty about appearance, and were discussed in relation to the cognitive-behavioral model.

Re compulsive buying/shopping

Aquino and Lins investigated the association between problematic buying/shopping with the Big Five's personality factors, during the COVID-19 pandemic, using an online survey of Portuguese adults. Regression analysis revealed significant correlations between various instances of buying/shopping, such as impulsive buying, compulsive buying, and panic buying, and some of the Big Five traits, highlighting the potential for improved understanding of these traits to inform preventive measures and effective treatment approaches.

Rocha et al. conducted a survey on the association between early maladaptive schemas (EMS) and compulsive and impulsive buying in young adults from Portugal. They found the *overvigilance* and inhibition schema was the main predictor of both impulsive and compulsive buying and that impaired limits was negatively associated with these tendencies. Coping mechanisms within this context were also explored.

Both aforementioned studies contribute to the conceptualization and study of problematic buying/shopping tendencies in populations other than Western, Educated, Industrialized, Rich, and Democratic (WEIRD) samples.

Re OCRDs in general

Di Ponzio et al. reported on the positive effects of high-frequency repetitive transcranial magnetic stimulation (rTMS) over the left DLPFC in Italian individuals with OCRDs, including SPD, TTM and HD. This study suggests that this rTMS protocol is a promising treatment option for OCRDs and highlight common circuits involved in these disorders.

Conclusion

In conclusion, the manuscripts included under this Research Topic cover a diverse range of themes, from the mechanisms underlying OCRDs, to the quest for personalized treatment approaches across the lifespan, while also addressing the misconception that these disorders are merely bad habits. The authors emphasized the need to further elucidate the etiologies and lifespan trajectories of OCRDs, as well as the development of eHealth treatment approaches. Nonetheless, this initiative demonstrates the progress made through global efforts, employing rigorous methodological standards, which can enhance clinical practice in addressing the unmet needs of patients throughout their lifetime.

Author contributions

CL: Writing—original draft, Writing—review and editing. KP: Writing—review and editing. EG: Writing—review and editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 11 August 2022
DOI 10.3389/fpsyt.2022.970747

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Anxiety and Stress Disorders, a section of the journal Frontiers in Psychiatry

RECEIVED 16 June 2022
ACCEPTED 25 July 2022
PUBLISHED 11 August 2022

CITATION
Liao Z, Ding L, You C, Chen Y and Zhang W (2022) The Chinese version of the family accommodation scale for obsessive-compulsive disorder self-rated: reliability, validity, factor structure, and mediating effect. *Front. Psychiatry* 13:970747. doi: 10.3389/fpsyt.2022.970747

The Chinese version of the family accommodation scale for obsessive-compulsive disorder self-rated: reliability, validity, factor structure, and mediating effect

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Background: Family accommodation (FA) in obsessive compulsive disorder (OCD) is a common phenomenon. Based on the cost of training interviewers and the time required to administer the scale, the Family Accommodation Scale for Obsessive-Compulsive Disorder Interviewer-Rated (FAS-IR) has been restricted to specific settings. A self-rated version of the family accommodation scale may solve these problems. The aim of this study was to examine the reliability, validity and factor structure of the Family Accommodation Scale Self-rated version (FAS-SR), and the relationship among FA, symptom severity and functional impairment.

Methods: In total, 171 patients with OCD and 145 paired relatives participated in this study. The Sheehan Disability Scale (SDS), Obsessive-Compulsive Inventory Revised (OCI-R), Zung Self-Rating Depression Scale (Zung-SDS), 12-item Family Assessment Devices (FAD-12), Clinical Global Impression of Severity Scale (CGI-S), Global Assessment of Functioning (GAF), and Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) were used as tools for patients. The FAS-SR, FAS-IR, FAD-12, and the patients' symptom severity of Y-BOCS compulsion were used as tools for relatives. The psychometric properties of the FAS-SR were evaluated using Cronbach's alpha coefficient, test-retest reliability and validity. Mediation analysis was used to determine the relationship among FA, symptom severity and functional impairment.

Results: A total of 97.9% of relatives of OCD patients reported at least one kind of FA behavior, and 56.6% of participants engaged in FA every day in the past week. The FAS-SR includes a three-factor structure: (1) providing reassurance and participation; (2) facilitation; and (3) modification. The scale's Cronbach's alpha and test-retest coefficients were 0.875 and 0.970, respectively. The total FAS-SR score was significantly positively associated with the Y-BOCS, FAD-12, CGI-S, FAS-IR, and SDS scores, and negatively associated with the total GAF

score. FA partially mediated the relationship between symptom severity and functional impairment.

Conclusion: The FAS-SR was proven to have satisfactory psychometric properties, and can play an important role in the evaluation and early intervention of OCD. This result indicates the importance of assessing symptom severity in conjunction with FA when evaluating OCD patients' functional impairment.

KEYWORDS

family accommodation, self-rated, reliability, validity, mediating effect

Introduction

Obsessive-compulsive disorder (OCD) is relatively prevalent among mental disorders and has a lifetime prevalence of 2.4% in China, according to a recent national epidemiological study (1). In addition, OCD was estimated to strongly contribute to the global burden of disease (2). OCD is a chronic, prolonged, serious and disabling disorder that frequently interferes with individuals' ability to function in society and decreases their quality of life (3–6). The negative or adverse consequences of OCD are not limited to patients alone (7, 8). Their family members, including parents, spouses, siblings and significant others, are also affected and distressed by symptoms in both adult and pediatric OCD patients, which cause unpleasant experiences and create a great burden for their caregivers. Patients' symptoms and behaviors play an important role in the course of the disorder and treatment outcomes (9, 10). According to recent research, it is clear that in addition to the symptoms of OCD that affect patients, their family members' responses have a deleterious effect on treatment outcomes (9–14).

In the last two decades, the relationship between OCD disorders and family dynamics has attracted increasing attention from researchers, and awareness of family accommodation (FA) has aroused growing interest in the illustration of OCD etiology and treatment outcomes (15–17). The terminology of FA refers to family members participating and assisting in the patients' rituals and accommodating their compulsions to prevent and alleviate their anxiety, which are behaviors frequently observed and reported in the families of both adult and pediatric OCD patients (8). On the basis of previous reports, almost all family members of OCD patients frequently experience this phenomenon on a daily basis or in extreme situations (7, 8). Accommodating behaviors can be maladaptive responses to OCD, even if FA is often treated as a global construct. The primary forms of FA included providing verbal reassurance, refraining from saying or doing things to trigger behaviors, participating in and facilitating compulsions, and following and respecting the rigid rules established by patients. The original intention of family members of OCD patients was an attempt to relieve their loved ones' anxiety and distress, and perhaps accelerate the compulsive behavior process, while their responses might be "successful" in the short term, the behaviors are maintained and repeated later (10, 18). As a result, FA behaviors actually prevent patients from confronting their obsessions, compulsions and anxiety. Furthermore, the patient's symptoms ultimately expand seriously, and an escalating loop between OCD symptoms and FA behaviors is established.

Selective serotonin reuptake inhibitors (SSRIs) and exposure-based cognitive-behavioral therapy (CBT) make up the standard first-line pharmacotherapy and psychotherapy options for OCD treatment (6, 19, 20). However, approximately half of individuals with OCD do not benefit from standard treatments and become refractory (21, 22). Factors associated with poor response to treatment of OCD have been widely reported, and there is some consensus among healthcare providers regarding these factors. For example, FA has been associated with poor treatment response in both adult and pediatric OCD patients, hindering the goals of CBT treatment and serving as an obstacle to the improvement of symptoms and family functioning in both pharmacological and psychotherapy regimens (10, 11, 13). Thus, the reduction of FA is increasingly referred to as an important part of the treatment plan and clinical target for OCD patients and even serves as a possible mediating factor of treatment outcomes (9, 12, 23, 24). As a result, the integration and management of FA as a plan to treat OCD patients could further advance the knowledge of OCD and improve clinical outcomes. In addition, research on FA will contribute to clinicians' understanding of the recognition, assessment and treatment outcomes of OCD.

Based on the abovementioned definition and various manifestations, several instruments have been developed to measure and individually assess FA by the pattern method of evaluation based on relatives' reports on the Family Accommodation Scale Interviewer-Rated (FAS-IR) and Family Accommodation Scale for OCD Self-Rated version (FAS-SR) (18, 25–27). The FAS-IR was originally developed by Calvocoressi et al. and was improved, revised and readjusted

from the 13-item FAS reported in 1999 (18). The FAS-IR was regarded as the gold standard inventory to measure FA behaviors, and has been adapted and translated into Brazilian Portuguese and Chinese versions (26, 28). The scale is extensively used in clinical and research settings and has demonstrated strong psychometric features (18, 26, 28). Unfortunately, some common disadvantages limit the use of clinician-administration instruments. First, it is costly and time-consuming to apply the instruments due to interviewer training and instrument administration. Second, it may miss some important information if the interviewees are unwilling to admit and report their responses to the OCD family member in the interviewer-rater investigation, especially when they realize that the patients' behaviors and/or requests were unreasonable. Third, the interviewers may easily recognize the distributed group in face-to-face interviews even if a blinded method is used in the random control study. As a result, the self-report questionnaire for assessing FA will improve the corresponding items and evaluate the occurrence or incidence of FA in a targeted manner by retaining the overall structure of the FAS-IR and refining the items. Compared with the clinician-rated instrument, the FAS-SR addresses these shortcomings and facilitates a more widespread collection of FA data. Additionally, the FAS-SR refers to family members who can independently measure and evaluate the incidence of FA according to the standard items and some examples, and the evaluation result is usually easy to understand.

Although FA in the OCD population has a relatively high incidence globally, individualized assessment of FA and associated factors related to treatment response is required in China (8). Similar to Western countries and other Asian countries, FA frequently occurs in family members of OCD patients in China according to our previous report and clinical experience (28, 29). However, few studies have emphasized OCD-related family pathology in the Chinese population. Although our previous study reported the Chinese version of the FAS-IR (28), the lack of these FAS-SR studies led to a lag in the development of family therapy and intervention for OCD patients, especially in regions with a paucity of trained clinical professionals. Therefore, the development and adaptation of the Chinese version of the FAS-SR will allow clinicians to observe and quantify the frequency and types of FAs in Chinese OCD patients and easily observe their associations with illness and as treatment-related variables based on relatives' understanding and realization.

This primary aim of this study is based on the abovementioned research in three ways. First, this study assessed the incidence of FA and examined the reliability and validity of the Chinese version of the FAS-SR. We hypothesized that the frequent incidence of FA behavior is based on the evaluation of the FAS-SR in individuals with OCD in China. Moreover, we hypothesized that the total score of the FAS-SR would be strongly correlated with the FAS-IR, which displayed excellent convergent validity. We also hypothesized that the FAS-SR scores would be moderately associated with symptom severity, poor family function and functional impairment in OCD patients. Second, exploratory factor analysis was performed to explore the factor structure of the FAS-SR. We hypothesized that FA has multiple constructs rather than a single construct. Third, the study aimed to explore a mediation model in which FA mediated the association between symptom severity and functional impairment. We hypothesized that FA would mediate the relationship between OCD symptom severity and functional impairment.

Materials and methods

Participants

The translation and adaptation procedures of the family accommodation scale have been reported in our previous study (29). Additionally, the recruitment strategy for patients and corresponding relatives and the inclusion and exclusion criteria have been reported in detail (28). One relative was paired with each OCD patient in this study. Because information on 26 family members was lost, a total of 171 patients and 145 paired relatives were recruited from a specialized OCD outpatient clinic in Xiamen Xianyue Hospital from 2018 to 2020 for the present study. All patients and relatives provided informed consent before the beginning of the investigation, and the protocol of the study was reviewed by the Xiamen Xianyue Hospital ethics commitment (2018-KY-010).

Measures

To ensure the stability of the result, the FAS-SR was first self-reported for the family member, and then, the trained interviewer evaluated the FAS-IR based on the blinded results of the FAS-SR. The instruments were detailed as follows. The assessments of patients and relatives were conducted in different rooms so that the relatives and OCD patients could respond without interference. The aim of the decision was to create a comfortable environment in which the relatives of OCD patients could thoroughly express and report their experiences of frustration or other negative emotions toward OCD patients. If a patient went to the clinic alone, the corresponding relative agreed to an interview at the next clinic in 7- to 10- days. The retest assessment of the FAS-SR was measured between 7 and 10 days in a partial sample.

A specifically created questionnaire was used to collect demographic and clinical variables for OCD patients, such as age, gender, educational level, marital status, occupational

status, region, religion, age at the onset of symptoms, course period of illness and treatment, and family history of OCD. Demographic variables for family members included age, gender, educational level, marital status, and relationship with patients.

Self-report measure

Family accommodation scale for obsessive compulsive disorder self-rated (FAS-SR)

The original version of the FAS-SR was developed by Pinto et al. to measure the frequency of FA in the past week based on the first section of the OCD symptoms checklist, which was self-reported by the patients' relatives (25). The structure of the FAS-SR was identical to that of the FAS-IR, which included two sections, a symptom checklist and 19 items on accommodating behaviors. To help relatives more thoroughly understand and accurately comprehend their FA behaviors, some wording and the structuring of these FA items were modified in the FAS-SR (25). Some items from the FAS-IR that were originally evaluated by one item were individually divided into two items in the FAS-SR. For example, the item providing reassurance in FAS-IR was divided into two items about providing reassurance of obsession and compulsion. The FAS-SR item description and content were made clearer and more comprehensive, and more information and examples were provided in comparison to the FAS-IR. Consistent with the FAS-IR scoring method, the 19 items are scored on a 5-point Likert scale, and the responses are none, 1/week, 2–3/week, 4–6/week, and every day. The total score of the scale ranges from 0 to 76, and higher scores demonstrate more severe FA behaviors. The FAS-SR has been widely used in clinical and research settings, and has been adapted and translated into different languages (27, 30, 31). The average time of assessment of the FAS-SR was 24.42 ± 7.09 minutes.

Sheehan disability scale (SDS)

The SDS was administered to assess the patients' functional impairment for all psychiatric disorders and is widely used in clinical and research settings (32). The SDS includes three domains: work/academic, social life/leisure, and family/home responsibilities. The total scores of the scales range from 0 to 30, and are measured on a visual analog scale as 0 (no impairment), 1–3 (moderated), 4–6 (moderated), 7–9 (marked), or 10 (extreme). The SDS has demonstrated good reliability and validity (32, 33).

Obsessive compulsive inventory revised (OCI-R)

The OCI-R is an 18-item scale used to evaluate OCD symptom dimensions in the past month for OCD patients (34–36). The scale includes six dimensions: obsessing, washing, checking, hoarding, neutralizing, and ordering symptoms. The total scores ranged from 0 to 72, and every item was measured on a 5-point scale from 0 to 4 (not at all, a little, moderately, a lot, and extremely). The scale displayed strong psychometric properties in OCD patients and non-clinical individuals (36). The OCI-R has also been widely used in OCD symptom assessment and improvement in both clinical practice and research settings (34, 37).

Zung self-rating depression scale (Zung SDS)

The scale is a 20-item self-report by patients about their depression (38). Every item of the scale is scored 1–4 (1 = a little of the time, 2 = some of the time, 3 = a good part of the time, 4 = most of the time). The Zung SDS is widely used in the clinic to evaluate some moods and conditions related to some patients with psychiatric disorders (38). The scale has displayed satisfactory psychometric features (39).

Family assessment device general functioning (FAD-12)

The FAD-12 was extracted from the original FAD and evaluates family functioning with 12 items for both patients and their relatives (40–42). The scale includes 6 forward-scored and 6 reverse-scored items, which measure responses on a scale from 1 to 4 for a total score of 12–48. Higher scores on the scale indicated worse levels of family functioning. The FAD-12 has been identified as a brief scale to measure family functioning with excellent reliability and validity (41).

Clinical interview measure

Family accommodation scale interviewer-rated (FAS-IR)

The FAS-IR is a 12-item clinician-rated semistructured instrument that is regarded as the gold standard in measuring accommodating behaviors (18). The FAS-IR was first developed by Calvocoressi et al. and was revised and improved from the 13-item FAS in 1999 (18). The instrument includes two sections, the OCD symptom checklist and 12 items on accommodating behaviors. The first section includes eight kinds of obsession, seven kinds of compulsion, and five kinds of other OCD-related problems. The interviewer obtains information from the family member regarding the patient's symptoms in the previous week and assesses the extent to which the family member participates in accommodating the patient's symptoms. The second section elaborates on an OCD relative's reports of the type of FA behaviors and the level of interference they engage in (18, 26). Each item includes common examples of accommodating behaviors, but the interviewers may wish to develop additional examples based on information collected from the relative's report of the patient's symptoms. The total scores of the scale range from 0 to 48, and responses are scored on a 5-point Likert scale (0 = none, 1 = 1/week,

2 = 2–3/week, 3 = 4–6/week, 4 = everyday; 0 = not at all, 1 = mild, 2 = moderate, 3 = severe, 4 = extreme). The FAS-IR has excellent psychometric properties and has been commonly used to evaluate the reduction in FA as a treatment target in studies of OCD patients' family-based psychotherapy (13, 18, 26). The Chinese version of the FAS-IR was reported in 2021 and has satisfactory reliability and validity (28).

Clinical global impression of severity scale (CGI-S)

The CGI-S was extracted from the CGI and has a single item to assess the overall clinical severity of the patients' symptoms and functional impairment (43). The total score ranges from 0 (healthy) to 6 (extremely or severe mental illness). The CGI-S was widely exploited in clinical and research settings, and the instrument had satisfactory properties in previous studies (43, 44).

Global assessment of functioning (GAF)

The GAF is a single item that measures the overall psychosocial and occupational functioning of individuals with a mental illness (45). The total score ranges from 1 to 100 and is divided into 10 equal intervals. A lower scale score shows worse global psychosocial function. The GAF is frequently used in both research and clinical settings and has adequate reliability and validity (45).

Yale-Brown obsessive compulsive scale (Y-BOCS)

The Y-BOCS is a 10-item instrument that evaluates OCD symptom severity in the past month and is regarded as the gold standard instrument to measure changes and improvement in severity during OCD treatment (46–48). The scale includes two subscales, with five items about obsessions and five items about compulsions. The scale is widely used in both clinical and non-clinical settings. The total scores range from 0 to 40, and every item is scored 0–4 (none, mild, moderate, severe, and extreme). The Y-BOCS has demonstrated satisfactory reliability and validity (46, 49). In the present study, the severity of OCD was assessed by the Y-BOCS based on the patient's experience and the compulsive subscale based on the relative's report.

Statistical analyses

The level of agreement between family members' observations and understanding of the OCD patients' symptom dimensions on the FAS-IR and the FAS-SR was examined by the kappa coefficients. The item-level frequencies and Cronbach's alpha coefficient were used to assess the reliability of the FAS-SR. The intraclass correlation coefficient (ICC) was calculated to evaluate the agreement between the FAS-SR and FAS-IR total scores. Exploratory factor analysis was employed to understand the factor structure of the FAS-SR. Primary components were extracted using varimax rotation, and eigenvalues were calculated to assess the amount of variance accounted for by a factor. The number of factors was determined based on both eigenvalues greater than 1 and screen plots. Two-way mixed consistency was used in the test-retest between the first and retested assessments of the FAS-SR. Spearman correlation coefficients were calculated to evaluate the convergent validity of the total FAS-SR scores associated with the FAS-IR, Y-BOCS, SDS, GAF, and FAD-12 scores based on the non-parametric distribution. The magnitude of associations between the total FAS-SR and FAS-IR scores on each of the criterion measures was compared by Steiger's Z test (50).

Mediation analyses were performed to examine whether FA as measured on the FAS-SR mediated the relationship between symptom severity and functional impairment using the PROCESS macro for SPSS (51), which utilizes the bootstrapped standard errors method for the direct and indirect effects of the mediator variable. The basic information of this procedure is the same as the class Baron and Kenny method, but this approach was required to increase statistical power through bootstrapping procedures and take measures to specific tests for the mediated effect. The number of bootstrapped resamples was set at 5,000, and the indirect mediation effect was regarded as significant when the exclusion of zero was between the 95% confidence intervals.

All analyses were performed using the Statistical Package for the Social Science (SPSS) version 21.0. $P < 0.05$ was used to determine statistical significance.

Results

Frequency data for the family accommodation scale self-rated

A total of 171 patients and 145 paired relatives participated in the survey because 26 relatives did not complete the interview. **Table 1** describes the demographic and clinical information of the participants. The age range of patients was 18–78 years old, with a mean age of 30.90 ± 10.61 years, and 54.4% were females. The relatives included 73 (50.3%) parents, 68 (46.9%) spouses and 4 (2.8%) others. The age range of relatives was 23–74 years old, with a mean age of 44.40 ± 10.54 years, and 53.8% were females. There were no significant differences in patient age, gender, or the total Y-BOCS scores of patients based on either patient or relative reports between relatives who completed the FAS-SR and those who did not (all $P > 0.05$).

10.3389/fpsyt.2022.970747

TABLE 1 Demographic and clinical characteristics of participants.

Variables	Patients (n = 171)	Family members (n = 145)
Age (years) (Mean ± SD)	30.91 ± 10.61	44.40 ± 10.54
Gender- n,%		
Female	93 (54.4)	78 (53.8)
Educational level- n,%		
Primary school and below	8 (4.7)	15 (10.3)
Junior middle school	19 (11.1)	27 (18.6)
High school	53 (31.0)	39 (26.9)
College and above	91 (53.2)	64 (44.2)
Marital status- n,%		
Married	90 (52.6)	135 (93.1)
Occupational status- n,%		
Employed	68 (39.8)	93 (64.1)
Retired	3 (1.8)	15 (10.3)
Housewife	18 (10.5)	13 (9.0)
Unemployed	34 (19.9)	10 (6.9)
Student	41 (24.0)	1 (0.7)
Other	7 (4.1)	13 (9.0)
Region- n,%		
Urban	124 (72.5)	101 (69.7)
Suburban	8 (4.7)	7 (4.8)
Rural	39 (22.8)	37 (25.5)
Age at the onset of symptom (years) (Mean ± SD)	23.88 ± 10.73	–
Illness duration (years) (Mean ± SD)	7.04 ± 7.16	–
Treatment duration (years) (Mean ± SD)	2.47 ± 4.47	–
Relationship with patient- n,%		
Parents	–	73 (50.3)
Spouse	–	68 (46.9)
Other*	–	4 (2.8)

*Include adult child, sibling, and significant other.

Table 2 compares the agreement of relatives' proportion of OCD symptom dimensions between the FAS-SR and FAS-IR. There was significant agreement on relatives' proportion of types of OCD symptoms between the two scales, except for miscellaneous compulsions.

Table 3 displays the frequency data for items on the FAS-SR. In sum, the proportion of participants who endorsed at least one, and daily (or an extreme) type of accommodating behavior in the past week was 97.9 and 56.6%, respectively. Both the provision of reassurance associated with obsessions (71.7%) and the reduction of leisure time (67.6%) were the most common phenomena. In addition, approximately half of the relatives believed that they provided reassurance about compulsions (59.3%), avoided talking about OCD triggers (62.8%), stopped themselves from doing things that could trigger OCD behaviors (54.5%), did not stop unusual OCD-related behaviors (53.8%), and changed their work/school schedules (53.1%). The least frequently endorsed accommodating behaviors included helping patients prepare food (29.0%), making it possible for patients to perform compulsions (23.4%), and providing items needed to perform compulsions (22.6%).

The total FAS-SR score ranged from 0 to 68, and the mean of the total scores was 20.01 ± 14.39.

The factor structure of the family accommodation scale self-rated

There were five factors with eigenvalues greater than 1 (6.065, 1.716, 1.434, 1.209, and 1.067). According to the results of the screen plot and the eigenvalue figures, the three factors of the scale were more reasonable and were finally identified. Moreover, both Bartlett's test was 940.427 (df = 171, P < 0.001), and Kaiser-Meyer-Olkin (KMO) was 0.844, indicating that the sample was appropriate for describing factor analysis. The cumulative contribution rate was 48.50%. The scale included three

TABLE 2 The agreement in relatives' endorsement of patient OCD symptom categories on FAS-IR vs. FAS-SR (n = 145).

Symptom dimension	FAS-IR		FAS-SR		Kappa	*P*
	n	100%	n	100%		
Obsessions						
Harming obsessions	62	42.8	58	40.0	0.574	<0.001
Contamination obsessions	89	61.4	83	57.2	0.686	<0.001
Sexual obsessions	2	1.4	2	1.4	–	–
Saving/losing obsessions	21	14.5	27	18.6	0.452	<0.001
Religious obsessions	14	9.7	15	10.3	0.349	<0.001
Obsession with need for symmetry or exactness	28	19.3	46	31.7	0.360	<0.001
Somatic obsessions	36	24.8	40	27.6	0.501	<0.001
Miscellaneous obsessions	51	35.2	71	50.0	0.445	<0.001
Compulsions						
Cleaning/washing compulsions	101	69.7	98	67.6	0.664	<0.001
Checking compulsions	82	56.6	78	53.8	0.554	<0.001
Repeating rituals	46	31.7	49	33.8	0.546	<0.001
Counting compulsions	12	8.3	15	10.3	0.225	0.006
Ordering/arranging compulsions	19	13.1	14	9.7	0.693	<0.001
Saving/collecting compulsions	7	4.8	8	5.5	0.508	<0.001
Miscellaneous compulsions	56	38.6	78	53.8	0.241	0.002

factors: (1) providing reassurance, participation, (2) facilitation, and (3) modification. The details are described in Table 4.

Reliability and validity

The FAS-SR demonstrated Cronbach's alpha of 0.879, and the corresponding Cronbach's alpha of three factors were 0.826 (factor 1), 0.741 (factor 2) and 0.746 (factor 3), respectively. Additionally, the total FAS-IR score ranged from 0 to 44, with a mean of 13.49 ± 8.24. The ICC between the FAS-SR and FAS-IR scores was 0.795 (95% CI, 0.715–0.852).

A total of 16 relatives were evaluated to measure the test-retest reliability. The ICC was 0.97 (95% CI: 0.92–0.99) between the first assessment (P50:28, P25-P75:7–38) and retest assessment (P50:25, P25-P75:6.25–30). There were no statistically significant differences in age, gender, or Y-BOCS total scores of OCD patients rated by relatives' reports between the relatives who completed and did not complete the retest of the FAS-SR (all $P > 0.05$).

A higher level of FA was significantly associated with more severe symptom severity in OCD patients measured by the Y-BOCS based on relative reports (r_s = 0.327, $P < 0.05$) but was slightly significantly associated with patient reports (r_s = 0.188, P = 0.023). In addition, a higher total FAS-SR score was associated with a worse level of family function (r_s = 0.157, P = 0.060 for patient interview, r_s = 0.342, $P < 0.001$ for relative-rated), a higher level of functional impairment (r_s = 0.286, $P < 0.001$), OCI-washing (r_s = 0.357, $P < 0.001$), OCI-ordering (0.181, P = 0.030), and a lower GAF score (r_s = -0.399, $P < 0.001$). There was no statistical association between the FAS-SR scores and Zung SDS scores (r_s = 0.048, P = 0.563). The results of Steiger's Z test demonstrated that there was no significant difference between the FAS-IR and FAS-SR on each of the criterion instruments. The results are displayed in Table 5.

Mediation of the relationship between symptom severity and functional impairment by family accommodation

This model examined whether FA was a mediator variable to measure the relationship between symptom severity on the clinically administered Y-BOCS and functional impairment, controlling for patient age, gender, educational level, marital status, occupational status and region. The results demonstrated that FA significantly and independently mediated the association between symptom severity and functional impairment (a*b path, β = 0.0548, 95% CI: 0.0033–0.1270). Higher symptom severity was associated with higher FA score, and FA score was positively associated with functional impairment. The direct effect of symptom severity on OCD functional impairment remained significant after the inclusion of mediators (c' path,

TABLE 3 The percentage of FAS-SR items.

FAS-SR items	Mean ± SD	Item-total r	Alpha if removed	Range	Frequency of endorsement					Percentage[a]
					0	1	2	3	4	
1. Reassured patient that there were no grounds for OCD concern	1.77 ± 1.47	0.481	0.868	0–4	41 (28.3)	27 (18.6)	27 (18.6)	24 (16.6)	26 (17.9)	104 (71.7)
2. Reassured patient that compulsions took care of OCD concern	1.43 ± 1.49	0.466	0.868	0–4	59 (40.7)	24 (16.6)	26 (17.9)	13 (9.0)	23 (15.9)	86 (59.3)
3. Waited for patient	1.26 ± 1.52	0.362	0.869	0–4	75 (51.7)	15 (10.3)	18 (12.4)	17 (11.7)	20 (13.8)	70 (48.3)
4. Directly participated in compulsions	0.99 ± 1.49	0.480	0.867	0–4	91 (62.8)	12 (8.3)	15 (10.3)	6 (4.1)	21 (14.5)	54 (37.2)
5. Made it possible for patient to complete compulsions	0.48 ± 0.99	0.555	0.866	0–4	111 (76.6)	12 (8.3)	14 (9.7)	3 (2.1)	5 (3.4)	34 (23.4)
6. Provided items needed to perform compulsions	0.47 ± 1.01	0.460	0.869	0–4	112 (77.2)	13 (9.0)	10 (6.9)	5 (3.4)	5 (3.4)	33 (22.6)
7. Made it possible for patient to avoid OCD triggers	0.94 ± 1.39	0.390	0.869	0–4	88 (60.7)	18 (12.4)	15 (10.3)	8 (5.5)	16 (11.0)	57 (39.3)
8. Helped patient make simple decisions	0.68 ± 1.06	0.435	0.868	0–4	91 (62.8)	25 (17.2)	17 (11.7)	8 (5.5)	4 (2.8)	54 (37.2)
9. Helped patient with personal tasks	0.56 ± 1.14	0.430	0.869	0–4	110 (75.9)	11 (7.6)	10 (6.9)	6 (4.1)	8 (5.5)	35 (24.1)
10. Helped patient prepare food	0.77 ± 1.36	0.405	0.868	0–4	103 (71.0)	11 (7.6)	3 (3.3)	10 (6.9)	14 (9.7)	42 (29.0)
11. Took on patient's family or household responsibilities	1.10 ± 1.50	0.374	0.869	0–4	85 (58.6)	10 (6.9)	8 (8.8)	10 (6.9)	20 (13.8)	60 (41.4)
12. Avoided talking about OCD triggers	1.68 ± 1.62	0.405	0.872	0–4	54 (37.2)	23 (15.9)	8 (8.8)	16 (11.0)	34 (23.4)	91 (62.8)
13. Stopped self from doing things that could trigger OCD	1.50 ± 1.63	0.429	0.868	0–4	66 (45.5)	18 (12.4)	8 (8.8)	15 (10.3)	31 (21.4)	79 (54.5)
14. Made excuses or lied for patient to cover up OCD	0.50 ± 0.92	0.273	0.874	0–4	100 (69.0)	28 (19.3)	5 (5.5)	3 (2.1)	4 (2.8)	45 (31.0)
15. Didn't stop unusual OCD-related behaviors	1.37 ± 1.53	0.304	0.871	0–4	67 (46.2)	17 (11.7)	15 (16.5)	10 (6.9)	25 (17.2)	78 (53.8)
16. Put up with unusual conditions in home due to OCD	1.06 ± 1.49	0.324	0.871	0–4	88 (60.7)	8 (5.5)	11 (12.1)	8 (5.5)	20 (13.8)	57 (39.3)
17. Cut back on leisure time	1.51 ± 1.42	0.549	0.870	0–4	47 (32.4)	35 (24.1)	14 (15.4)	14 (9.7)	22 (15.2)	98 (67.6)
18. Changed my work/school schedule	1.12 ± 1.36	0.560	0.868	0–4	68 (46.9)	32 (22.1)	10 (11.0)	7 (4.8)	17 (11.7)	77 (53.1)
19. Put off my own family responsibilities	0.83 ± 1.22	0.442	0.869	0–4	84 (57.9)	30 (20.7)	10 (11.0)	8 (5.5)	10 (6.9)	98 (42.1)

FAS-SR, Family Accommodation Scale for Obsessive-compulsive Disorder, Self-reported. 0 = none/never, 1 = 1 day, 2 = 2–3 days, 3 = 4–6 days, 4 = every day. [a] Percent of respondents reporting frequency of accommodation as "often-at least once per day" or greater (≥1).

10.3389/fpsyt.2022.970747

TABLE 4 Exploratory factor analysis of the Chinese version of the FAS-SR.

FAS-SR items	Factor 1	Factor 2	Factor 3
5. Made it possible for patient to complete compulsions	**0.753**	0.176	0.175
6. Provided items needed to perform compulsions	**0.693**	0.205	0.017
7. Made it possible for patient to avoid OCD triggers	**0.675**	0.150	0.019
4. Directly participated in compulsions	**0.644**	0.058	0.272
2. Reassured patient that compulsions took care of OCD concern	**0.618**	0.064	0.223
3. Waited for patient	**0.604**	0.204	0.047
1. Reassured patient that there were no grounds for OCD concern	**0.602**	0.072	0.242
15. Didn't stop unusual OCD-related behaviors	**0.498**	0.203	0.124
8. Helped patient make simple decisions	**0.473**	0.393	0.155
9. Helped patient with personal tasks	0.286	**0.712**	-0.015
10. Helped patient prepare food	0.193	**0.701**	0.165
11. Took on patient's family or household responsibilities	0.139	**0.637**	0.259
14. Made excuses or lied for patient to cover up OCD	-0.023	**0.628**	0.154
16. Put up with unusual conditions in home due to OCD	0.320	**0.484**	0.049
13. Stopped self from doing things that could trigger OCD	0.227	**0.464**	0.356
17. Cut back on leisure time	0.118	0.061	**0.859**
18. Changed my work/school schedule	0.179	0.172	**0.789**
19. Put off my own family responsibilities	0.281	0.149	**0.611**
12. Avoided talking about OCD triggers	0.090	0.284	**0.570**
Cronbach's	0.826	0.741	0.746

FAS-SR, Family Accommodation Scale for Obsessive-compulsive Disorder, Self-rated.
The factor loadings $\geq$ 0.40 are marked in the bold.

TABLE 5 Convergent validity of FAS-SR with criterion measures as compared to FAS-IR.

	FAS-SR total	*P*	FAS-IR total	*P*	Steiger's Z[a]
Patients rated (*n* = 171)					
Y-BOCS total	0.188	0.023	0.289	<0.001	−1.756
Patient obsession severity	0.140	0.092	0.214	<0.001	−1.267
Patient compulsion severity	0.207	0.013	0.298	<0.001	−1.589
Patient global functioning (GAF)	−0.399	<0.001	−0.433	<0.001	0.637
Functioning impairment (SDS)	0.286	<0.001	0.300	<0.001	−0.248
Work/school	0.133	0.112	0.160	0.054	−0.460
Social life	0.290	<0.001	0.285	0.001	0.088
Family life/home responsibility	0.315	<0.001	0.344	<0.001	−0.521
Family global functioning (FAD)	0.157	0.060	0.158	0.057	−0.017
OCI total score	0.155	0.062	0.157	0.060	−0.034
OCI hoarding	0.107	0.217	0.013	0.878	1.583
OCI ordering	0.181	0.030	0.177	0.033	0.069
OCI checking	0.060	0.470	−0.036	0.666	0.404
OCI neutralizing	−0.025	0.767	0.013	0.876	−0.639
OCI obsessing	−0.036	0.669	−0.036	0.664	0.000
OCI washing	0.357	<0.001	0.414	0.000	−1.051
Zung SDS	0.048	0.563	0.134	0.108	−1.464
Relative rated (*n* = 145)					
Patient compulsion severity (Y-BOCS)	0.332	<0.001	0.436	<0.001	−1.944
FAS-IR total	0.749	<0.001	–	–	–
Family global functioning (FAD)	0.342	<0.001	0.373	<0.001	−0.564

[a]Two-tailed Z-critical is 1.96 for $P < 0.05$ and 2.58 for $P < 0.01$. FAS-SR, Family Accommodation Scale for Obsessive-compulsive Disorder, Self-rated. FAS-IR, Family Accommodation Scale for Obsessive-compulsive Disorder, Interviewer-Rated.

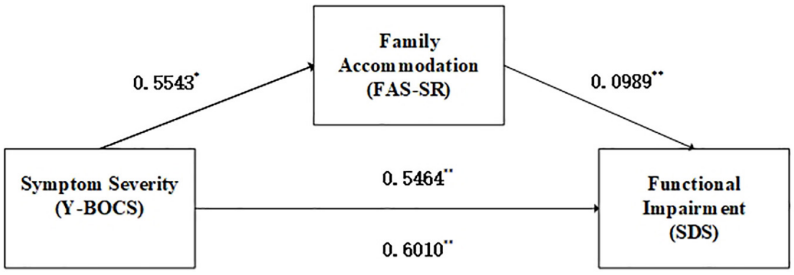

FIGURE 1
Mediation effects of family accommodation on symptom severity and functional impairment. *$P < 0.05$, **$P < 0.01$. Y-BOCS, Yale-Brown Obsessive-Compulsive Scale; FAS-SR, Family Accommodation Scale for OCD Self-rated version; SDS, Sheehan Disability Scale.

$\beta = 0.5464$, $SE = 0.1101$, $P < 0.001$). **Figure 1** illustrates the meditation model.

Discussion

To the best of our knowledge, this is the first study to report FAS-SR in adult OCD patients in China. Similar to previous reports, this study demonstrated that the Chinese version of the FAS-SR has satisfactory reliability and validity. The Chinese version of the FAS-SR can be widely used in Chinese OCD participants to assess and quantify family members' responses to the symptoms of their loved ones.

Consistent with previous research, family members reported high rates of FA, again confirming that FA is believed to be a common and ubiquitous phenomenon in Chinese family members of OCD patients (7–9, 18, 27, 30, 52). The results demonstrated that almost all subjects endorsed at least one kind of FA behavior, and more than half of the participants endorsed every day or had facilitated an extreme FA behavior within the past week. These results are also consistent with the original version in a previously reported study (25). Although the behaviors may be seemingly relatively innocuous, they unfortunately caused undesired consequences of symptom maintenance and reinforced OCD symptomology in the long run. The family members aimed to help the patients feel safe by relieving their in-the-moment anxiety and distress and not to disrupt daily life routines or time spent executing compulsions. However, FA was usually detrimental to the patients' long-term mental health and function by preventing OCD patients from habituating to anxiety and learning that the consequences they feared typically did not occur. As a result, the finding of a high incidence of FA affirmed that it is necessary to focus on the important role of FA in OCD occurrence, development, and outcome.

The most frequent FA behavior was offering reassurance about continued obsessions and cutting back on leisure time. Consistent with previous studies, the provision of reassurance related to obsessions also confirmed that this item was the most common type of accommodation (7, 8, 25, 27, 30, 52, 53). Compared to other obvious behaviors, this method of accommodation was perceived as more passive and with less direct involvement and participation, so this behavior was more common in relatives of OCD patients. On the other hand, making it possible for patients to perform compulsions and providing items needed to do compulsions were less frequently reported. There are more overt tasks that family members need to direct to take part in some compulsions. Overt tasks benefit from increased focus on direct family involvement compared to providing assurance, needing more time and increasing the burden.

Considering the high incidence of FA and common behaviors in relatives of OCD patients, it may be that professional policies should be developed to target these myriad behaviors and integrate the relatives into the treatment plan on evidence-based relative management strategies to help the patients with OCD better tackle OCD-related distress and anxiety with self-efficacy. Additionally, providing and popularizing some knowledge on proper psychoeducation about the deleterious consequences of FA, integrating family members into the patients' treatment and training them on appropriate responses to OC symptoms would increase family support and eliminate maladaptive behaviors.

As expected, the result of the test-retest analysis was excellent. To the best of our knowledge, this is the first study to explore the test-retest reliability of the FAS-SR. These results reinforced the stability of the self-reported instrument for assessing FA. In addition, internal consistency was similar to the original and other language versions of the FAS-SR, which reported coefficients of 0.90, 0.88, and 0.936, respectively, demonstrating strong internal consistency of the instrument (25, 27, 30). The results confirmed that the Chinese version of the FAS-SR had satisfactory reliability.

Because the sample size of the study taking the original version of the FAS-SR was too small, the factor structure of the FAS-SR was not explored (25). This hinders the contradistinction compared to the original version of the FAS-SR. Our result was not consistent with the Hindi versions

of the FAS-SR (30). The reasons for the difference between the Chinese and Indian language versions of the FAS-SR are as follows. Owing to some cultural differences between the two countries and the differences in the inclusion criteria for participants in the two studies, these discrepancies may explain the different factor structures of the Chinese and Hindi versions of the FAS-SR. Additionally, the multiple structure of the FAS-SR showed that the assessment of FA required the consideration and analysis of these problematic behaviors from different dimensions and aspects. In conclusion, the Chinese version of the FAS-SR displayed multiple structures, not a global structure.

The hypothesis that the total FAS-SR score was moderately correlated with several variables related to patient symptom severity and OCD-related family pathology was supported. In addition, the association between the FAS-SR score and observed variables did not differ from the association between the FAS-IR scores and the same observed variables (27, 52). The results were consistent with those reported by Pinto et al. in the original version of the FAS-SR (25). Moreover, our results are in accordance with previous reports that demonstrated severe FA behaviors related to poorer family functioning, higher symptom severity, and more severe functional impairment (52, 53). These results suggested that dysfunctional family interactions, family conflict and distress due to the home environment described FA behaviors.

Consistent with the hypothesis, the total score of the FAS-SR was significantly associated with OCD symptom severity in both patient-rated and relative reports, and the relationship was very weak. This result was consistent with the majority of previous reports, especially from a recent meta-analysis (25, 30), and it was likely that OCD patients who displayed higher symptom severity demand increased FA behavior. However, the result was inconsistent with a study of the Japanese population reported in 2016 (27). Compared to the association between the total FAS-IR scores and patient-rated OCD symptom severity, the figure was relatively lower than the abovementioned results, even though the difference was not statistically significant. There was a possibility that the relatives of OCD patients underestimated their accommodating behaviors by self-reporting despite the existence of severe OCD symptoms. Moreover, family members may believe their accommodating behavior is simply supportive of OCD patients. Additionally, the reported high levels of shame, embarrassment and stigma attached to OCD often result in the patients intentionally ignoring and decreasing OCD symptom severity. In addition, it should be emphasized that the relationship between OCD symptom severity and FA is likely bidirectional, necessitating future longitudinal investigations to understand its clinical course.

Similar to previous studies, in regard to the clinical correlates of FA in OCD, poor family functioning, washing symptoms, higher CGI-S scores, and lower GAF scores were significantly correlated with the total FA score (25, 27, 30, 50). These results supported the hypothesis that some factors were significantly associated with the total FA scores, and the FAS-SR had good convergent validity. The symptom of OCI washing was the most common symptom reported. This result may have application in the clinic, especially when doctors encounter patients who have this primary symptom. However, some other symptoms were not associated with FA, which is particularly true if the patient struggles with sharing behaviors perceived as grotesque or amoral, making him or her less prone to seek accommodation from family members. Owing to the limitation of the research design, it was not obvious that the family members had such psychopathologies before or after the onset of OCD symptoms. There was no statistical association between the FAS-SR and Zung SDS scores, and the results showed that the FAS-SR displayed excellent discrimination validity.

Inconsistent with the hypothesis, FA partially mediated the relationship between symptom severity and functional impairment. Similar to previous reports, the mediation model demonstrated that more severe OCD symptomology was linked with increased FA behaviors, which ultimately caused greater functional impairment in OCD patients (9). Contrary to the hypothesis, the direct effect of symptom severity on functional disability-associated OCD remained significant in the mediation model. Piacentini et al. also reported a change in FA before the change in OCD symptom severity and functional impairment, suggesting the importance of reducing accommodating behaviors to decrease symptom severity and functional impairment (54). Therefore, regarding their respective contributions to functional impairment in OCD patients, the results showed the importance of identifying FA behaviors and targeting symptom severity. In conclusion, it is important to target these FA behaviors in OCD evaluation and treatment. As such, family-based treatments designed to target these specific symptoms and integrate family members in the therapeutic process are expected to be particularly efficacious.

Based on the study design and other factors, future research should explore the shortcomings related to this study. First, because the FAS-SR and FAS-IR had differences in the number of items and the response options, the FAS-SR was developed based on the structure of the FAS-IR. As a result, there was no way to compare each individual item between the FAS-SR and FAS-IR. Second, our study design was not designed to evaluate the sensitivity of FA to changes in treatment. It is necessary to conduct follow-up studies to understand the relationship between the accommodating behavior and treatment outcome of OCD in future studies. Third, these findings should be considered within the limitations of developing a meditation model in a cross-sectional design. Fourth, the FAS-SR reported that one's own behavior was susceptible to certain biases and different levels of understanding, and it was limited to people with low levels of education. Because the sample of other relatives was small, the type of kinship should be diversified and balanced to assess how this variable affects the extent of

accommodating behaviors in future studies. In addition, the sample of the present study was insufficient to explore the factor structure of the FAS-SR with confirmatory factor analysis; future studies should include larger sample sizes to further understand the factor structure of the FAS-SR.

Conclusion

In sum, the FAS-SR could overcome the limitations of interviewer administration and systematically evaluate problematic behaviors based on the relatives' view and understanding. The FAS-SR provided the opportunity to target FA behaviors through relative self-report, which may be beneficial for reducing clinicians' time, saving labor costs and speeding up the diagnostic process compared to the use of clinician-administered instruments. Additionally, the present study filled a current gap in the literature by establishing a self-reported instrument for relatives of OCD patients that enables a standardized method of assessing FA behaviors in OCD patients and has some implications for clinical assessment, intervention and academic areas in China. First, the FAS-SR may be a cost- and time-effective instrument to evaluate the involvement of family members in OCD patients' symptoms, which could help clinicians identify the level of accommodation and obtain more detailed information on family behaviors. Second, given the high incidence of FA behaviors reported in this study and linking FA with family functioning, symptom severity, and functioning impairment, it seems that the evaluation of FA behaviors should be incorporated into all pretreatment assessments of OCD to help guide clinicians in the formulation of family-based treatment plans. Third, having more detailed information about the most common type of accommodating behaviors guides clinicians in their assessment of family dynamics, providing more specific psychoeducation and enabling the development of exposures and other desirable strategies to reduce FA behaviors. Fourth, FA partially mediated the relationship between symptom severity and functional severity. Given the association with decreased function and poorer treatment response, targeted intervention and treatment for those associations and construal are expected to improve the treatment outcome of OCD patients. In sum, these results demonstrated that the Chinese version of the FAS-SR has sound psychometric properties, which suggests that the instrument is a useful tool to measure FA and could aid in early treatment intervention and personalized treatment efforts in the future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Xiamen Xianyue Hospital Ethics Commitment. The patients/participants provided their written informed consent to participate in this study.

Author contributions

ZL, WZ, and LD designed the protocol in this study. ZL, CY, YC, and LD collected the data and performed the clinical assessment. ZL, CY, and YC analyzed the data. ZL wrote the manuscript. All authors contributed to and have approved the final manuscript.

Funding

This work was financially supported by the Xiamen Municipal Bureau of Science and Technology (Nos. 3502Z20189054 and 3502Z20194082).

Acknowledgments

We thank Lisa Calvocoressi and Fayong Li for providing original instruments and helping to translate and cross-culturally adapt of the Chinese version of FAS-SR. We would also like to sincerely thank the participants for their consideration cooperation.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychiatry

TYPE Systematic Review
PUBLISHED 06 September 2022
DOI 10.3389/fpsyt.2022.951925

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Anxiety and Stress Disorders, a section of the journal Frontiers in Psychiatry

RECEIVED 24 May 2022
ACCEPTED 01 August 2022
PUBLISHED 06 September 2022

CITATION
Strappini F, Socci V, Saliani AM, Grossi G, D'Ari G, Damato T, Pompili N, Alessandri G and Mancini F (2022) The therapeutic alliance in cognitive-behavioral therapy for obsessive-compulsive disorder: A systematic review and meta-analysis.
Front. Psychiatry 13:951925.
doi: 10.3389/fpsyt.2022.951925

The therapeutic alliance in cognitive-behavioral therapy for obsessive-compulsive disorder: A systematic review and meta-analysis

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Background: The therapeutic alliance has been recognized as one of the most researched key elements of treatment across different therapeutic approaches and diagnostic domains. Despite its importance, our current understanding of its clinical relevance in patients with obsessive-compulsive disorder (OCD) is still debated. This study aimed to examine empirical evidence on the effect of alliance on treatment outcomes in Cognitive Behavioral Therapy (CBT) in patients with OCD in a systematic review and meta-analysis.

Methods: Original peer-reviewed articles until March 2022 were included if they were (1) written in English; (2) included a clinical group with a current primary OCD diagnosis; (3) involved individual CBT; (4) used a validated therapeutic alliance scale that was related to the outcome measurement; (5) reported an effect size.

Results: Thirteen studies were included, six of which contained sufficient statistical information to be included in the meta-analysis. A total of 897 patients took part in all reviewed studies. We found a modest effect of alliance on post-treatment outcome [$Tau^2 = -0.1562$ (*C.I. 95%*: −0.2542 to −0.0582)].

Discussion: The results show the existence of considerable variability and methodological inconsistencies across studies. We discuss the role of methodological factors that could account for this divergence, the research limitations, and the implications for current research.

Systematic review registration: [https://osf.io/dxez5/?view_only=bc2deaa7f0794c8dbef440255b2d4b3b].

KEYWORDS

OCD, therapeutic relationship, alliance-outcome association, working alliance, therapeutic alliance

Introduction

Obsessive-Compulsive Disorder (OCD) is a serious mental health condition characterized by recurrent and persistent thoughts, urges, or images that are experienced as highly disturbing and intrusive (obsessions) and/or stereotyped recurrent mental or physical behaviors aimed to ignore or neutralize them (compulsions) (1). OCD symptom domains typically include contamination obsession and washing/cleaning compulsion; obsession concerning responsibility for harm, injury, or bad luck and checking compulsion; unacceptable obsessional thoughts concerning sex, violence, or religion associated with mental neutralizing strategies; obsession about symmetry, completeness, and exactness and ordering compulsion (2). Given the complexity and heterogeneity of symptoms, several genetic, behavioral, and cognitive models have been proposed to explain the mechanisms behind this spectrum [e.g., (3–6)].

The estimated lifetime prevalence of the full disorder is approximately 2–3%, with most individuals with OCD being affected before their mid-twenties (7, 8). OCD shows a chronic course, and it is highly comorbid with anxiety disorders and major depressive disorder (9). In the absence of effective treatment, OCD results in significant distress, functional impairments in social and occupational functioning, and reduced quality of life. Therefore, it is considered a disabling mental health condition associated with significant personal and socio-economic costs (10).

A combined approach that includes cognitive therapy and behavioral therapy represents the currently recommended psychological treatment of choice for OCD (11), showing the highest degree of empirical support in meta-analytic investigations [e.g., (12–14)]. According to NICE guidelines, it is recommended a "stepped care" model, with increasing intensity of treatment according to clinical severity and complexity (2005). This treatment includes exposure with response prevention (EX/RP) with or without OCD-focused cognitive therapy (CT). EX/RP is a behavioral therapy that comprises the implementation of a series of in-session and between-session exposures that are planned and implemented through collaboration between patient and therapist. The treatment generally includes more or less prolonged exposure to obsessional triggers and procedures aimed at blocking rituals. Although the optimal frequency of sessions has not been defined, both intensive, which involves daily sessions over 1 month, and weekly sessions, have been proved effective in reducing symptoms (15, 16). Compared to medications alone, EX/RP protocol is more effective with a lower relapse rate (17). However, despite the effectiveness of such structured, evidence-based treatment, up to 18.7% of OCD patients will drop out prior to completion of treatment (18). Further, about 50% of OCD patients still complain about some residual symptoms even after successful treatment, with a negative impact on their quality of life (19–21). Indeed, a significant proportion of OCD patients receiving cognitive and behavioral therapies is subjected to post-treatment relapse, with an estimated full recovery rate of approximately 25% (22). Despite the undoubtedly high impact that CT and EX/RP exert on patients, there is still a significant degree of variability associated with treatment response. This variance cannot be fully explained by the effect of the specific treatment and probably needs to be accounted for by other variables. Therefore, identifying the complex factors associated with successful treatment outcomes is crucial to optimizing the delivery of evidence-based psychotherapeutic interventions.

In the last decades, research in the field of psychotherapy has increasingly focused on examining potential mechanisms of therapeutic change, aiming to identify predictors of treatment response. In this context, the therapeutic relationship variables received particular attention, especially in the operationalized construct of the alliance. From a transtheoretical perspective, the alliance can be defined as a collaborative stance between client and therapist, underpinned by three components: (a) consensus on therapeutic goals, (b) agreement on therapeutic tasks, and (c) a positive bond between client and therapist (23). The therapeutic alliance is historically defined as a "non-specific" interpersonal factor auxiliary to technical procedures that produce change (24). Cognitive-behavioral perspective emphasizes the collaborative nature of the therapeutic alliance. Within this framework, the alliance is conceptualized as a necessary but not sufficient therapeutic change factor (25, 26), allowing the creation of trust and safety conditions between patient and therapist that, in turn, facilitate the application of specific techniques.

Nevertheless, the therapeutic alliance is widely recognized as a crucial component of treatment across all psychotherapeutic approaches. Accordingly, a substantial number of empirical research have been addressed to explore the association between alliance and post-treatment outcomes. In this respect, the recent Third Interdivisional APA Task Force on Evidence-Based Relationships and Responsiveness synthesized empirical studies investigating the association between the therapeutic relationship and outcome and suggested alliance as a "demonstrably effective" ingredient of the therapeutic change process across treatments and diagnoses (27). On the whole, literature accumulated so far suggest that the alliance is moderately associated with treatment outcomes in a transdiagnostic way (28–33), yet its impact on process change has been sparsely investigated in specific disorders. Indeed, most experimental and meta-analytic studies estimate the alliance-outcome association by aggregating disorders and treatments. However, evidence suggesting potential differences across disorders also exists, with some diagnostic groups being more affected by therapeutic alliance than others (34, 35). For instance, the alliance seems to have less impact on severe anxiety disorders, substance abuse, and eating disorders than on other disorders, such as depression (27, 32, 36–38). Notably,

investigating how the alliance works for specific disorders has been delineated as one of the key questions for future studies by the Third Interdivisional APA Task Force on Evidence-Based Relationships and Responsiveness (27).

In this respect, no systematic review to date has been specifically aimed at exploring the alliance-outcome relationship in individuals receiving Cognitive-Behavioral Therapy (CBT) for OCD.

Although OCD is no longer categorized as an anxiety disorder in the DSM based on significant diagnostic validators, it is important to highlight that a substantial overlap between OCD and the anxiety disorders is still acknowledged by many clinicians and researchers [e.g., (39)]. For this reason, some recent reviews pulled together OCD with disorders like post-traumatic stress disorder, generalized anxiety disorder, and social anxiety disorder. Specifically, two recent qualitative reviews on the role of therapeutic alliance in anxiety-related disorders (32, 33) added a contribution to this research area. In their critical review, Buchholz and Abramowitz (32) provided an overview of existing research on the alliance-outcome relationship in exposure therapy for anxiety-related disorders, including OCD. Results suggest a link between a strong alliance and symptom reduction in EX/RP therapy for OCD, with some evidence indicating that task and goal alliance dimensions, relative to the bond alliance, were the strongest predictors of post-treatment outcome, along with treatment adherence. Importantly, this critical literature review also revealed substantial methodological and conceptual differences among investigations, including alliance assessment tools, timing and perspective of the alliance assessment, and diagnoses (32). Accordingly, in a subsequent critical review (33), the alliance-outcome relationship in CBT for anxiety disorders was also found to differ significantly across the timing of the alliance assessment (e.g., early, middle, and late assessment in the course of therapy), perspectives of the alliance rater (e.g., patient, therapist or observer-rated alliance), and specific alliance dimensions. However, it is important to note that the alliance-outcome relationship in OCD was not the primary focus of investigation in these recent literature reviews; further, both reviews restricted their critical analysis to adult samples and face-to-face therapies, potentially limiting the generalizability of the results to younger individuals with OCD as well as electronically delivered treatments such as internet-based CBT (iCBT).

Collectively, recent findings suggest a role of the alliance, particularly task and goal alliance dimensions, in predicting post-treatment outcomes in anxiety-related disorders, including OCD. Crucially, the literature accumulated so far has produced mixed findings potentially due to significant methodological and conceptual differences among studies (32, 33). Therefore, the effective role of the therapeutic alliance as a change mechanism in CBT for individuals with OCD remains unclear. The present systematic review and meta-analysis aimed to synthesize the available empirical studies investigating the relationship between therapeutic alliance and post-treatment outcomes with CBT in patients with OCD. Further clarifying the impact of the therapeutic alliance in the psychotherapeutic approach for individuals with OCD could enrich our understanding of effective therapeutic change factors implementing evidence-based treatments for this diagnostic group.

Materials and methods

The systematic review process was conducted according to the PRISMA guidelines (40–43)[1] and preregistered on Open Science Framework (OSF).[2] The PRISMA protocol consists of a 27-item checklist and a 4-phase flow diagram that guides the systematic review process (see **Figure 1**).

Research strategies

We conducted a systematic search of articles published in peer-reviewed journals articled indexed in the following electronic databases: *PubMed* (1949 to March 2022), *Scopus* (1788 to March 2022), *PsycINFO* (1806 to March 2022), *PsychArticles* (1800 to March 2022), and *Web of Science* (1900 to March 2022). The search strategy used Boolean combinations of the following keywords: ("obsessive-compulsive disorder" OR "OCD") AND ("therapeutic relationship" OR "working relationship" OR "collaborative relationship" OR "alliance" OR "working alliance" OR "helping alliance" OR "therapist factors" OR "mediator" OR "emotional bond" OR "alliance-outcome relationship"). Mendeley reference manager software[3] was used to import the references from the databases and to remove duplicates. The first screening was made by reading the title and abstract by the authors F.S. and V.S. The same authors read the full text of the selected studies. In addition to systematic searches in the above databases, we also searched for additional articles in the reference lists of the selected papers (i.e., backward research) and identified studies that cited the selected articles (i.e., forward research).

Eligibility criteria

According with our aims (i.e., investigating the relation between therapeutic alliance and outcome in OCD), we included studies that fulfilled the following criteria: (a) original, peer-reviewed articles; (b) written in English; (c) included a clinical

1 https://www.bmj.com/content/372/bmj.n71

2 https://osf.io/dxez5/

3 https://www.mendeley.com/reference-management/reference-manager

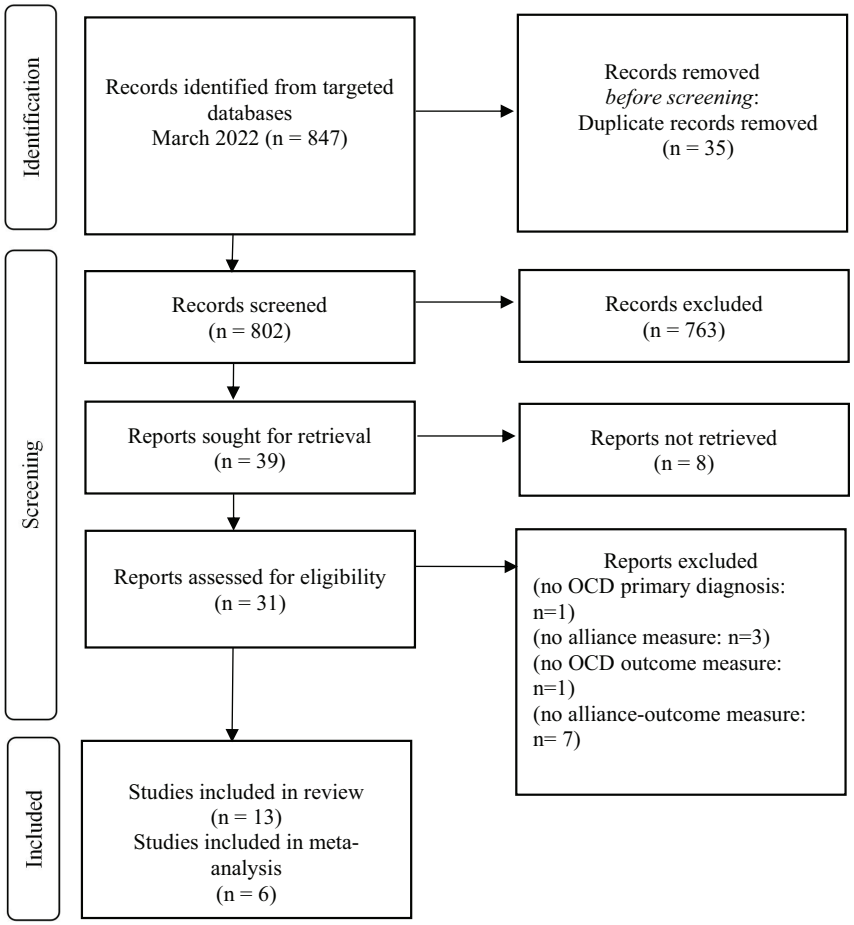

FIGURE 1
Flowchart of selection process for included articles.

group with a current primary OCD diagnosis; (d) were empirical and included quantitative data (i.e., reviews, case studies, and qualitative papers were excluded); (e) involved individual CBT; (f) used a validated therapeutic alliance scale with adequate psychometric properties (specifically, we included only studies that used the scales recommended by Martin et al. (31) and Elvins and Green (44) as core measures of the construct); (g) measured the relationship between therapeutic alliance and at least one systematic outcome measure (Yale-Brown Obsessive Compulsive Scale, Y-BOCS; Obsessive Compulsive Inventory, OCI) in the context of individual CBT for OCD; (h) a reported effect (*d* or *r*), its equivalent (standardized β weight), or other statistic (*t* or *F*) that could be converted to an effect. Articles from all publication years were accepted.

Data collection

Descriptive and quantitative data extraction was performed from each study and included: (a) metadata (i.e., authors and year of publication); (b) information related to the sample (i.e., sample size, age, gender, and onset age); (c) methodological information (i.e., alliance and OCD scales, alliance and outcome rater(s), the timing of the assessment); (d) main results and effects size (see **Table 1**).

Moreover, all the articles were screened according to the research criteria for process research proposed by Lemmens et al. (45) and employed by Baier et al. (46) in a systematic review to assess the quality of the studies. These criteria comprised: (a) the use of a randomized controlled trial (RCT) design, (b) the use of a control group, (c) sample size defined as $n \geq 40$, (d) the inclusion of different mediators in the design and statistical analysis, (e) assessment at two or more time points of alliance (not averaged during the analyses), and (f) experimental manipulation of the construct of the alliance.

The author F.S. performed a quality check and accuracy of the author's V.S. data extraction. Inter-rater kappa reliability between the two coders was excellent ($\kappa = 0.95$), and minimal differences in coding were resolved through discussion till the agreement became perfect.

TABLE 1 Synthetic description of studies that have examined the influence of therapeutic alliance on treatment outcome.

Study	*N*	%*F*	Age	Onset (years)	Intervention	Outcome measure	OCD rater(s)	Alliance measure	Timing	Alliance rater(s)	Alliance-outcome relationship	Effect	Size	C.I. 95 %	For *r*
												r	*d*	*LL*	*DL*
Hoogduin et al. (79)	60				EX/RP	Self-monitoring	P	RI	Mid	P T	Yes	0.31 0.47	0.65 1.06	0.52 0.65	0.006 0.24
Hoogduin et al. (79)	25				EX/RP	Self-Monitoring	P	RI	Early Mid	P T	Yes	0.43 0.42	0.95 0.92	0.7 0.7	0.04 0.03
Keijsers et al. (63)	40P 9T	55	$M = 34.8$ $SD = 13.7$		EX/RP	MOCI	I.E.	RI	Early	P T	Yes	0.02 0.44	0.04 0.98	0.4 0.71	−0.38 0.05
Vogel et al. (76)	37	73	$M = 35.1$ $SD = 12.1$		EX/RP	Y-BOCS	I.E., T	HAQ bond-related items	Mid	P	Yes	−0.43	−0.49 0.12	0.08 0.36	−0.51 −0.26
Keeley et al. (64)	25	44	$M = 13.2$ $SD = 2.7$	$M = 10.48$	EX/RP and CT	CY-BOCS	I.E.	TASC-R WAI	Early Mid	P T	Yes	−0.34	−1.11	−0.2	−0.7
Simpson et al. (58)	30	47	$M = 39.9$ $SD = 13.4$	$M = 20.5$	EX/RP or EX/MI	Y-BOCS	I.E.	WAI	Early	P T	Mediated by adherence	−0.39 −0.52	−0.85 −1.22	0.006 −0.16	−0.68 −0.76
Maher et al. (59)	28				EX/RP	Y-BOCS	I.E.	WAI	Early	P	Mediated by adherence				
Andersson et al. (65)	101	66	$M = 34.9$ $SD = 12.7$	$M = 16.8$ $SD = 9$	iCBT	Y-BOCS	I.E.	WAI	Mid	P	Yes	−0.14	0.28	0.06	−0.33
Wheaton et al. (66)	37	51	$M = 33.8$ $SD = 12.5$		EX/RP	Y-BOCS	I.E.	WAI	Early	P	Mediated by adherence	−0.1	−0.2	0.23	−0.41
Hagen et al. (67)	44P 13T	66	$M = 23.7$ $SD = 9.7$		EX/RP	Y-BOCS	I.E., T	WAI	Early	P	Yes	−0.36	−0.77	−0.1	−0.57
Herbst et al. (67)	30	65	$M = 35$	$M = 34.8$ $SD = 137$	iCBT	Y-BOCS OCI-R		WAI	Late		Yes	0.33	0.69	0.62	−0.03
Schwartz et al. (69)	155	60	$M = 34.9$ $SD = 11.7$		CBT with EX/RP	Y-BOCS	T, Self-rated	BPSR	Throughout	P	No				
Strauss et al. (70)	108 P 10 T	21	$M = 4$	$M = 34.8$ $SD = 13.7$	EX/RP-SMT	Y-BOCS OCI-R	I.E.	WAI	Different times	P T	Yes—EX/RP No—SMT				
Wolf et al. (71)	208 P 42 T	62	$M = 35$ $SD = 10.2$		EX/RP/ CBT/IBA	Y-BOCS	I.E.	WAI	Early	P T	Yes	−0.21	0.43	−0.07	−0.33

N, number of participants with obsessive-compulsive disorder; %F, percentage of females; EX/RP, Exposure with response prevention; CT, Cognitive Therapy; CBT, Cognitive-Behavioral Therapy; ICBT, Internet-based Cognitive Behavioral Therapy; MI, Motivational Interviewing; SMT, Stress Management Training; IBA, Inference Based Approach; MOCI, Maudsley Obsessional Compulsive inventory; Y-BOCS, Yale-Brown Obsessive-Compulsive Scale; CY-BOCS, Children's Yale-Brown Obsessive-Compulsive Scale; OCI-R, Obsessive-Compulsive Inventory-Revised; P, Patient; T, Therapist; IE, Independent Evaluator; RI, Relationship Inventory; WAI-S, Working Alliance Inventory; HAq, Helping Alliance Questionnaire; TASC-R, Therapeutic Alliance Scale for Caregivers and Parents; BPSR, Bern Post-Session Report.

10.3389/fpsyt.2022.951925

Meta-analysis procedure

For the articles included in the systematic review, additional exclusion criteria were considered for conducting the meta-analysis in order to improve comparability between studies. Specifically, we included the studies that reported: (a) standardized β weights smaller than 0.5 or bigger than −0.5; (b) direct effect analysis of the relationship between the therapeutic relationship and outcome (see paragraph Statistical Analyses for more details).

Statistical analyses

For each study, we extracted effect sizes computed as correlation coefficients or standardized β weights between therapeutic alliance and treatment outcome measures. Methodological considerations suggest that β weights should not be used as surrogates for correlation coefficients because they reflect the influence of the predictor variables in a multiple regression model (47). Thus, we approximated the bivariate Pearson correlation using the standardized regression coefficients as suggested by Peterson and Brown (48). The standardized β weights (that fell within an interval between −0.5 and 0.5) were transformed in Pearson correlation using the formula:

$$r = \beta + 0.05\lambda$$

where λ equals 1 when β is non-negative and 0 when β is negative.

The authors have shown that the relationship between r and β appears robust and independent of sample size and the number of predictor variables when within this interval. Indeed, they reported that "it is possible to derive a formula for imputing an r value missing assuming a knowledge of a corresponding β weight" because there is "a relatively tight joint distribution of β and r values within the range from −0.50 to 0.50" (48). To compute this formula we used the algorithm suited by the Practical Meta-Analysis Effect Size Calculator[4] (49)].

In studies with more than one outcome measure, we averaged correlations or standard weights using the arithmetic mean to obtain one effect for each study, to avoid over-representing multi-analyses studies in the following analysis.

Then, each correlation was converted in Cohen's d using the conversion software Psychometrica [Calculation of Effect Sizes,[5] Dettelbach (Germany): Psychometrica]. By convention, an effect size of 0.2 is considered small, a value of 0.5 is moderate, and a value of 0.8 or greater is considered a relatively large effect (50).

4 https://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-SMD22.php

5 https://www.psychometrica.de/effect_size.html

The meta-analyses were performed with Jamovi 2 (MAJOR module following procedures suggested by Borenstein et al. (51) and Cooper (52). All analyses were carried out using the Fisher r-to-z transformed correlation coefficient as the outcome measure. We started by fitting a random-effects model to the data (53) and estimated the amount of heterogeneity (i.e., tau^2) with the restricted maximum-likelihood estimator (54). In addition to the estimate of tau^2, the Q-test for heterogeneity (55) and the I^2 statistic were computed. In case any amount of heterogeneity was detected (i.e., $tau^2 > 0$, regardless of the results of the Q-test), the software provided a prediction interval for the true outcomes.

To assess whether studies may be outliers and/or influential in the context of the model, we used studentized residuals and Cook's distances (56). Studies with a studentized residual larger than the $100 \times [1–0.05/(2 \times k)]^{th}$ percentile of a standard normal distribution were considered potential outliers (i.e., using a Bonferroni correction with two-sided alpha = 0.05 for k studies included in the meta-analysis). Studies with a Cook's distance larger than the median plus six times the interquartile range of the Cook's distances are considered influential.

We computed the rank correlation test and the regression symmetry test to assess publication bias using the standard error of the observed outcomes as the predictor, and we created a funnel plot (57).

Results

Study selection

The literature search strategy and inclusion criteria yielded 847 studies that measured the relationship between the therapeutic alliance and post-treatment outcome in subjects with OCD. As shown in **Figure 1**, the literature search generated 802 potentially relevant articles (after 35 duplicates removal).

After titles and abstract screening, 763 were excluded. The full text of the remaining 39 eligible studies was retrieved and reviewed; articles were excluded either because they did not meet the inclusion criteria, or were qualitative studies, reviews, or commentaries.

This screening resulted in the inclusion of 13 articles for review. Studies were published between 1989 and 2022 and conducted in the United States or Europe. The sample sizes ranged from 17 to 208 for the patients and from 9 to 42 for the therapists. Most of the studies did not report the number of therapists who took part in the study. The average age ranged from 13 to 40 years old, and 55% were women. All articles reported that the participants had a diagnosis of OCD. In total, 897 patients took part in all studies reviewed [(58,59) employed the same sample of patients; thus, the sample was counted only once]. Eight studies reported the average age of onset, which varied from 16.81 to 34.8 years old.

Regarding the criteria for process research (45, 46), we note that seven studies (54%) were part of an RCT design in which different treatments were tested, and six had a control group. Eight studies (61%) had a sample size greater than 40 patients, and three (25%) employed multiple mediators in the experimental design. Finally, four studies (30%) assessed alliance more than in two-time points, and none did an experimental manipulation of the alliance between patient and therapist (**Table 1**).

Of the 13 selected articles, eight reported a relationship between therapeutic alliance and the outcome measure. Three studies found that patient adherence fully mediated the relationship, one found mixed results, and another did not find any relationship (**Table 2**).

Obsessive-compulsive disorder subtypes

Although the cardinal features of OCD are obsessions and compulsions, a variety of clinically significant obsessive-compulsive symptoms (e.g., checking, excessive washing, and ordering) may meet the diagnostic criteria for OCD. This pattern of heterogeneity that includes the age of onset (early vs. late onset), patterns of comorbidity, and presenting symptoms have been associated with different subtypes schemes presumably underlying different etiologies and neural correlates [e.g., (60–62)].

Only two articles provided information about OCD subtypes in the selected sample. Specifically, Maher et al. (59) reported that 4% of the sample belonged to the hoarding subtype; Keijsers et al. (63) reported that 53% of patients belonged to the checking subtype, 15% to the washing, 17% to the checking and washing, and 15% had obsessions only. However, no study investigated the relationship between the OCD subtype and alliance.

Intervention/treatment

Most of the studies employed EX/RP intervention in various formats, from short and intensive [daily and lasting < 4 weeks; (64)] to more standard plans with weekly or twice-weekly sessions lasting between 4 and 8 weeks (58, 59, 65–71). Among these studies, four used a combined CBT protocol: the Pediatric OCD Treatment (64, 72), a CBT program that included both group and dyadic psychotherapy sessions (69), and the web-based ICBT (65, 68). All combined programs included a mix of psychoeducation, cognitive training, and EX/RP. Finally, one study employed also Stress Management Training [SMT; (73)] based on exposure with cessation of compulsions (58), one used the EX/RP augmented by motivational interviewing (MI) strategies (70), while another adopted the Inference Based Approach (IBA) (71).

Overall, all studies administered the EX/RP protocol either as a stand-alone treatment or in combination with other CBT interventions, and all patients received individual treatment.

Outcome measurement

Symptom severity and treatment response were evaluated by the clinician-rated Yale-Brown Obsessive Compulsive Scale [Y-BOCS; (74, 75)], a semi-structured interview regarded as the "gold standard" in the measurements of OCD symptoms (obsessions and compulsions in the last week) (58, 59, 65–71, 76). Most of the studies employed independent evaluators for the rating, i.e., clinical psychologists, blind to treatment conditions and treatment outcomes. Only one study adopted both the clinician and self-report versions [Y-BOCS-SR; (69)]. Two studies also administered the Obsessive-Compulsive Inventory revised [OCI-R; 68, 70, 77)], and one used the Maudsley Obsessive-Compulsive Inventory [MOCI; (78)]. Both OCI and MOCI are self-report measures that assess the distress associated with obsessions and compulsions. Finally, only the earliest reviewed study adopted patients' self-monitoring as an outcome measurement (79).

Despite some consistency in the scales used for outcome evaluation, studies considerably varied in the measurement timing. Two studies included only one time-point assessment at the end of the treatment (67, 68), two studies measured before and after the treatment (66, 71), six studies used three or four timepoints at baseline, mid-treatment, and at the end of the treatment (58, 59, 63, 64, 70, 76), and one study measured the symptoms with the self-report Y-BOCS at the end of each week (69). Finally, one study also took measurements at different time points during follow-up at 3, 6, 9, and 12 months (76). As it will be later discussed, the number of time points in which the outcome is measured represents an essential parameter for studying the reciprocal influence between symptom change and alliance.

Although symptom change represents an important parameter and a general index of treatment success, it might not be sufficient to depict the psychological wellness in the patient's daily life. Indeed, an individual's functioning presumably depends on both symptom severity and symptom management. Thus, assessing the quality of life in relation to therapeutic alliance and post-treatment outcomes seems to provide a complementary measurement. However, only one of the reviewed studies assessed the quality of life using the Quality of Life Enjoyment and Satisfaction Questionnaire [QLESQ; (80)], a self-report measure administered at different time points, and it did not find any relation between alliance and QLESQ (70).

Finally, as suggested by Buchholz and Abramowitz (32), another important variable to relate to the alliance is patients' dropout during treatment. Recent studies seem to suggest a positive relationship between therapeutic alliance and patient retention [cf. review of (81–84)]. Despite its importance, only

TABLE 2 Studies meeting criteria for process research.

Study	RCT	Control group	$n \geq 40$	Multiple mediators	Temporality	Manipulation
Hoogduin et al. (79)	0	0	1	0	0	0
Hoogduin et al. (79)	0	0	0	0	1	0
Keijsers et al. (63)	0	0	1	0	0	0
Vogel et al. (76)	0	0	0	0	0	0
Keeley et al. (64)	0	0	0	0	1	0
Simpson et al. (58)	1	1	0	1	0	0
Maher et al. (59)	1	1	0	1	0	0
Andersson et al. (65)	1	1	1	0	0	0
Wheaton et al. (66)	1	1	0	1	0	0
Hagen et al. (67)	0	0	1	0	0	0
Herbst et al. (68)	1	1	1	0	0	0
Schwartz et al. (69)	0	0	1	0	1	0
Strauss et al. (70)	1	1	1	0	1	0
Wolf et al. (71)	1	1	1	0	0	0

a few studies reported the number of patients that dropped the treatment, which was, in any case, a low rate.

Alliance measurement

Five different measures of the therapeutic alliance, in varying formats, were used in these studies.

Most of the reviewed studies assessed the alliance with the Working Alliance Inventory [WAI; (85)], a self-report inventory that was originally designed to measure Bordin's working alliance dimensions (bond, task, and goals). Five studies administered the patient-rated version (58, 59, 65–67), three used both the patient and therapist versions (64, 70, 71), and one did not specify which version was used (68). Among these studies, some employed the standard version composed of 36 items (58, 59, 64), while others adopted the short forms composed of 12 items by Tracey and Kokotovic (65, 67, 68, 70, 86) or by Hatcher and Gillaspy (66, 68, 87). Keeley et al. (64), that assessed the therapeutic alliance in a pediatric population, also administered the WAI to the caregivers and the Therapeutic Alliance Scale for Children-Revised to the patients [TASC-R; (88)].

The remaining studies assessed the quality of alliance using the self-report Barret-Lennard Relationship Inventory [RI, (89)] (79), the items related to the bond of the Helping Alliance Questionnaire HAq (90, 76), and the alliance subscale of the Bern Post-Session Report (91). These scales differ from the WAI in several aspects, such as the dimensions of the alliance that are represented and the number of items that the measures contain. For instance, the RI, a measure of empathy, correlates only with the WAI bond scale but not with the task and goals dimensions (44). Meta-analytic results have shown that the different versions of the same scale (e.g., long or short format and different rater versions) differed in predicting treatment outcomes (30). Despite some similarities and shared themes between the alliance scales, they do not have a common account of the alliance construct (92, 93). In particular, no scale has a complete representation of the different properties belonging to the concept of alliance that has been proposed in the past years.

Another potential confounding factor in the alliance-outcome relationship is the variability across alliance raters. Ideally, a good measure of the alliance should have a good consistency, measured as inter-rater reliability (94). Horvath et al. (30) estimated that the variables "type of measure" and "raters" account for 23% of the variance in predicting the treatment outcome. However, the variability across raters *per se* does not seem to represent a strong methodological issue, given the moderate correlation between patients' and therapists' alliance scores (31). Nevertheless, the reviewed studies showed mixed results in predicting treatment outcomes among alliance raters. For instance, Keeley et al. (64) and Hoogduin et al. (79) found that only therapist rating predicted treatment outcome when the alliance was measured in an early stage. However, both therapist and patient predicted the treatment outcome when the alliance was measured in a mid-phase. Conversely, Strauss et al. (70) found that only patient averaged alliance scores covaried with outcome treatment, but patient and therapist early scores were not associated with symptom change. Some mixed results were also shown in the study published by Keijsers et al. (63), where patient ratings correlated with a reduction in obsessive fear; however, only therapist ratings classified patients as success or treatment failure with multivariate analysis. Finally, Wolf et al. (71) showed that only therapist rating measured in an early phase significantly predicted the post-treatment outcome. Taken together, these results show that therapist and patient ratings differed in how they predicted treatment outcomes across studies. Thus, it would be helpful to relate

these differences across raters in predicting symptom change with some inter-rater reliability measure (95). Indeed, only one study reported a measure of consistency across raters and found a weak significant correlation (71), although most recent studies reported overall good reliability of alliance scores measured with Cronbach's alpha.

Albeit, the therapeutic alliance has been described as an intrinsic dyadic concept that involves a process of mutual influence and impact between the therapist and the patient [e.g., (23, 96–98)], 50% of the studies reviewed here asked only patients to rate alliance. This limitation reflects the main trend in therapeutic alliance studies that mostly focus on patients' views only (30). However, recent studies have highlighted the importance of taking into account both patient and therapist perspectives, introducing the concept of patient-therapist alliance "congruence" (i.e., the inter-rater agreement on alliance quality at one time-point) and the alliance "convergence" (i.e., the degree of change over time in the inter-rater agreement on alliance quality) (99–101). These constructs reflect the dynamic nature of this dyadic process and carry complementary information on a therapeutic relationship that is asymmetric by nature (102).

Wide variability across studies was also observed in the evaluation timing. Indeed, seven studies collected data only at one time-point, either in the early (58, 59, 63, 66, 67, 71, 76), mid (76), or late phase of the treatment (68). Two studies used three or four time-points at baseline, mid-treatment, and at the end of the treatment (64, 70), and one study measured alliance through all treatment at the end of each week (69).

Alliance-outcome relationship measurement

All studies reviewed here assessed the relationship between alliance and some measure of symptom outcome. The two earliest studies computed the correlation between alliance and self-report symptom outcome (79) or obsessive fear symptom change (63). Both studies found evidence of a positive effect of alliance on the treatment outcome. However, these results should be taken with caution because of the less rigorous methodology employed.

Subsequent studies investigated the role of the alliance as a mediator of symptom change with more sophisticated statistical analyses, such as a causal stepwise approach using linear regressions (103) and structural equation modeling (104). Other methods included growth analysis (105) and the longitudinal mixed-effects model (106). Overall, the nine studies that used a regression approach found evidence of alliance as a predictor of positive change. However, three of eight found that the general effect of alliance [(58, 59), with an overlapping sample] or task alliance (66) on treatment outcome was fully mediated by patient's adherence to between- and within-session exposure tasks. Among the most recent studies having the highest frequency of ratings of both alliance and symptoms (i.e., at the end of each week or throughout all treatment), no alliance's influence on symptom decrease was found (69, 70). The only study that compared simultaneous and cross-lag models to assess the effect of reciprocal influence in the alliance-outcome relationship found that patient alliance covaried with symptoms change as measured with the Y-BOCS; however, changes in previous Y-BOCS scores predicted subsequent changes in alliance scores, thus suggesting that an improvement in the reported symptoms precedes the changes in the alliance scores (70).

Furthermore, among the studies that assessed alliance on patients alone, one followed the data analysis suggested by Baldwin et al. (107). This analysis consists of decomposing alliance-outcome correlations into two components: the "within-therapist correlations" at the patient level (i.e., how the alliance is related to outcome in each therapist) and "between-therapist correlations" at the therapist level (i.e., how the alliance is related to outcome across therapists). Importantly, this method allows computing the cross-level interaction between patients' and therapists' variability (107). In the study that implemented this analytic method, it was found that therapist variability in the task/goal dimension of the alliance predicted treatment outcome, while patient variability in the alliance did not. Conversely, the therapeutic bond was not related to the outcome.

Overall, this qualitative analysis of the reviewed studies points to some indication of a positive relationship between alliance and treatment outcome. Nevertheless, given the high degree of methodological variance even in the most recent studies that employed more advanced statistical and experimental design, these results should be interpreted in the context of this variability across studies.

Meta-analysis

The purpose of this section of the review is to quantify the present literature regarding the existence and strength of the relation between therapeutic alliance and outcome in the context of OCD. As the preceding qualitative analysis illustrated, there is considerable variability across studies with regard to how and when alliance and outcome were measured, who were the raters, and how the relationship alliance-outcome was measured. Thus, to improve comparability among the results, some exclusion criteria were applied that narrowed down to $k = 6$ the number of studies that were included in the analyses (64–67, 71, 76). In particular, one study was excluded because it included self-monitoring as outcome measure and did not use a validated alliance scale (79); the others did not report any statistics that could be used in the meta-analysis (59, 63, 68–70, 73). All the pooled effect sizes reflected patient's rating.

We first performed a model with the global alliance score (task, goal, and bond). In the selected studies (64–67, 71),

the observed Fisher *r*-to-*z* transformed correlation coefficients ranged from −0.3541 to −0.0902, with most estimates being negative (100%). The estimated average Fisher *r*-to-*z* transformed correlation coefficient based on the random-effects model was $Tau^2 = -0.1562$ (*C.I.95%*: −0.2542 to −0.0582; **Figure 2**). Therefore, the average outcome differed significantly from zero ($z = -3.1231$, $p = 0.0018$). According to the *Q*-test, there was no significant amount of heterogeneity in the true outcomes [$Q(4) = 2.3834$, $p = 0.6656$, $tau^2 = 0.0000$, $I^2 = 0.0000\%$]. Hence, even though there may be some heterogeneity, the true outcomes of the studies were generally in the same direction as the estimated average outcome.

An examination of the studentized residuals revealed that none of the studies had a value larger than ± 2.5758; hence there was no indication of outliers in the context of this model. According to Cook's distances, none of the studies could be considered overly influential. Neither the rank correlation nor the regression test indicated any funnel plot asymmetry ($p = 0.8167$ and $p = 0.3780$, respectively; see **Figure 3**).

Next, we pooled the effect sizes for the task/goal alliance dimension and for the bond dimension separately. For the task/goal dimension, in the included studies (66, 67, 71), the transformed correlation coefficient based on the random-effects model was $Tau^2 = -0.1977$ (95% CI: −0.3149 to −0.0805). Therefore, the average outcome differed significantly from zero ($z = -3.3071$, $p = 0.0009$; **Supplementary Figure 1**). According to the *Q*-test, there was no significant amount of heterogeneity in the true outcomes [$Q(2) = 1.9141$, $p = 0.3840$, $tau^2 = 0.0000$, $I^2 = 0.0244\%$].

For the bond dimension, in the included studies (66, 67, 71, 76), the transformed correlation coefficient based on the random-effects model was $Tau^2 = -0.1372$ (95% CI: −0.3669 to −0.0924). Therefore, the average outcome did not differ significantly from zero ($z = -1.1710$, $p = 0.2416$; **Supplementary Figure 2**). According to the *Q*-test, the true outcomes appear to be heterogeneous [$Q(3) = 9.2209$, $p = 0.0417$, $tau^2 = 0.0351$, $I^2 = 66.2000\%$]. A 95% prediction interval for the true outcomes is given by −0.5703 to 0.2958. Hence, although the average outcome is estimated to be negative, in some studies the true outcome may in fact be positive. This amount of heterogeneity might depend on pooling effect sizes from two different scales (WAI and HAq). Although both scales measure the bond dimension and are presumably correlated, they cannot be traced back to a common second-order factor.

Discussion

This systematic review aimed to synthesize the current scientific evidence on the relationship between therapeutic alliance and treatment outcome in CBT in patients with OCD.

Overall, we found a modest association between alliance and treatment outcome. This result is consistent with previous systematic reviews and meta-analyses that quantified this relationship with an aggregate *r* of 0.28 across disorders and treatments (27) or found a positive association between alliance and symptom change in anxiety-related disorders (32, 33). In particular, our results suggest that task and goal alliance domains, which may be more characterized as cognitive factors (32), are associated with post-treatment outcomes, while the therapeutic bond is not. Most of the included studies measured alliance in the early or mid-phase of the treatment. Thus, it is possible that agreeing on the goals and the willingness to be engaged in the exposure tasks might be predictive factors in the first sessions of the therapy.

We also found substantial variability of different sources across studies. Hoogduin et al. (79) and Keeley et al. (64) reported that both early- and mid-treatment therapist alliance, but only mid-treatment patient alliance, was associated with an improved outcome in adult and pediatric populations, respectively. Consistently, Vogel et al. (76) and Andersson et al. (65) reported that mid patient alliance was associated with better outcomes. Conversely, Keijsers et al. (63) found that early patient alliance but not therapist alliance was associated with improvement in obsessive fears (though not to compulsive behaviors). Similarly, Hagen et al. (67) found that early patient task and goal alliance (though not bond) was associated with a better outcome, while Wheaton found that only early patient task alliance predicted post-treatment outcome. Also, Wolf et al. (71) found that early task and goal alliance and early therapist alliance (total score) predicted the post-treatment outcome. Differently from these studies that reported a positive association between alliance and outcome, one study found that overall early patient alliance was not related to outcome (69). Moreover, one of the most recent studies found a mixed pattern of results, and only in EX/RP (not in SMT) symptom change was associated with subsequent changes in alliance (though not vice versa) (70). Finally, three studies found that overall early patient alliance was mediated by adherence (58, 59, 66).

All the reviewed studies differ in many methodological aspects, such as outcome and alliance measurements, alliance raters and timing, and statistical approaches. Most recent studies which adopted more sophisticated analyses (e.g., structural equation, linear growth analyses, stepwise regression analysis, and cross-lagged model), took into account early symptom improvement and examined temporal associations of the alliance over time, are also showing less or no evidence of alliance affecting treatment outcome. Thus, our results should be interpreted in the context of this variability, and several limitations should be considered. For instance, half of the studies employed RCTs to examine differences across treatment, and used a control group. Second, 58% of studies used a sample size equal to or greater than 40, that is generally considered the minimum number to have sufficient power in the meta-analysis

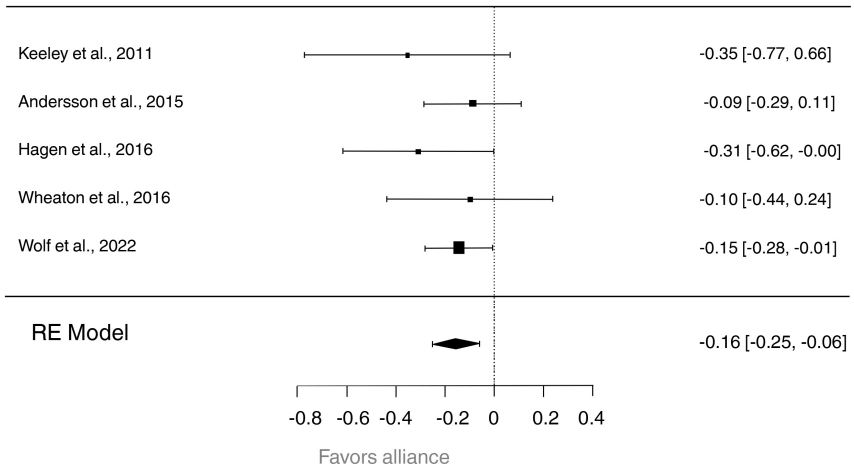

FIGURE 2
Forest plot visualizing the relationship between the global therapeutic alliance and the treatment outcome for each included study. Horizontal bars show 99% confidence intervals, with the study having a significant effect denoted by horizontal bars that do not touch the dotted vertical line (the line of no effect). Diamonds sizes reflect the weight of the overall study.

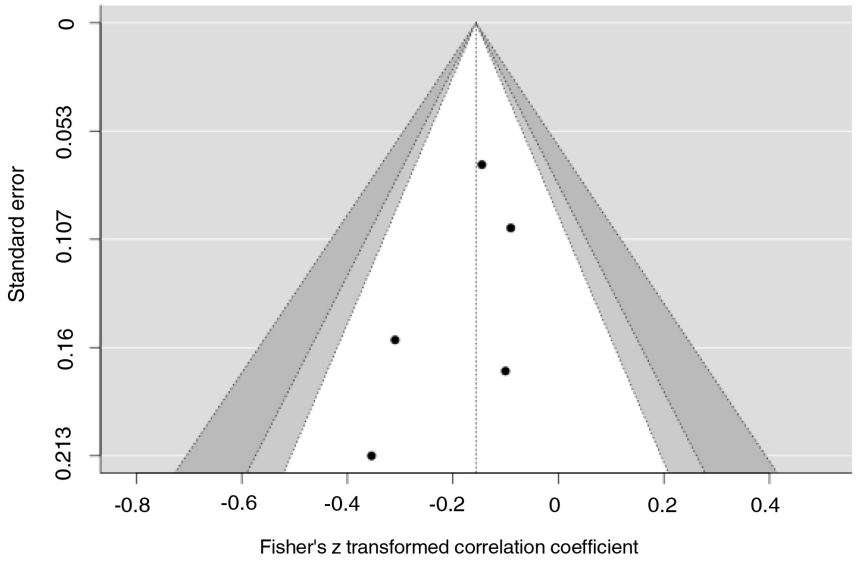

FIGURE 3
Funnel plot. Estimates (*z*-score) from selected studies (on the horizontal axes) plotted against each study's standard error (on the vertical axes).

(108, 109). However, our meta-analysis, which had an average sample size of 66 participants, is sufficiently powered to detect small effects [1-β err prob 0.99, formula retrieved by (110)]. Third, three studies disentangled the effect of alliance from other factors, such as symptom severity, adherence to treatment, quality of life, patient's expectancy, and motivation, and OCD sub-types (e.g., washing, hoarding). Therefore, more mediation studies are needed to assess how alliance contributes to mediate the relationship between treatment and symptom change and to separate its effect from other specific and generic factors (e.g., age, gender, comorbidity with other disorders, age of onset, use of psychiatric medication, patient's and therapist's factors). Fourth, the small number of available studies and the fact that some of them were carried out by some overlapping research groups (and presumably with similar programs and methodology), although mostly with different samples, makes it difficult to reach firm conclusions. Fifth, only four studies assessed alliance at two or more time-points, not averaging during the analyses (64, 69, 70, 79).

Temporality represents an essential parameter in experimental designs investigating the therapeutic alliance. While in the past, process-based research tended to represent

the association between alliance and outcome as a static "snapshot" by taking measurements at only one time-point or by averaging, the inherently dynamic nature of the therapeutic interaction is now being increasingly recognized [e.g., (111)]. This change of view, which implies studying how alliance changes over the course of treatment through cycles of ruptures and repairs (112), and how it interacts with the specific treatment, entails achieving a fuller picture of this dynamic dyadic process. Indeed, a key factor in studying this phenomenon implies understanding the direction of the alliance-outcome link. A positive link might have at least three different sources: (a) alliance produces patient's symptoms change; (b) symptom change induces a change in the therapeutic alliance between therapist and patient; (c) alliance and treatment outcome influence each other (113). To test the idea that alliance influences treatment outcome, the alliance must predict outcome as measured at a subsequent time point, taking into account potential changes in the outcome preceding alliance measurement (114). Thus, a gold standard for future studies would be to collect repeated measurements of alliance and outcome (after and during session) and combine them with more sophisticated statistical approaches (e.g., cross-lagged panel model) to analyze the interactions and reciprocal influences between these variables over time. Among the reviewed studies Schwartz et al. (69), had the highest sampling rate, assessing alliance and outcome at the end of each session/week. On the other hand Strauss et al. (70), compared simultaneous and cross-lagged models to study the reciprocal influences between alliance and outcome but sampling fewer time-points.

Another important factor to consider is the different impact of therapeutic alliance domains on symptoms change. Indeed, three studies that disentangled the effect of goal, task and bond, found that treatment outcome was significantly predicted by goal and task alliance but not by bond (66, 67, 71). This result could be associated with the specific EX/RP techniques that are used for the treatment of OCD, that require setting appropriate goals, and providing tasks that allow patients to go far enough in exposures to the fearful stimuli or situations (115). It is possible to argue that such a structured and challenging treatment protocol, for both therapist and patient, creates the basis for building an alliance that relies more on tasks and goals consensus than on emotional attachment and more in general on the feelings and attitudes that patient and therapist have toward each other. It is also possible to speculate that bond might represent a more significant outcome predictor in therapies with less structured protocols.

Finally, it must be noted that a significant association between alliance and outcome does not imply a significant clinical impact. For instance, Wolf et al. (71) found that although therapeutic alliance significantly predicted post-treatment outcome, it accounted for only 2% of symptoms improvement, resulting in alliance being not clinically relevant in their sample. This result might be due to the high rates in the alliance scores that makes it difficult to reach higher scores and thus a stronger association between alliance and outcome (71). Future studies need to take into account alliance scores variability and possible ceiling effects that might hinder the effect of alliance on post-treatment outcome.

Some limitations should be considered when interpreting these results. First, in this review, there is a possible language bias since the research strategy was limited to articles published in English, and we also did not include unpublished studies. Therefore, it is possible that some relevant papers were missed. Also, since studies with samples of different ages were included, it was not possible to draw conclusions on specific populations. Moreover, most of the studies in the current review were based on research protocols that included structured interventions and highly trained therapists; thus, the generalizability of these results to more naturalistic settings (e.g., general community practice and patients with comorbidities) remains unclear. Naturalistic studies are required to demonstrate whether alliance works in the field with patients with OCD. Finally, for the statistical analyses, we used the approach proposed by Peterson and Brown (48) to convert the standardized β weights into Pearson correlation coefficients. Although this approach has been widely used in the literature because it provides a straightforward method to deal with missing values, it has some limitations. Recently, it has been shown that this approach can lead to an underestimation of meta-analytic correlations and that the estimated correlations do not perform better than using existing correlations (116, 117). Thus, our meta-analytic results should be interpreted in the context of this trade-off between generalization and approximation.

In summary, the present review shows some evidence of an interactive effect between alliance and the treatment outcome in individuals with OCD, although with considerable variability in reporting varying measurement time-points, experimental designs, statistical approaches, measurements tools, and alliance raters. However, we sought to achieve the greatest possible consistency in our data extraction and meta-analysis.

Future studies that include more refined temporal assessment of alliance, larger samples, and measures of potentially interacting variables are required to better understand whether changes in alliance interact with treatment response or vice versa and which is the clinical impact of this association. Understanding this complex relationship will ultimately help to improve outcomes for individuals living with OCD.

Data availability statement

The original contributions presented in this study are included in the article/**Supplementary material**, further inquiries can be directed to the corresponding author/s.

Author contributions

AMS, GG, and FM conceived the study. FS and VS reviewed the literature, analyzed the data, and wrote the first version of the draft. GA supervised the statistical analyses. GD'A, TD, and NP contributed to the discussion of the literature. All authors contributed to the writing and editing of the draft.

Funding

This study was supported by the Italian Ministry of Education, University and Research.

Acknowledgments

We sincerely thank Nadja Wolf for sharing statistical details about published data and all the co-authors, Patricia van Oppen, Adriaan W. Hoogendoorn, Anton J. L. M. van Balkom, and Henny A. D. Visser.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2022.951925/full#supplementary-material

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frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 27 September 2022
DOI 10.3389/fpsyt.2022.977238

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Anxiety and Stress Disorders, a section of the journal Frontiers in Psychiatry

RECEIVED 24 June 2022
ACCEPTED 25 August 2022
PUBLISHED 27 September 2022

CITATION
Kang WH, Loo MY, Leong XM, Ooi YF, Teo WQ, Neoh TJ and Ling WC (2022) Body dysmorphic disorder and depression among male undergraduate students in a Malaysian University.
Front. Psychiatry 13:977238.
doi: 10.3389/fpsyt.2022.977238

Body dysmorphic disorder and depression among male undergraduate students in a Malaysian University

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Introduction: Body dysmorphic disorder (BDD) and depression have been reported to be both prevalent among young people worldwide, resulting in serious implications in their quality of life and social functioning. This is worrying especially in men where mental disorders are often overlooked and under-researched. This study aims to determine the proportion of male university students with symptoms suggestive of body dysmorphic disorder and depression, as well as their perception on their body image.

Methods: In this cross-sectional study, 1,308 male students between the aged of 17–26 years in a private university in Malaysia *via* self-administered online questionnaire comprising the Patient Health Questionnaire (PHQ)-9, the Body Dysmorphic Disorder Questionnaire (BQQD) and the Body Self-Image Questionnaire (BSIQ), in addition to their sociodemographic parameters. Data analyses were performed with Mann Whitney test, chi square test and Fisher's exact test.

Results: 3.3 and 54.2% of the students had symptoms suggestive of BDD and depression respectively, with up to 9.02% of the students reporting having moderate to severe depression. There was a significant association between BDD symptoms and students staying alone, whilst depression was significantly associated with studying in the rural campus. Furthermore, a significant association was demonstrated between presence of BDD and depression symptoms. Most of the students were dissatisfied with their whole body, especially their height.

Conclusion: The proportion of BDD and depression symptoms among male students in our university is quite high. Universities and the public health sector should develop better support service targeting male university students.

KEYWORDS

body dysmorphia, depression, Malaysian students, height dissatisfaction, obsessive-compulsive disorder

Introduction

Body dysmorphic disorder (BDD), one of an obsessive-compulsive spectrum disorder, is often described as having distressing or impairing obsessions with perceived physical imperfections that are usually unobservable or appear only slight to others (1–3). Individuals with BDD often have a negative perception on their own body image that leads to significant negative emotions thus affecting their daily functioning (4). BDD in adults usually leads to high rates of social and occupational dysfunction whereas BDD in youth is associated with a poorer academic performance, social withdrawal and higher school dropping out rates (2). Despite the increasing prevalence of BDD among young people worldwide (4–11) and the serious implications toward their quality of life and social functioning, there is still a lack of data on BDD in the general population of Malaysia, especially among young male adults.

Depression is characterized by persistent sadness, anhedonia, trouble sleeping, changes in appetite, loss of energy and difficulty concentrating and is common among university students (12). In Malaysia, it was reported up to 70% of university students admitting that they have symptoms suggesting of depression (13–16). Aside from affecting the academic achievement of students (17), untreated depression may also lead to increased psychological morbidity and other mental disorders (18).

Women are known to be more prone to suffer from internalizing mental disorder, such as major depression and eating disorders (19), while mental illnesses in men are often overlooked and untreated, resulting in higher morbidity and mortality rates (20). Although suicide has been the leading cause for death among young men in several countries, the mental health of this group is generally overlooked (21). This implies that there is an urgent need to study the epidemiology of mental disorders among male adolescence. The current study aims to determine the proportion of symptoms suggesting of BDD and depression among male undergraduate students in a local university as well as their associated factors. Furthermore, this study examines the body self-image perception among these students. We hypothesize that a high number of male Malaysian university students may be a risk of depression and BDD.

Methods

Study design

This was a single-center cross-sectional study conducted between 11 November 2021 till 20 January 2022. The target population of this study was male foundation students and undergraduates aged from 17 to 26 years from both Universiti Tunku Abdul Rahman (UTAR) Sungai Long Campus and Kampar campus. Ethics approval was obtained before the initiation of the study.

The sample size was calculated based on the formula for estimation for a proportion, $n = \frac{Z^2 P\,(1-P)}{d^2}$ where n is the sample size, Z is standard normal deviate 1.960, d is the precision of 0.03, and p is the pre-study estimate of depression among Malaysian medical students as reported by Shamsuddin et al. (13).

A random sampling method was used where 2,149 participants were randomly selected from the list of 10,747 male undergraduate students registered in the university, which represented 20% of the total population. All male foundation students and undergraduates from Universiti Tunku Abdul Rahman, between the ages of 17–26 years and students were included in the study and excluded if they refused to participate in this study or were not able to provide informed consent. Students agreeable to participate in the study were given a self-administering online questionnaire. A total of 1,308 students agreed to enroll in the study, showing a calculated response rate of 60.8%, whilst 24 students decline to participate and the remaining 817 students did not respond within the stipulated timeframe.

Measures

The questionnaire consists of 7 sections: (i) sociodemographic parameters, (ii) Patient Health Questionnaire-9 (PHQ-9), (iii) Body Dysmorphic Disorder Questionnaire (BDDQ), and (iv) Body Self-Image Questionnaire-Short Form (BISQ-SF). The 6 socio-demographic parameters included age, gender, faculty, household members, history of mental illness, history of recreational drug abuse.

The Patient Health Questionnaire-9 (PHQ-9) is widely used to access the respondents' depression severity levels based on a four-point Likert scale rated from 0 (Not at all) to 3 (nearly every day). This section consisted of 9 questions and the total sum up scores was classified according to the following categories in terms of depression severity level: none or minimal, mild, moderate, moderately severe and severe. This depression subscale has been published in previous studies, showing a Cronbach alpha of 0.86–0.89 respectively (22).

The BDDQ is a self-report screening tool for BDD and consists of 4 questions asking about the concern of the physical appearance and a total score of 4 indicates a possibility of BDD. Phillips et al. reported a sensitivity and specificity of this scale of 100 and 93% respectively (23).

The Body Self-Image Questionnaire-Short Form (BSIQ-SF) is used to access the participant's perceptions toward their body image. This questionnaire has 21 Likert scale questions which each classified into 4 different domains which included negative affect, attractiveness evaluation, physical functionality awareness

and height dissatisfaction. Higher dissatisfaction toward body and height is usually indicated by higher scores in negative affect and height dissatisfaction. On the contrary, a higher score in attractiveness evaluation and physical functionality awareness points toward the individual having a higher body satisfaction and more likely to maintain good physical functionality. The results were accessed using 5-point Likert scale included: "Not at all true of myself," "slightly true," "about halfway true," "mostly true," and "completely true." The BSIQ-SF has been validated for local use in Malaysia (24).

Statistical analysis

The data were analyzed with SPSS version 22.0 (IBM, Chicago, USA). Descriptive statistics are presented as frequency and percentage for categorical data and as mean and standard deviation for continuous variable if they are normal distributed or as median and interquartile range (IQR) if they are not normal distributed. In addition to it, all quantitative data was assessed for normal distributions in this study. Chi-square or Fisher's exact test were used to analyse categorical variables. On the other hand, Mann-Whitney test or Kruskal-Wallis test was employed to look for the relationship between categorical data (sociodemographic parameters) and continuous data (BDDQ/ PHQ-9/ BSIQ-SF). For continuous data, Spearman's correlation test was used to analyse the correlation between age and BSIQ scores. For logistic regression, a backward stepwise approach is chosen to determine statistically significant independent variables.

The statistical significance level for all inferential test was set at $P < 0.05$.

Results

BDD among UTAR male undergraduate students and its associated factors

Based on the BDDQ questionnaire, approximately 3.3% out of the 1,308 male undergraduate students reported symptoms suggestive of BDD. Among all the socio-demographic parameters, there is a significant association between BDD symptoms and students staying alone ($x^2 = 5.726$, $p = -0.026$) (Table 1). There is no significant association between BDD symptoms and students studying medicine and health sciences ($x^2 = 0.012$, $p = 0.914$) with only 7.5% out of 43 the students with BDD symptoms were from the faculty of medicine and health sciences (Table 1).

Only 793 (60.6%) of all the respondents are worried about their appearance, and among these respondents, 60.4% of them wished they could think about their appearance less. 39.6% of these respondents were dissatisfied with their whole body, while 37.1% were unhappy about their face. In addition, 46.4% of the respondents were concerned that they did not look thin enough or might look too fat, and 30.6% felt that this often upset them a lot.

Due to these dissatisfactions, 127 (16.0%) out of the 793 students admitted that this had gotten in the way of their social activities and 50 (6.3%) claimed that it has caused problems with their school, work, or other activities. Only 2.9% of these 793 students spent more than 3 h thinking about their look, followed by 7.9% spending 1–3 h per day and 89.2% spent less than an hour.

With multivariate logistic regression, after adjusting for family history of mental illness or recreational drug use, personal history of recreational drug use, as well as location of campus, the only significant predictor for BDD symptoms is staying alone (OR = 2.551, 95%CI 1.153–5.649, $p = 0.021$).

Depression symptoms among UTAR male undergraduate students and its associated factors

Approximately 54.2% of students reported to have symptoms suggestive of depression in the PHQ-9 questionnaire where 9.02% had symptoms suggestive moderately severe to severe depression while 13.23 and 31.96% had moderate and mild depressive symptoms respectively. No significant association between most of the socio-demographic parameters was seen except for location of the campus ($x^2 = 8.762$, $p = -0.003$). Almost 50% of male students studying medicine or health sciences had symptoms suggestive of depression, but this only constitutes 6% of all the students claiming to have depression symptoms. There was also no significant association between medical and health sciences students with symptoms of depression ($x^2 = 2.195$, $p = 0.138$) (Table 1).

The median and interquartile range for the PHQ-9 score was 5 (7); the mean and IQR PHQ-9 score for students with symptoms suggestive of depression is significantly higher than those without symptoms ($U = 0$, $p < 0.001$). Among all the variables, students from the Kampar campus and with a family history of recreational drug use had significantly higher PHQ-9 median scores respectively compared to students from Sungai Long campus or without family history of recreational drug use ($U = 199{,}188$, $p = 0.031$; $U = 5{,}546.5$, $p = 0.012$). The most frequent symptoms that the respondents had were issues with energy levels (71.5%), followed by little interest or pleasure in doing things (68.4%) and feelings of down and depressed and hopelessness (55.2%) (Table 2).

With multivariate logistic regression, after adjusting for family history of mental illness or recreational drug use, personal history of recreational drug use, as well as status of living

TABLE 1 Socio-demographic parameters of UTAR male undergraduate students according to BDD and depression status.

Variable	BDD ($n = 43$)	No BDD ($n = 1,265$)	p value	Depression ($n = 709$)	No depression ($n = 599$)	p value
Campus			0.28[a]			0.002[a]
Sungai Long Campus	18	640		330	328	
Kampar Campus	25	625		379	271	
Faculty			0.12[b]			0.129[a]
Faculty of Accountancy and Management	1	97		51	47	
Faculty of Arts and Social Science	6	68		49	25	
Faculty of Business and Finance	3	164		92	75	
Faculty of Creative Industries	4	40		27	17	
Faculty of Engineering and Green Technology	3	43		28	18	
Faculty of Information and Communication	9	149		89	69	
Faculty of Medicine and Health sciences	4	83		41	46	
Faculty of Science	6	86		51	41	
Institute of Chinese Studies	0	4		2	2	
Faculty of Engineering and Science	4	314		152	166	
Center for Foundation Studies	3	217		127	93	
Staying alone			0.026[a]			0.125[a]
Yes	8	104		67	45	
No	35	1,161		642	554	
Family history of mental illness			0.126[b]			0.051[a]
Yes	3	35		26	12	
No	40	1230		683	587	
History of recreational drug use			0.791[b]			0.408[b]
Yes	0	7		3	4	
No	43	1,258		706	595	
Family history of recreational drug use			0.265[b]			0.151[b]
Yes	1	13		10	4	
No	42	591,252		699	595	

[a]Chi square; [b] Fisher's Exact test.

alone, the only significant predictor for symptoms suggestive of depression is location of campus (OR = 1.397, 95%CI 1.122–1.736, $p = 0.003$).

Perception on body self-image and its correlation between depression and BDD among UTAR male undergraduate students

25.7% of all the 1,308 students did not think they look good in their clothes. Most of the students were unhappy with their height, with 23.8% students often expressed their wish to be taller, 17.9% wished that they could be taller and 13.1% expressed that they would like their body better if they were taller. On the contrary only 6.7% of the students thought that they were overweight and 9.2% wished they were thinner (Table 3).

Respondents with symptoms suggestive of depression based on the PHQ-9 scores, had a significantly higher scores in the negative affect (U = 130,792, $p < 0.001$) and height dissatisfaction (U = 162,738, $p < 0.001$) domains, while their scores in the attractive awareness domain was significantly lower (U = 194,876, $p = 0.01$). Similarly, respondents with symptoms of BDD had significantly higher scores in the negative affect (U = 7,354, $p < 0.001$) and height dissatisfaction domains (U = 18,526, $p < 0.001$) but a significantly lower score in the physical functionality domain (U = 20,460, $p = 0.005$).

There was a significant positive correlation between the PHQ-9 score and the negative affect score (r (1306) = 0.373 $p < 0.001$), height dissatisfaction score (r (1306) = 0.193 $p < 0.001$), and the physical functionality score (r (1306) = 0.086 $p = 0.002$) respectively. However, there was a significant negative correlation between PHQ-9 score and attractive awareness score (r (1306) = −0.089, $p = 0.001$).

TABLE 2 Symptoms suggestive of depression and their frequency among UTAR male undergraduate students in the PHQ-9 questionnaire.

	Not at all (%)	Several Days (%)	More than half the days (%)	Nearly every day (%)
Little interest or pleasure in doing things	413 (31.6%)	635 (48.5)	173 (13.2)	87 (6.7%)
Feeling down, depressed, or hopeless	586 (44.8%)	537 (41.1%)	124 (9.5%)	61 (4.7%)
Trouble falling or staying asleep, or sleeping too much	594 (45.5)	433 (33.1)	159 (12.2)	122 (9.3)
Feeling tired or having little energy	373 (28.5)	585 (44.7)	227 (17.4)	123 (9.4)
Poor appetite or overeating	850 (65)	303 (23.2)	96 (7.3)	59 (4.5)
Feeling bad about yourself – or that you are a failure or have let yourself or your family down	654 (50)	396 (30.3)	163 (12.5)	95 (7.3)
Trouble concentrating on things	680 (52)	379 (29)	167 (12.8)	82 (6.3)
Moving or speaking so slowly that other people could have noticed or so fidgety or restless that you have been moving a lot more than usual	980 (74.9)	239 (18.3)	63 (4.8)	26 (2)
Thoughts that you would be better off dead, or thoughts of hurting yourself in some way	1,003 (76.7)	196 (15)	71 (5.4)	38 (2.9)

Discussion

BDD among UTAR male undergraduate students and its associated factors

The proportions of students at risk of having BDD was almost similar to previous studies which reported 0.6–12.3% of their male cohort having BDD (4–11). Once again, the application of different assessment tools to determine BDD in different studies could have resulted in the large range of prevalence observed. Most of the respondents in our study were dissatisfied with their whole body and face whereas respondent from other studies were more concern with their hair, face, weight and skin (4, 7–9, 25). Separately, there is a significant association between staying alone and BDD, as individuals with BDD often have poor psychosocial functioning and avoids social interaction (26).

Most of our respondents were dissatisfied with their height, as evident by the BSIQ scores. This was in line with other previous literature that reported Asian boys and men are more discontent with their height (27). Men often perceive height as an important component of masculinity. Taller men are thought to be more attractive, more intelligent and more confident (28, 29). A high dissatisfaction in height among our cohort may be due to the fact that a person's height cannot be altered easily without invasive or potentially dangerous intervention (30). However, we did not assess whether height dissatisfaction results in disability or impairment among our respondents and we did not include screening for eating disorders in our study, as this is closely related to BDD. In this, we also believe that height dissatisfaction should be spelled out clearly as a "body area" in the BDDQ owing to its high proportion among young Asian men and possibly improving the sensitivity of the BDDQ questionnaire.

Depressive symptoms among UTAR male undergraduate students and its associated factors

Our study reported up to 54.2% who may be at risk of depression due to the presence of symptoms. This is comparable to other local studies which had reported 33.4–74.4% in their male cohort (13–16). The application of various screening tools for depression in previous studies may explain the large range of prevalence observed whereby most of our male students reported mild depression symptoms, compared to the previous studies where most of their male students had moderate depressive symptoms. However, the global pooled prevalence of depression among both male and female college students were reported to be 33.6% (31).

Interestingly, there were significantly more students at risk of depression in the Kampar campus, which is located in a rural area, contrary to prior studies (15). Our study is the first to report this observation as previous literatures have pointed out a higher prevalence of mental health problems in adolescents residing in urban areas, suggesting a detrimental effect of urbanicity among adolescents (32–34).

Prior studies have reported a higher degree of depression among medical students (31). In our cohort, up to 46.5% of the male undergraduate students enrolled in medical and health sciences had depressive symptoms. The results from our finding was almost similar to previous local studies which reported that 33.3–74.4% Malaysian medical

TABLE 3 Body self-image perception of UTAR male undergraduate students according to the BSIQ.

	Not at all (%)	Slightly (%)	About halfway (%)	Mostly (%)	Completely (%)
Negative affect					
I think my body is unattractive	260 (19.9)	472 (36.1)	334 (25.5)	185 (14.1)	57 (4.4)
I think my body looks fat in clothes	612 (46.8)	260 (19.9)	213 (16.3)	161 (12.3)	62 (4.7)
My naked body makes me feel sad	594 (45.4)	323 (24.7)	207 (15.8)	121 (9.3)	63 (4.8)
Being around good-looking people makes me feel bad about my body	473 (36.2)	301 (23.0)	281 (21.5)	171 (13.1)	82 (6.3)
My body is overweight	754 (57.6)	191 (14.6)	158 (12.1)	118 (9.0)	87 (6.7)
I feel depressed about my body	700 (53.5)	289 (22.1)	203 (15.5)	81 (6.2)	35 (2.7)
I wish I were thinner	618 (47.2)	221 (16.9)	193 (14.8)	156 (11.9)	120 (9.2)
Most days I feel bad about my body	703 (53.7)	301 (23)	195 (14.9)	63 (4.8)	46 (3.5)
Attractive awareness					
I look good in clothes	336 (25.7)	294 (22.5)	338 (25.8)	216 (16.5)	124 (9.5)
My body is healthy	79 (6.0)	204 (15.6)	415 (31.7)	426(32.6)	184 (14.1)
I'm usually well dressed	236 (18.0)	352 (26.9)	426 (32.6)	221(16.9)	73 (5.6)
My body looks good	228 (17.4)	393 (30.0)	465 (35.6)	165 (12.6)	57 (4.4)
My body is in shape	267 (20.4)	408 (31.2)	420 (32.1)	162 (12.4)	51 (3.9)
Having a well-proportioned body is important to me	111 (8.5)	233 (17.8)	309 (23.6)	430 (32.9)	225 (17.2)
Physical functionality awareness					
I pay careful attention to my face and hair, so that I will look good	199 (15.2)	326 (24.9)	344 (26.3)	306 (23.4)	133 (10.2)
I feel better about my body when I'm fitter	122 (9.3)	167 (12.8)	272 (20.8)	442 (33.8)	305 (23.3)
Body size matters to me	277 (21.2)	406 (31.0)	436 (33.3)	153 (11.7)	36 (2.8)
The way I feel about my body improves when I exercise regularly	90 (6.9)	220 (16.8)	313 (23.9)	444 (33.9)	241 (18.4)
Height dissatisfaction					
I often wanted to be taller	237 (18.1)	225 (17.2)	224 (17.1)	311 (23.8)	311 (23.8)
I wish I were a different height	366 (28)	248 (19)	214 (16.4)	246 (18.8)	234 (17.9)
If i were a different height, I'd like my body better	369 (28.2)	236 (18.1)	273 (20.9)	257 (19.6)	172 (13.1)

and health science students exhibited symptoms of depression (15, 35–38), suggesting that medical students were more vulnerable to develop depressive symptoms compared to other students (39). This may largely due to the fact that curriculum for medical and health science students are more intense and complex compared to the other students (35, 37, 40, 41). However, no significant association was seen between enrolling in medical and health sciences and depression.

BDD and depression

BDD and depression symptoms among our participants were significantly associated with each other ($x^2 = 9.099$, $p = 0.003$). There is conflicting literature regarding the association of BDD and depression where some literature reported individuals with BDD has a 2.3–4.2 times higher risk for co-existing neuropsychiatric disorders especially depression (11, 42), whilst Pimenta et al. commented that there were no association between BDD and depression in their study (43). However, both studies were conducted in both men and women, while our study only focuses on young men. This association can be partially explained by the higher susceptibility of men with BDD exhibiting negative thought and behavior patterns which increases the vulnerability of developing depression (42).

Strengths and limitations

To our knowledge, this study is the first in the country to determine the proportion of students with symptoms suggestive of body dysmorphic among young adults as well as their

perception on their self-image. However, our sample population consists mainly of students of Chinese ethnicity. Hence, our findings may not be generalized to the other universities in the country. Furthermore, both the PHQ-9 and BDIQ only serve as screening tools for depression and BDD and the diagnosis of both mental disorders require a more structured interview by a trained healthcare provider. A mediator or moderator modeling would be more superior to determine the association between the independent variables and the presence of BDD and depression symptoms. In addition to this, the proportion of depressive symptoms could be much higher than expected as the study was conducted during the COVID-19 pandemic where the movement restriction order was being implemented.

Conclusion

There is a high proportion of young male university students who is at risk of developing depression and BDD. Majority of our male university students are dissatisfied with their height, where the level of dissatisfaction significantly correlates with the severity of depressive symptoms. This implicates the dire need for university authorities to take a proactive approach to screen for depression and BDD among university students, as well as to educate them on mental health resilience.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Science and Research Ethics Committee, University Tunku Abdul Rahman. The patients/participants provided their written informed consent to participate in this study.

Author contributions

WK and WL have made substantial contributions to conception and design of the study, interpretation of the data, and as well as critical revision of the manuscript. ML, XL, YO, TN, and WT have been involved in acquisition of data, analysis and interpretation of data as well as early drafting of the manuscript. All authors have given final approval of the version to be published.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychiatry

TYPE Clinical Trial
PUBLISHED 18 October 2022
DOI 10.3389/fpsyt.2022.989550

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Anxiety and Stress Disorders, a section of the journal Frontiers in Psychiatry

RECEIVED 08 July 2022
ACCEPTED 28 September 2022
PUBLISHED 18 October 2022

CITATION
Hollmann K, Hohnecker CS, Haigis A, Alt AK, Kühnhausen J, Pascher A, Wörz U, App R, Lautenbacher H, Renner TJ and Conzelmann A (2022) Internet-based cognitive behavioral therapy in children and adolescents with obsessive-compulsive disorder: A randomized controlled trial. *Front. Psychiatry* 13:989550. doi: 10.3389/fpsyt.2022.989550

Internet-based cognitive behavioral therapy in children and adolescents with obsessive-compulsive disorder: A randomized controlled trial

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Objectives: Obsessive-compulsive disorder (OCD) in childhood and adolescence often leads to significant impairment in various areas of life and has a high risk of becoming chronic. Cognitive behavioral therapy (CBT) is the recommended first-line treatment, but it is too rarely implemented in accordance with guidelines and is often not available close to the patient's home. Importantly, internet-based CBT could help to reduce this gap in care. Having previously successfully demonstrated the feasibility of an internet-based CBT approach, we aimed to assess its effectiveness in a waiting list controlled randomized trial.

Methods: Children and adolescents aged 6–18 years with a principal diagnosis of OCD received 14 sessions of therapist-delivered CBT *via* videoconference distributed over 16 weeks. After inclusion, participants were randomly assigned to either the treatment or waiting list group. Participants in the treatment group began treatment immediately after baseline diagnostics, and participants in the waiting list group began treatment after a 16-week waiting period. The primary outcome was a pre-post comparison of OCD symptoms as measured with the Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS). Additionally, remission was an important outcome measure. Follow-up assessments were conducted for all measures 16 and 32 weeks after completion of treatment.

Results: A total of 60 children and adolescents were included into the analyses. Over the course of the treatment, OCD symptoms according to the CY-BOCS significantly decreased in the treatment group compared to the waiting-list control group. Cohen's d between groups was 1.63. After the patients in the waiting list group also received the treatment, the OCD

symptoms decreased significantly in this group as well. This improvement of symptoms increased over the course of the follow-up assessments. Remission rate peaked at the 32-week follow-up, with 68% in the treatment group and 79% in the waiting list group. Importantly, patient satisfaction with treatment was high to very high.

Conclusion: In our study, OCD symptoms decreased significantly and remission rate was high after internet-based CBT. Those effects were comparable to those found in studies of face-to-face treatment. Although further evidence is needed, these are early indications that our approach may be a viable way to provide access to adequate treatment for children and adolescents affected by OCD.

Clinical trial registration: [www.ClinicalTrials.gov], identifier [NCT05037344].

KEYWORDS

obsessive-compulsive disorder (OCD), children, adolescents, internet-based psychotherapy, ambulatory assessment, videoconference, cognitive behavioral therapy (CBT), exposure with response prevention

Introduction

Obsessive-compulsive disorder (OCD) in childhood and adolescence is common with a prevalence of 1–3% (1–3). OCD characteristics are intrusive thoughts, urges, doubts, impulses and images that impose themselves on the individual against their will and cause strong unpleasant feelings, such as anxiety, discomfort, or distress. To reduce these feelings, patients with OCD frequently perform ritualized and repetitive actions that take up a large amount of time. Without adequate treatment, the course of OCD is usually chronic, and OCD symptoms may persist into adulthood (4, 5). OCD is associated with significant impairments in various areas of life (e.g., school, leisure time, friends, and family) (6), frequently resulting in a reduced level of psychosocial functioning (7). In addition, OCD has a high rate of comorbidity with other mental illnesses (8–10), contributing to the complexity of the disorder and its treatment.

Abbreviations: CBCL/16-18R, Child Behavior Checklist; CFT 20-R, Basic Intelligence Test Scale 2-Revised; CGAS, Children's Global Assessment Scale; CGI-S, Clinical Global Impressions-Severity; CGI-I, Clinical Global Impression scale- Improvement; COIS-R, The Child Obsessive-Compulsive Impact Scale- Revised; CSQ-8, Client Satisfaction Questionaire-8; CYBOCS, The Children's Yale-Brown Obsessive Compulsive Scale; DIKJ, Depressionsinventar für Kinder und Jugendliche; ECG, Electrocardiography; E/RP, Exposure with Response Prevention; iCBT, Internet-based cognitive behavioral therapy; KINDL, Questionnaire for Measuring Health-Related Quality of Life in Children and Adolescents; K-SADS-PL, The Schedule for Affective Disorders and Schizophrenia for School-Age Children Present and Lifetime Version; OCD, Obsessive-compulsive disorder; CBT, Cognitive behavioral therapy; RCT, Randomized controlled trial; SCARED, Screen for Child Anxiety Related Emotional Disorders; STFF, Summary Therapist Feedback Form; ULQIE, Lebensqualitäts-Inventar für Eltern chronisch kranker Kinder; YSR/11-18R, The Youth Self Report.

Various studies (11, 12) have shown that starting treatment as soon as possible after the initial manifestation of OCD is important to avoid a chronic course. For this reason, it is vital that the disease is diagnosed early and that interventions are initiated according to the guidelines. The treatment of choice for OCD is cognitive behavioral therapy (CBT) and it should include exposure exercises with response prevention (E/RP) as a core element (13, 14). In terms of reducing OCD symptoms, meta-analyses demonstrate between-group effect sizes (ES) for CBT of 1.20 (15) and higher (ES = 1.45) (16). It is recommended that the exercises are conducted accompanied by therapists and in the places where the OCD symptoms occur most frequently (13). In cases of severe OCD and significant impairment, a combined treatment of CBT and medication with Selective Serotonin Reuptake Inhibitors (SSRI) should be considered (13). Treatment with medication alone should only be used when psychological treatment is declined by children or adolescents with OCD and their families, or they are unable to engage in treatment (14).

Despite the clear evidence base for CBT, many patients are not treated with it, and even when they are, E/RPs are too rarely used (17). The main reasons for this are structural (lack of availability of CBT, especially in rural areas) (18), on the part of the treatment providers themselves (lack of experience and associated uncertainty in the implementation of E/RPs) (19, 20), and practical (considerable time and organizational effort to implement E/RPs) (19, 20). The latter is especially true for the therapeutic accompaniment of E/RPs in the patient's home environment.

Internet-based psychotherapy could help overcome at least some of these barriers in several ways. First, it would

eliminate long travel times for patients, enabling some to attend regular treatment appointments with OCD experts in the first place. In addition, it is conceivable that an internet-based approach could lower the inhibition threshold for seeking help, especially for patients who, due to their OCD, cannot leave their home environment or can do so only with considerable difficulty. Therapists would have the opportunity to accompany their patients *via* video conference during exposure exercises in the respective trigger situations at home, significantly reducing the high organizational and time costs (e.g., travel time). Specifically, internet-based psychotherapy *via* videoconferencing could lead to a more frequent application of E/RP in the home context, which are accompanied therapeutically. This could further improve the treatment efficacy.

Recently, contact restrictions during the COVID-19 pandemic highlighted the importance of expanding access to psychotherapy beyond the current levels (21). Preliminary study findings indicated that the pandemic was also associated with an increase in symptom severity among children and adolescents with an preexisting OCD (22), whereas being in therapeutic treatment had a protective effect (23). However, the continuation of psychotherapeutic interventions throughout the pandemic was only possible with the assistance of videoconferencing. In Germany, where our trial was conducted, the technical and legal framework was created in 2019 to allow video-based therapy and further technology-based interventions to be used in standard care (24, 25). Consequently, this increase in the digitalization of psychotherapy expanded the range of available therapies, and the basis for this expansion is the growth in existing evidence for internet-based therapy approaches.

Various technology-based CBT approaches exist for pediatric OCD, which, on a preliminary level, can be divided into internet-based (e.g., videoconferencing, mail, chat, online programs) and non-internet-based (e.g., telephone) CBT. In addition, the CBT approaches differ concerning their scope, whether there is contact with a therapist, and whether the therapy is conducted synchronously in time between therapist and patient. Video-based approaches allow exposure exercises to be accompanied by the psychotherapist in the home environment in real time on the screen. Two studies with children and adolescents have been conducted in this regard (26, 27). From these, initial indications of effectiveness have emerged. However, these need to be confirmed and extended, as the total number of patients studied is still quite small (n = 53). In addition, some of the results refer to a subpopulation (4–8-year-olds) (26). Of the more representative sample in terms of age, the stability of effects was measured only in a part (n = 14) and this only over the relatively short period of 3 months.

We conducted a study to test the feasibility of a novel internet-based CBT approach, whereby therapist-administered psychotherapy sessions took place *via* videoconferences (28). As a basis for this kind of treatment, an existing therapy manual (29) was transformed into a version that could be used online. In addition, various technical elements and devices were combined to an extent that went beyond the previous use of technology in studies on childhood and adolescent OCD. Specifically, ambulatory assessment was essential; using a smartphone application, patients and parents provided daily feedback on OCD symptomatology, mood, the involvement of other family members in the performance of the rituals and avoidance behavior, and other stressors (e.g., daily hassles). Another element of the treatment was the use of an online data cloud system where the therapy materials were made available to patients and their parents. Overall, the feasibility study showed that our approach worked well and was accepted by both patients and their parents. In addition, there was a "high" to "very high" level of satisfaction with the treatment, and a reduction in OCD symptoms was achieved. From the therapists' perspective, the accompaniment of E/RPs in the home environment was highlighted as very positive. Finally, the therapist rated the ambulatory assessment as very helpful as it provided a good overview of the patient's progress during the week and allowed him to address specific events in more detail during the sessions.

As the overall innovative concept was found to be feasible and was well accepted by the families, the effectiveness of the approach will be examined in the current study. The results to date of video-based approaches for pediatric OCD, although promising, are affected by the limitations described above. Evidence that such an approach is effective in typical children and adolescents with OCD remains, in our view, inconclusive. Further initial evidence is warranted. We therefore decided to use a randomized controlled trial with a waiting list control group design. The treatment consisted of 14 therapy sessions *via* videoconference, distributed over 16 weeks. Our primary hypothesis was that OCD symptoms, measured with the Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS), would decline more in the group that begins treatment immediately after enrollment in the study than during the same period in the waiting list control group. In addition, we hypothesized that, after the waiting list control group also received treatment, their OCD symptoms would decrease significantly. Furthermore, we expected the treatment success to be maintained beyond the end of therapy, as assessed using two follow-up measurements conducted in both groups at 16 and 32 weeks after treatment completion.

Materials and methods

Study design

The study was a single-blinded wait list randomized controlled trial designed to demonstrate the effectiveness

of internet-based CBT for children and adolescents with OCD. The participants were randomly assigned to either the treatment or waiting list group. Participants in the treatment group began treatment immediately after baseline assessment, whereas participants in the waiting list group began treatment after waiting period. The duration of the waiting period was 16 weeks, which corresponded to the duration of treatment in the treatment group.

For the treatment group, the primary and secondary outcomes were measured before randomization (baseline, t0), at post-treatment (week 16, t1), at follow-up I (week 32, t2), and at follow-up II (week 48, t3). For the waiting list group, the outcomes were also measured before randomization (baseline, t0), at the end of the waiting period (week 16, t1), at post-treatment (week 32, t2), at follow-up I (week 48, t3), and at follow-up II (week 64, t4).

The study was carried out at the Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, University Hospital of Psychiatry and Psychotherapy, in Tübingen, Germany. The study was approved by the Ethical Committee of the Medical Faculty of the University of Tübingen (639/2018BO1 dated 09/18/2018). The trial was registered at the US National Institutes of Health (ClinicalTrials.gov) #NCT05037344.

Participants

The participants were recruited primarily through the OCD outpatient clinic in Tübingen, which is located in the south of Germany. Recruitment support came from colleagues of an OCD outpatient clinic in Cologne, located approximately 400 km away from Tübingen in western Germany. The colleagues there made potential participants aware of the study and recommended contacting the clinic in Tübingen. The core element of participant recruitment was a campaign conducted in collaboration with the Department of Communication of the University Hospital Tübingen using Google AdWords. When the relevant search terms were entered, information about the study was shown, and families could access the landing page *via* a link. Information about the study was also provided on the homepage of the German Society for OCD. Furthermore, brochures about the study were sent to schools nearby, as well as to child and adolescent psychiatrists and psychotherapists in Tübingen.

Eligible participants were children and adolescents between the ages of 6–18 years with a primary diagnosis of OCD according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), a Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS) total score of $\geq$ 16, daily access to a broadband internet connection, a at least one legal guardian, especially a parent who was able to participate in the study, and the ability to read and write in German. Participants with psychiatric comorbidities were included if the comorbid disorder did not have a higher treatment priority than OCD; participants taking a psychotropic medication could also be included if the medication had been at a stable dose for the 6 weeks prior to the baseline assessment. When children and adolescents were enrolled in the study, parents were specifically told that drug treatment status must remain unchanged.

Participants were excluded if they had an IQ below 70, a psychiatric comorbidity that required initial treatment, such as anorexia nervosa with massive underweight, suicidal ideation, or such a degree of severity of OCD symptoms that the indication for full inpatient treatment existed. This was the case, for example, when school attendance was no longer possible. In addition, participants were excluded if they had a substance use disorder or if their family was psychologically distressed to the point that participation in the sessions and care of their children during the study was not possible. No other psychological treatment was allowed during participation in the study.

Autism spectrum disorder was not considered an exclusion criterion for the study as long as the OCD symptoms were clearly in the focus at the time of the screening/baseline assessment and the affected subjects were able to express a clear desire for change in relation to these symptoms.

After the families had contacted the study team by mail or telephone, an appointment was made with them for a telephone screening. The aim was to clarify to the extent possible whether the inclusion criteria were fulfilled and whether there were indications of the presence of exclusion criteria. In addition, the families received information about the treatment in the study and study design. Both the children and adolescents and at least one legal guardian/parent participated in this screening, which was conducted by a licensed psychotherapist. In the event of potential eligibility, the children and adolescents and at least one guardian were invited to the clinic in Tübingen for a detailed assessment. This initially consisted of an interview with a licensed psychotherapist, in which the focus was on an in-depth exploration of OCD symptoms, their impact on family life, and the final clarification of the children's and adolescents' motivation for therapy. In addition, the families were given the opportunity to clarify any unanswered questions they had regarding study design and CBT for OCD. All children, adolescents and guardians provided written informed consent to participate during this appointment. If no clear indications of fulfilled exclusion criteria emerged in the interview, another licensed psychotherapist, whose role in the study was solely to conduct the diagnostic assessment, took over and conducted baseline measurements with the children, adolescents and legal guardians/parents (see sections Primary and Secondary outcome measures - Clinician-rated). To avoid overtaxing the children and adolescents, this frequently occurred on a separate appointment. In addition, children and adolescents as well as

parents completed various clinical questionnaires (see section secondary outcome measures—child- and parent-rated). If the inclusion criteria were fully met, random assignment to one of the two conditions was made. Subsequently, participants and their parents were informed of inclusion and group membership by the psychotherapist who had conducted the interview. Before the first therapy session, another appointment was held during which participants and parents received an introduction to the use of the technical equipment (a.o. tablet with videoconference program, smartphone with ambulatory assessment application, data cloud) by a research assistant.

Due to the COVID-19 pandemic, the entire assessment was conducted *via* videoconferencing beginning in the spring of 2020. Informed consent forms and questionnaires were exchanged by mail between families and the study team.

The participants were able to discontinue treatment at any time if side effects occurred or at their request and were subsequently assisted in identifying another treatment option.

Randomization and masking

The randomization list was developed by our Institute of Clinical Epidemiology and Applied Biometry (IKEaB) and originally consisted of eight blocks of six participants each. The allocation ratio between the treatment and waiting list groups was 1:1, and stratification did not occur. Several participants dropped out, almost exclusively during the waiting period from the control group. To prevent the sample size of the waiting list group from falling below 20, two additional blocks of six subjects each were created, increasing the number of included participants to 60. The allocation ratio remained unchanged at 1:1. The randomization list was kept in an opaque envelope in a locked cabinet. After inclusion in the study, the participants received a participant number according to the order of their detailed assessment, which was used to indicate which group they had been assigned to in the list. Feedback regarding which of the two groups the participants had been assigned to was given to them by one of the psychotherapists from the study team. The diagnosticians were blinded to group membership at all data collection points and did not have access to the randomization list. The families were repeatedly reminded by the study team that they were not allowed to provide any information regarding their group membership during the diagnostic procedure.

Interventions

Participants in both groups received 14 sessions of CBT *via* videoconferencing. We decided to schedule 16 weeks for this, as we had learned in our feasibility study that it is not always possible to conduct one therapy session per week due to external circumstances such as flu-like infection of the participant. Each therapy session was scheduled to last up to 90 min. Once again, the treatment guide we developed specifically for internet-based CBT was used, which is based on the CBT manual by Wewetzer and Wewetzer, (29) and used successfully in a previous pilot study. The core elements of this guide are therapeutically supervised exposures with response management, cognitive interventions, and family-centered interventions.

Similar to traditional CBT treatment for OCD, our internet-based CBT consisted of four phases. Phase I (session 1) included the establishment of a therapeutic relationship and psychoeducation on the topic of compulsions. This also included the creation of an explanatory model. Phase II (sessions 2–4) taught participants how exposures with response prevention work and prepared them for this. Other key content included creating distance from the content of the obsessions, initial cognitive interventions, and first steps to reduce the extent of involvement of other family members in the compulsions. The central elements of Phase III (sessions 5–12) were the implementation of E/RPs (part of each session from session 5 onward), in addition to cognitive interventions and family-centered interventions. The exposure exercises were supervised therapeutically on screen and subsequently performed independently by the participants several times between sessions. Finally, Phase IV (sessions 13–14) focused on relapse prevention.

The treatment providers were licensed psychotherapists with several years of professional experience and expertise in OCD in childhood and adolescence. They received supervision from the therapeutic head of study during weekly team meetings. The head of study was a licensed psychotherapist with a high level of expertise and practical experience in the treatment of children and adolescents with OCD due to several years of leading the special outpatient clinic for pediatric OCD. In addition, he is co-author of the German-language guideline for OCD.

All the therapy materials were stored in a password protected data cloud in separate folders for participants and parents. Another component of the treatment was the information that participants and parents submitted separately on a daily basis *via* the application. This information was related to OCD symptomatology and the resulting impairments in daily life, avoidance behaviors, mood, and daily stresses. In addition, *via* the application, the participants kept a log of the progress of their independently performed E/RPs, and the therapists had access to this data and could use it when preparing for the next session. For this purpose, the families received a smartphone secured by software so that only access to study-specific applications was possible. Furthermore, another application was used that connected the smartphone to a physiological wristband. Using this application, subjects were asked to set timestamps for various events (e.g., the start and end of E/RP, the time of going to bed and waking up).

Technical equipment

All the families were provided with a smartphone and a tablet, both of which had been preconfigured by our department. The therapy sessions were conducted *via* videoconference using the program Vidyo®. We used the secured data cloud of our hospital for the storage of therapy materials. Physiological data were measured using the AS97 physiology wristband from Beurer, which recorded heart rate, activity level in the form of movement, and sleep quality data. The aim was to collect information regarding physical signs of stress, especially during E/RPs in children and adolescents with OCD. We aim to report on the analysis of these data in a separate article.

Measurements

Primary outcome measure—Clinician-rated

The primary outcome measure was the CY-BOCS, considered the gold standard for the diagnostic assessment of OCD in children and adolescents (30). This is a semi-structured, clinician-administered interview that evaluates the severity of obsessions and compulsions across five dimensions (time occupied by symptoms, interference, distress, resistance and degree of control over symptoms). The total score is calculated using 10 items, with a maximum possible score of 40 points. The cut-off value for identifying clinically relevant obsessive-compulsive symptomatology is $\geq$ 16 points. Internal consistency was good for the Obsession and Compulsion Severity Scores (Cronbach's alpha = 0.80 and 0.82), and the Total Score (Cronbach's alpha = 0.90) (31). This also applies to the Test-retest stability for the Obsession and Compulsion Severity Scores (ICC = 0.70 and 0.76), and the Total Score (ICC = 0.79) (31). The intraclass correlations for the CY-BOCS Total, Obsession, and Compulsion Severity scores were 0.84, 0.91, and 0.66, respectively, suggesting good to excellent interrater agreement (32). *The Clinical Global Impressions* (CGI) (33) are ratings used by the clinician to rate the severity of psychopathology (CGI-Severity) on a scale of 1 (no symptoms) to 7 (extremely severe) and the change after treatment compared to the baseline (CGI-Improvement) on a scale ranging from 1 (very much improved) to 7 (very much worse). At r = 0.58, there is a substantial relationship between obsessive-compulsive symptom severity scores (measured *via* the CY-BOCS) and the global OCD syndrome severity (measured via the CGI–Severity scale) (34).

Secondary outcome measures—Clinician-rated

The *Schedule for Affective Disorders and Schizophrenia for School-Age Children Present and Lifetime Version* (K-SADS-PL), is a semi-structured, clinician administered interview that assesses a range of psychopathology in children and adolescents. Interrater agreement in scoring screens and diagnoses was high (range: 93–100%) (35). The *Children's Global Assessment Scale* (CGAS) allows a clinician to assess participants' overall level of functional strain. The rating ranges from 0 to 100, with higher values indicating a better level of social function. The inter-rater reliability was 0.84, and the test-retest reliability at 0.85 (36). Finally, the *Basic Intelligence Test Scale 2-Revised* (CFT 20-R) is a speech-free measure of fluid intelligence. Psychometric results revealed a good retest-reliability (r = 0.80–0.82) and high internal consistency (Cronbach's alpha = 0.95) (37).

At all measurement time points, all clinician-rated measures were performed by diagnosticians blinded to group membership. All diagnosticians were licensed psychotherapists, had performed all outcome measures prior to the start of the study, and were experienced in their use.

Secondary outcome measures—Child- and parent-rated

The *Child Obsessive–Compulsive Impact Scale—Revised* (COIS-R) is a self-report and parent-report questionnaire designed to assess the impact of OCD symptoms on the psychosocial functioning of children and adolescents in home, social, and academic environments. Reliability was excellent for the parent-report total score (ICC = 0.81). The youth-report form yielded similar test–retest reliability for the total score (ICC = 0.89) (38).

The *Screen for Child Anxiety Related Emotional Disorders* (SCARED) is a self- and parent-report questionnaire that assesses symptoms of panic disorder, generalized anxiety disorder, separation anxiety disorder, and social anxiety disorder, in addition it assesses symptoms related to school phobia. For the total score and each of the five factors in the child and parent versions, the authors report good internal consistency (Cronbach's alpha = 0.74–0.93), good test-retest reliability (intraclass correlation coefficients = 0.70–0.90), and moderate parent-child agreement (r = 0.20–0.47) (39).

The *Depression Inventory for Children and Adolescents* (DIKJ) assess emotional distress. Considering the diagnostic criteria of the DSM-5, the degree of depressive impairment was assessed with the help of 26 items. The internal consistency was high (Cronbach's alpha = 0.92) (40).

The *Child Behavior Checklist* (CBCL/4–18), which is a parent-report scale, measures a wide range of child behavioral and emotional problems, as well as the *Youth Self Report* (YSR/11–18), which is a self-report scale for children and adolescents. For both measures, the internal consistency for the total score was Cronbach's alpha = 0.93. The correlation between parent and child total scores was r = 0.33 in a clinical norm sample (41).

The *Questionnaire for the Measurement of Health-Related Quality of Life in Children and Adolescents* (KINDL) is available in a child- and a parent-report version (42). The subscales are physical well-being, emotional well-being, self-esteem, family, friends, and everyday functioning. These can be summed to

obtain a total score. Psychometric results revealed a high degree of reliability (Cronbach's alpha = 0.70 for most of the subscales). The *Ulm Quality of Life Inventory for Parents* (ULQIE) measures quality of life of parents of chronically ill children. The instrument contains the dimensions physical and daily functioning, satisfaction with the situation in the family, emotional distress, self-development, and wellbeing. Cronbach's alpha for the subscales = 0.75–0.88; for the global scale = 0.91. Retest reliability was between 0.69 and 0.86 (43).

Measurements of satisfaction, feasibility, and implementation

The *Client Satisfaction Questionnaire-8* (CSQ-8) was completed at post-treatment to assess the participant's perceptions of the value of the services received (44). The questionnaire consists of eight items answered on a four-point Likert scale ranging from one to four. The total score ranges from 8 to 32, with higher scores indicating more satisfaction. The internal consistency was found to be 0.93 (45). We developed our own *Final Therapy Evaluation Questionnaire* based on relevant research as a measure of treatment evaluation (46, 47) for the child, the parents, and the therapist. Each item was rated on a four-point Likert scale, including the response options "I agree," "I somewhat agree," "I somewhat disagree," and "I disagree." This questionnaire covered questions regarding satisfaction with the therapy and aspects of implementation, such as adherence (intervention was delivered as intended—answered only by the therapist), quality (how well different program components were conducted), and program differentiation (unique features of the program).

The *Summary Therapist Feedback Form* (STFF) was conducted after treatment, with responses provided on a seven-point Likert scale ranging from "Not at all" to "Somewhat" to "Very much" in response options. This feedback form focused on therapists' feedback regarding the user-friendliness of the therapy materials, the comprehensibility, the practicability of the treatment manual, and whether all essential treatment elements were included in the manual (44).

Adverse events

In each therapy session, the therapists obtained an impression of the general emotional state of the participants and the extent of their OCD symptoms. If there were indications of a deterioration, contact was immediately made with the head of the study to discuss the further procedure and, if necessary, to initiate action (e.g., inpatient admission). If the situation was not acute, it was discussed at the weekly team meeting. If there was any uncertainty regarding the urgency, the head of study could be contacted at any time.

Sample size

Existing studies were consulted for guidance on effect sizes, based on comparisons of CY-BOCS total scores. In a CBT for children and adolescents conducted *via* webcam (27), the effect size between treatment group (n = 16) and waiting list group (n = 15) for the treatment effect was d = 1.36. The effects in decreased CY-BOCS scores remained stable at 3-month follow up assessment. Another study on pediatric OCD (48), which compared a face-to-face exposure treatment (n = 10) with a waiting list group (n = 10) yielded an effect size of d = 1.23 between these two conditions at post-treatment assessment. The changes remained stable during the follow-up period, which averaged 14 weeks. In our feasibility study (28), in which we had used the same approach as in this RCT, the effect size pre-post-treatment was d = 2.02 at N = 9. We therefore knew that our approach was very likely to lead to symptom reduction.

Power calculations should take into account that the planned analysis of treatment effectiveness in this study will be a mixed ANOVA with group as the between-subject factor (treatment group; waiting list group) and time as the within-subject factor (t0 = baseline; t1 = end of treatment/end of waiting period). The interaction effect group × time was particularly important for the treatment evaluation and should therefore have had enough power. Another consideration was that the sample should be large enough to allow secondary analyses in follow-up analyses on individual courses and subgroup effects, and to obtain sufficient data in follow-up assessments. Regarding potential drop-outs, we were guided by another technology-based study, in which the follow-up duration was 12 months (49). Already at 6-month follow-up, up to 30% of the participants no longer participated in the assessments.

Assuming a large effect size (η^2 = 0.15), an alpha-error of p = 0.05, and a 1-beta-error of 0.8, the total sample size was estimated by 48 (i.e., 24 per group). The goal was to have at least 20 participants per group at the end of treatment in both groups (t2). According to drop-outs during the waiting period (9 of eligible 24 participants) and to prevent the sample size of the waiting list group from falling below 20 and to gain enough data for the follow-up assessments, it was necessary in the course of the study to increase the number of included participants to 60 (n = 30 in each group).

Data processing and statistical analysis

The data were analyzed using R (Version 4.0.0) and IBM SPSS Statistics (Version 27). All randomized participants were included in the analyses, in accordance with intention-to-treat principles (50). For various reasons, results were not available for all participants for all measurement time points. For example, families who dropped out of the study before the

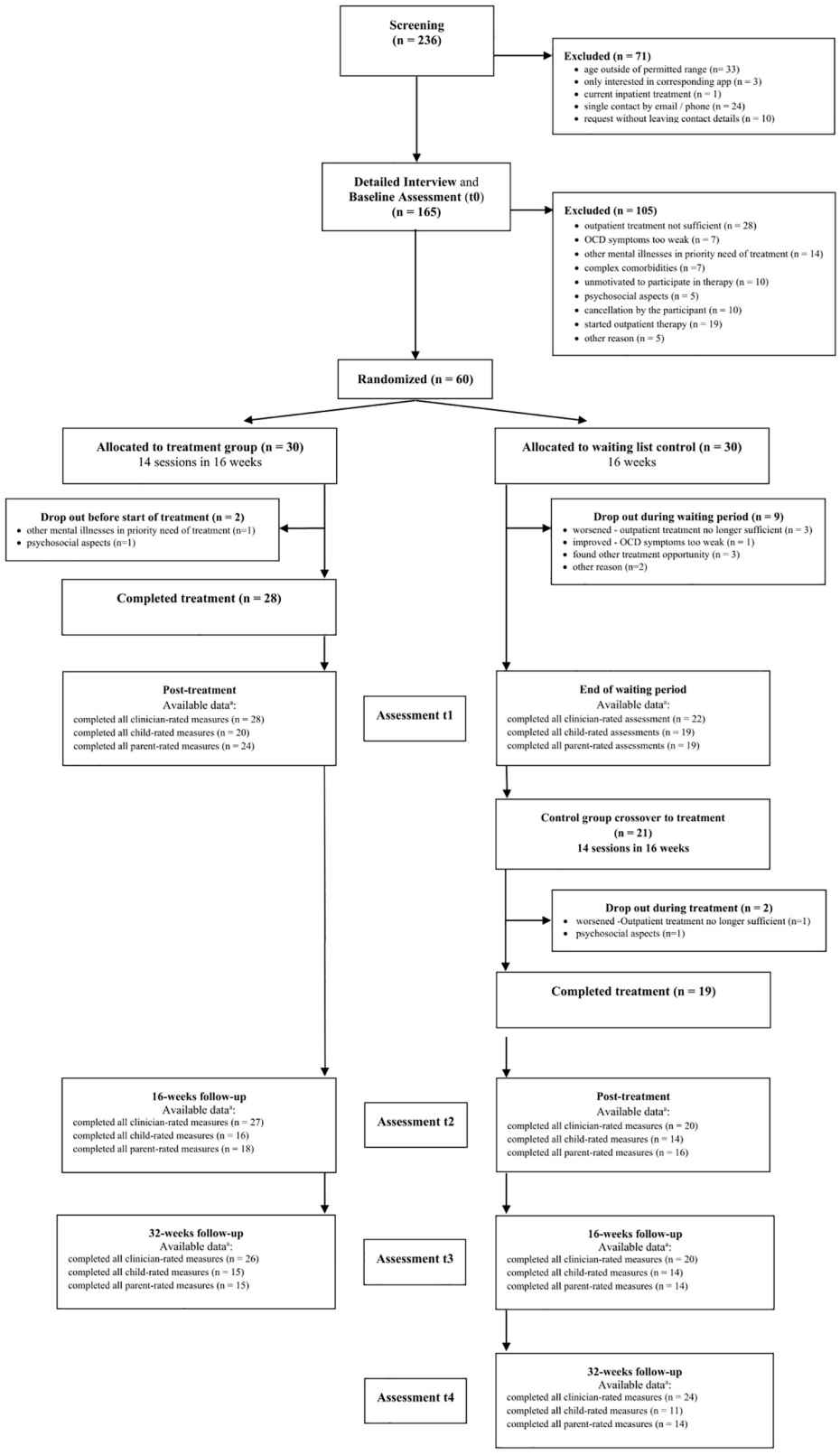

FIGURE 1
Study flow chart. Listed as available data [a] are all data available at that measurement point, regardless of whether participants received treatment or not.

TABLE 1 Sociodemographic and clinical characteristics of participants at baseline (N = 60).

	Treatment group (n = 30)	Waiting list group (n = 30)	Statistical analysis regarding possible group differences
Gender			
Female/male	12 (40.0%)/18 (60.0%)	12 (40.0%)/18 (60.0%)	χ^2 (1) = 0, p = 1.0
Age (years)			
Mean (*SD*) [range]	12.60 (2.88) [7–17]	13.87 (2.68) [7–18]	t(58) = 1.76, p = 0.084
Migration background			
Yes/no	5 (17.0%)/24 (80.0%)	5 (16.7%)/25 (83.3%)	χ^2 (1) = 003, p = 0.953
IQ			
CFT 20-R mean *(SD)*	109.35 (13.52)	106.93 (11.62)	t(55) = 0.73, p = 0.470
Parent educational level mother			
Undergraduate degree or higher	22 (75.9%)	13 (46.4%)	χ^2 (1) = 5.21, p = 0.022[a]
No academic degree	7 (24.1%)	15 (53.6%)	
Parent educational level father			
Undergraduate degree or higher	17 (63.0%)	14 (50.0%)	χ^2 (1) = 0.939, p = 0.418[a]
No academic degree	10 (37.0%)	14 (50.0%)	
Distance between patients' residence and study site (km)			
Mean *(SD)* [range]	173.46 (174.5) [10-771]	170.5 (127.5) [15–557]	t(58) = 0.08, p = 0.940
Duration of OCD symptoms (months)			
Mean *(SD)* [range]	28.20 (26.64) [3–105]	33.63 (34.21) [1–120]	t(58) = 0.69, p = 0.495
Previous psychological treatment of OCD			
Treatment: yes/no	16 (53.3%)/14 (46.7%)	15 (50.0%)/15 (50.0%)	χ^2 (1) = 0.067, p = 0.796
CBT including E/RP	1 (3.3%)	1 (3.3%)	[b]
CBT without E/RP	6 (20.0%)	1 (3.3%)	[b]
Other	9 (30.0%)	13 (43.3%)	[b]
Ongoing psychotropic medication			
Medication: yes/no	2 (6.7%)/28 (93.3%)	3 (10.0%)/27 (90.0)	χ^2 (1) = 0.183, p = 0.669
SSRI	2 (6.7%)	1 (3.3%)	[b]
Tricyclic antidepressants	0 (0.0%)	1 (3.3%)	[b]
Stimulants	0 (0.0%)	1 (3.3%)	[b]
Number of participants with 0–3 comorbid diagnoses			
Comorbid diagnosis: yes/no	20 (66.7%)/10 (33.3%)	23 (76.7%)/7 (23.3%)	χ^2 (1) = 0.739, p = 0.390
One	10 (33.3%)	13 (43.3%)	[b]
Two	8 (26.7%)	6 (20.0%)	[b]
Three	2 (6.7%)	4 (13.3%)	[b]
Frequency of comorbid diagnoses (K-SADS-PL)			[b]
Depressive episode	2	5	
Anxiety disorders			
Specific phobia	8	10	
Social phobia	1	2	
Generalized anxiety disorder	4	8	
Separation anxiety	4	2	
Tic disorder	4	2	
ADHD	5	5	
Childhood emotional disorders with sibling rivalry	2	1	
Other childhood emotional disorders	1	1	
Depersonalization and derealization syndrome	1	0	
Autism spectrum disorder	0	1	

[a]The variables for calculation of the chi-square test were educational level (undergraduate degree or higher vs. no academic degree) and group (treatment group vs. waiting list group).
[b]No statistical analysis was performed due to the insufficient number of values per cell. N = 59 for migration background. N = 57 for IQ. N = 57 for mothers' educational level. N = 55 for fathers' educational level.

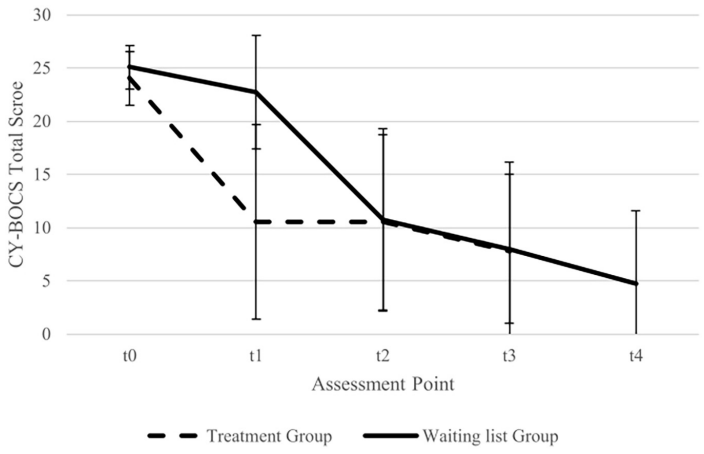

FIGURE 2
Imputed data for total Children's Yale Brown Obsessive Compulsive Scale (CY-BOCS) mean scores (with standard deviation) for treatment group and waiting list group. Assessment points treatment group: t0 = baseline, t1 = post-treatment, t2 = 16 weeks Follow Up, t3 = 32 weeks follow-up. Assessment points waiting list group: t0 = baseline, t1 = pre treatment, t2 = post-treatment, t3 = 16 weeks follow-up, t4 = 32 weeks follow up.

start of treatment, were mostly no longer willing to participate in diagnostic appointments.

Regarding the handling of missing values, the recommendations of the National Research Council (51) were followed. In a first step, an analysis of the missing data was performed and found that not all of the missing data fulfilled the Missing Completely at Random Criterion (MCAR) (52). Data were analyzed to determine if missing values correlated with any baseline characteristics (i.e., group, sex, age, comorbidity, duration of OCD symptoms) or missing values of other measures *via* chi-square tests und logistic regressions. Subsequently, considering the variables associated with the pattern of missing data, multiple imputations for interval scaled outcome measures were performed. Fifty new data sets were created for each outcome measure for each of the measurement time points t1 to t4. An exception is the assessment of whether participants met the criteria for remission and/or response. No imputation was performed for this categorical assignment, and only participants who had received the full treatment were included.

Both data sets (original and imputed data) were analyzed in the below mentioned manner. Importantly, regardless of which of the two data sets was used, there were no differences in the results regarding the effectiveness of the treatment and the stability of the treatment effects.

Presented are the analyses of the imputed data. An overview of the original primary and secondary outcome measures can be found in **Appendix Table A1**.

Differences between the two groups at t0 were calculated using *t*-tests and chi-square tests. If necessary, the degrees of freedom in the *t*-tests were Welch corrected. For all primary and secondary outcomes norm values were used, if available.

Analyses were done in two steps for interval scaled measures. In the first step, the effectiveness of the treatment was assessed. Mixed ANOVAs with group as the between-subjects factor (treatment group; waiting list group) and time as the within-subjects factor (t0 = baseline assessment; t1 = end of treatment/end of the waiting period) were calculated.

In a second step, the stability of the treatment effects found in the first step were examined. Mixed ANOVAs were calculated with group as the between-subjects factor (treatment group; waiting list group) and time as the within-subjects factor (post-treatment, follow-up I, follow-up II). To establish a calculation basis for the comparison of the two groups with regard to the follow-up values after completion of the treatment, the results for all primary and secondary outcome measures were combined in the SPSS matrix into three variables per outcome measure. For example, the CY-BOCS scores from measurement time point t1 for the treatment group and measurement time point t2 for the waiting list group formed the variable "CY-BOCS post-treatment," the scores of t2 for the treatment group and those of t3 for the waitlist group formed "CY-BOCS Follow-Up I," and the values at t3 for the treatment group and t4 for the waiting list group formed "CY-BOCS Follow-Up II."

To further analyze significant results of the ANOVAS two-sided *t*-tests were conducted. For measures that were strongly hypothesis-driven (CY-BOCS, CGI-I) the alpha level was 0.05. For all others, it was set to 0.001, to reduce the risk of an alpha error.

Effect sizes (ES) were estimated for CY-BOCS total scores using Cohen's *d*. These were calculated both between groups at measurement point t1 and within groups for the comparison of

pre-treatment and post-treatment. If the standard deviations of the compared CY-BOCS means weren't equal, pooled standard deviations where used.

Participants were classified as responders if they had at least a 35% reduction in total CY-BOCS scores compared with baseline measurements (t0) and if they had a CGI-Improvement value of 1 or 2. Remission was defined as a CY-BOCS total score of 12 or less and a CGI-Severity value of 1 or 2 after treatment was completed (53).

As all participants received the same treatment, there was no analysis by group in terms of the measurements of feasibility, acceptance, and implementation. For the CSQ-8, means and standard deviations were calculated across all participants, both for the individual items and the total score. For the STFF, means and standard deviations were calculated across all therapists for each item. The responses to the Final Therapy Evaluation Questionnaire were considered separately for participants and parents, and the frequency of agreement with the statements was determined as a percentage.

Results

Sample characteristics and study flow

Figure 1 displays the participant flow. A total of 236 families were screened for eligibility between January 2019 and November 2020.

60 children and adolescents in total were enrolled in the study and randomly assigned in equal numbers to one of the two conditions, making each group a total of 30 participants. In the treatment group, two participants dropped out of the study before beginning the intervention. The remaining 28 subjects began and all completed treatment. In the waiting list group, nine participants dropped out by the end of the waiting period, leaving the remaining 21 participants to begin treatment. During treatment, 2 subjects dropped out of the study, so it was still completed by 19 participants in the waiting group.

Data from all 60 participants at each measurement time point were included in the analysis of the original data, if available, even if they had not received or completed treatment. As shown in **Figure 1**, the number of participants who attended post-treatment follow-up visits varied.

Table 1 presents the baseline characteristics of the sample. The two groups did not differ significantly concerning any demographic or clinical variables, except for the mothers' educational level. In the treatment group, the proportion of mothers with an academic degree was significantly higher than in the waiting list group. Of the participants, 60% were male (n = 36), and the mean age of all participants was 13.54 years (SD = 2.76). The average distance between the families' homes and the study center in Tübingen was M = 171.9 km (SD = 151.5), and the median was Mdn = 132.0 km. The participants had experienced obsessive-compulsive symptomatology for an average of M = 31.03 months (SD = 30.76), and the median was Mdn = 20.00 months. At baseline assessment, 71.7% (n = 43) of the participants were diagnosed with at least one comorbid mental disorder. Overall, 31 participants (52%) had previously received psychological treatment, 22 had been treated with a psychotherapy other than CBT, and nine had been treated with CBT. E/RP had previously been used with two participants during their CBT treatment. In the other psychotherapy procedures, no E/RP against OCD symptoms had been conducted for any participant.

Effectiveness of the treatment

Primary outcomes

Children's Yale-Brown Obsessive Compulsive Scale[1]

A graphical representation of the CY-BOCS scores for every assessment point is shown in **Figure 2** and a list of the individual scores for all outcome measures in **Table 2**.

A mixed two-way ANOVA with group (treatment group, waiting list group) as the between-subjects factor and time (t0, t1) as the within-subjects factor for CY-BOCS scores showed a significant effect of time [F (1, 58) = 68.47, p < 0.001], a significant effect of group [F (1, 58) = 39.22, p < 0.001], and a significant group x time interaction effect [F (1, 58) = 34.52, p < 0.001]. The significant interaction was further analyzed. In the treatment group, there was a significant difference between t0 and t1 [t (29) = 8.43, p < 0.001], whereas in the waiting list group, the difference was not significant [t (29) = 2.24, p = 0.067]. Between-group comparisons revealed a significant difference between the treatment group and the waiting list group for t1, with those in the treatment group showing lower CY-BOCS scores than those in the waiting list group [t (46.47) = 6.33, p < 0.001], whereas comparison between the groups was non-significant for t0 [t (55.70) = 1.73, p = 0.089].

Cohen's d between groups for t1 was d = 1.63. The within-group effect size for the treatment group (t0 to t1) was d = 2.01.

Clinical global impressions-severity

A mixed two-way ANOVA with group (treatment group, waiting list group) as the between-subjects factor and time (t0, t1) as the within-subjects factor for CGI-Severity scores showed a significant effect of time [F (1, 58) = 76.87, p < 0.001], a significant effect of group [F (1, 58) = 51.39, p < 0.001], and a significant group x time interaction effect [F (1, 58) = 36.84, p < 0.001]. In the treatment

1 ANOVAs revealed, neither age nor sex had influence on CY-BOCS scores at any timepoint or change of scores over time.

TABLE 2 Imputed data for primary and secondary outcome measures.

	Unadjusted mean ± standard deviation								
	Treatment group				Waiting list group				
Measure	**Baseline assessment (t0)**	**Post-treatment (t1)**	**Follow-up I (t2)**	**Follow-up II (t3)**	**Baseline assessment (t0)**	**End of waiting period (t1)**	**Post-treatment (t2)**	**Follow-up I (t3)**	**Follow-up II (t4)**
Clinician-rated measures									
CY-BOCS	24.03 ± 2.54	10.52 ± 9.15	10.51 ± 8.26	7.83 ± 8.35	25.07 ± 2.07	22.74 ± 5.32	10.76 ± 8.58	8.00 ± 7.01	4.75 ± 6.84
CGI-Severity	4.93 ± 0.52	2.35 ± 1.56	2.34 ± 1.52	2.05 ± 1.45	5.07 ± 0.37	4.59 ± 0.81	2.42 ± 1.51	1.99 ± 1.15	1.46 ± 0.85
CGI-Improv.		1.89 ± 1.17	1.81 ± 1.18	1.62 ± 1.02		3.86 ± 0.89	1.50 ± 1.15	1.35 ± 0.67	1.21 ± 0.42
CGAS	60.20 ± 10.48	82.10 ± 14.86	81.68 ± 11.68	83.96 ± 14.88	60.03 ± 10.05	65.40 ± 11.46	82.22 ± 13.31	85.87 ± 10.14	90.14 ± 10.08
Child-rated measures									
YSR	60.41 ± 20.08	48.18 ± 16.66	45.93 ± 17.73	42.69 ± 21.48	58.56 ± 18.50	53.75 ± 17.87	49.56 ± 18.40	46.71 ± 21.19	43.69 ± 21.50
SCARED	20.75 ± 13.25	14.02 ± 10.88	14.57 ± 10.11	12.48 ± 10.68	21.16 ± 11.55	17.45 ± 11.25	16.08 ± 10.67	14.49 ± 12.98	11.69 ± 11.07
COIS-RC	19.70 ± 17.04	8.01 ± 10.12	5.51 ± 8.92	4.88 ± 11.70	17.44 ± 10.86	12.17 ± 9.13	6.07 ± 8.11	3.84 ± 9.26	1.09 ± 8.51
DIKJ	14.20 ± 10.03	10.66 ± 8.58	8.36 ± 7.84	6.47 ± 7.67	14.81 ± 7.88	11.32 ± 8.38	9.20 ± 7.64	7.29 ± 6.91	6.22 ± 7.19
KINDL	70.40 ± 12.64	73.65 ± 11.40	72.72 ± 12.62	74.65 ± 12.69	68.94 ± 11.06	73.30 ± 11.56	75.90 ± 11.03	76.21 ± 12.25	78.38 ± 11.52
Parent-rated measures									
CBCL[a]	63.77 ± 7.75	56.80 ± 10.96	55.84 ± 10.08	52.05 ± 10.92	64.15 ± 7.27	60.84 ± 8.61	55.94 ± 8.90	52.82 ± 8.86	50.27 ± 8.59
SCARED	20.34 ± 13.11	15.85 ± 10.44	14.93 ± 10.67	12.43 ± 12.05	20.33 ± 8.53	17.46 ± 9.49	14.96 ± 10.60	11.67 ± 10.34	9.95 ± 9.21
COIS-RP	25.87 ± 18.10	12.10 ± 13.06	11.60 ± 17.69	7.66 ± 13.52	22.75 ± 12.14	15.92 ± 12.51	11.77 ± 16.38	6.42 ± 11.25	2.69 ± 11.13
KINDL	64.87 ± 12.65	72.08 ± 11.67	71.98 ± 12.12	75.24 ± 11.21	62.20 ± 14.00	68.54 ± 12.95	71.31 ± 10.18	76.80 ± 10.04	78.23 ± 11.10
ULQUIE	75.20 ± 16.78	75.17 ± 16.10	73.38 ± 21.31	77.33 ± 17.86	75.88 ± 15.26	81.58 ± 11.01	84.40 ± 13.44	86.18 ± 13.06	86.43 ± 15.77

[a] *T*-values.

10.3389/fpsyt.2022.989550

TABLE 3 Statistical analyses of secondary outcome measures—treatment effects.

	Mixed two-way ANOVA with the factors group (treatment, waiting list) and time (t0, t1)		
Measure	**ME time**	**ME group**	**IA time × GROUP**
Clinician-rated measure			
CGAS	***F*** **(1, 58) = 47.87, *p* < 0.001; t1 > t0**	***F*** **(1, 58) = 13.17, *p* = 0.001; TG > WG**	***F*** **(1, 58) = 17.81, *p* < 0.001** TG: t (29) = 7.02, $p < 0.001$; t1 > t0 WG: t (29) = 2.22, $p = 0.053$ t0: t (57.90) = 0.06, $p = 0.950$ t1: t (54.22) = 4.89, $p < 0.001$; TG > WG
Child-rated measures			
YSR	F (1, 58) = 12.14, $p = 0.010$	F (1, 58) = 0.41, $p = 0.639$	F (1, 58) = 2.84, $p = 0.232$
SCARED	F (1, 58) = 7.55, $p = 0.019$	F (1, 58) = 0.77, $p = 0.436$	F (1, 58) = 0.80, $p = 0.466$
COIS-RC	***F*** **(1, 58) = 17.35, *p* < 0.001; t1 < t0**	F (1, 58) = 0.25, $p = 0.068$	F (1, 58) = 2.63, $p = 0.149$
DIKJ	F (1, 58) = 11.36, $p = 0.005$	F (1, 58) = 0.19, $p = 0.717$	F (1, 58) = 0.34, $p = 0.658$
KINDL	F (1, 58) = 4.84, $p = 0.047$	F (1, 58) = 0.26, $p = 0.670$	F (1, 58) = 0.30, $p = 0.674$
Parent-rated measures			
CBCL[a]	***F*** **(1, 58) = 15.76 *p* < 0.001; t1 < t0**	F (1, 58) = 1.54, $p = 0.260$	F (1, 58) = 2.17, $p = 0.201$
SCARED	F (1, 58) = 6.27, $p = 0.031$	F (1, 58) = 0.21, $p = 0.713$	F (1, 58) = 0.54, $p = 0.561$
COIS-RP	***F*** **(1, 58) = 25.34, *p* < 0.001; t1 < t0**	F (1, 58) = 0.12, $p = 0.799$	F (1, 58) = 3.11, $p = 0.125$
KINDL	F (1, 58) = 13.18, $p = 0.002$	F (1, 58) = 1.39, $p = 0.284$	F (1, 58) = 0.23, $p = 0.716$
ULQUIE	F (1, 58) = 1.69, $p = 0.277$	F (1, 58) = 1.52, $p = 0.293$	F (1, 58) = 1.82, $p = 0.279$

[a] T-Values. Significant values, defined as $p \leq 0.001$, are in bold. ME Time, Main Effect Time; ME Group, Main Effect Group; IA Time × Group = Interaction of Time × Group. TG, Treatment group; WG, Waiting list group.

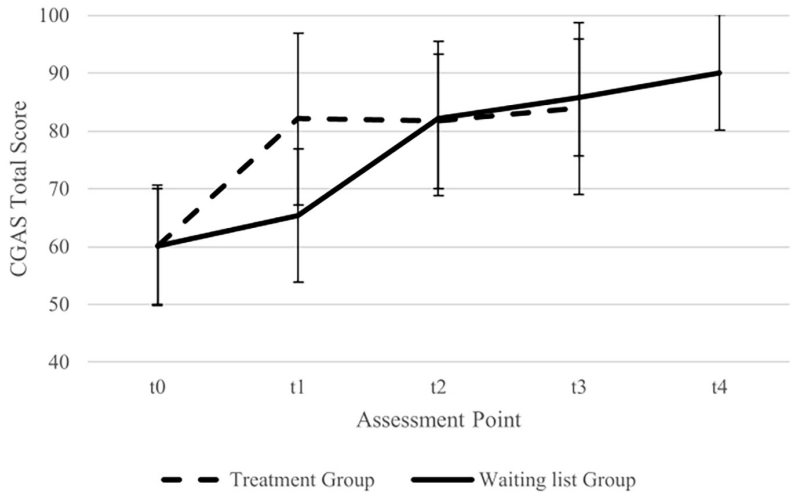

FIGURE 3
Imputed data for total Children's Global Assessment Scale (CGAS) mean scores (with standard deviation) for treatment group and waiting list group. Assessment points treatment group: t0 = baseline, t1 = post-treatment, t2 = 16 weeks follow up, t3 = 32 weeks follow-up. Assessment points waiting list group: t0 = Baseline, t1 = pre treatment, t2 = post-treatment, t3 = 16 weeks follow-up, t4 = 32 weeks follow up.

group, there was a significant difference between t0 and t1 [t (29) = 8.41, $p < 0.001$]. This difference also existed in the waiting list group [t (29) = 2.92, $p = 0.020$]. Between-group comparisons revealed a significant difference between the CGI-Severity in the treatment group and the waiting list group at t1 [t (43.68) = 6.99, $p < 0.001$; treatment group < waiting list group], whereas comparison between the groups was non-significant for t0 [t (51.96) = 1.15, $p = 0.256$].

Clinical global impressions-improvement

After completed treatment (t1), the participant's condition was rated as much better or very much better (CGI-Improvement value of "1" or "2") in 22 of 28 participants (79%)

TABLE 4 Response and remission rates for participants who completed treatment.

	Percent of treated participants (included sample)					
	Response criteria fulfilled			Remission criteria fulfilled		
	Post-treatment	Follow-up I	Follow-up II	Post-treatment	Follow-up I	Follow-up II
Treatment group	79% (22/28)	71% (20/28)	68% (19/28)	64% (18/28)	67% (18/28)	68% (19/28)
Waiting list group	100% (19/19)	79% (15/19)	89% (17/19)	63% (12/19)	79% (15/19)	79% (15/19)

Only participants for whom the results of all primary outcome measures were available at all measurement time points are listed as responders and remitters.

TABLE 5 Statistical analyses of secondary outcome measures—stability of effects.

	Mixed two-way ANOVA with the factors group (treatment, waiting list) and time (post-treatment, follow-up I, follow-up II).		
Measure	ME time	ME group	IA Time x Group
Clinician-rated measure			
CGAS	F (2, 116) = 3.92, p = 0.037	F (1, 58) = 2.13, p = 0.188	F (2, 116) = 1.77, p = 0.268
Child-rated measures			
YSR	F (2, 116) = 2.78, p = 0.229	F (1, 58) = 0.60, p = 0.601	F (2, 116) = 0.55, p = 0.649
SCARED	F (2, 116) = 2.74, p = 0.242	F (1, 58) = 0.43, p = 0.627	F (2, 116) = 1.03, p = 0.485
COIS-RC	F (2, 116) = 4.18, p = 0.053	F (1, 58) = 2.73, p = 0.252	F (2, 116) = 0.84, p = 0.529
KINDL	F (2, 116) = 1.26, p = 0.461	F (1, 58) = 2.60, p = 0.235	F (2, 116) = 0.77, p = 0.559
DIKJ	F (2, 116) = 4.58, p = 0.075	F (1, 58) = 1.13, p = 0.431	F (2, 116) = 0.68, p = 0.583
Parent-rated measures			
CBCL[a]	F (2, 116) = 8.66, p = 0.003	F (1, 58) = 1.07, p = 0.390	F (2, 116) = 0.94, p = 0.488
SCARED	F (2, 116) = 4.79, p = 0.051	F (1, 58) = 1.37, p = 0.371	F (2, 116) = 1.03, p = 0.448
COIS-RP	F (2, 116) = 5.89, p = 0.029	F (1, 58) = 2.10, p = 0.279	F (2, 116) = 1.45, p = 0.372
KINDL	F (2, 116) = 4.88, p = 0.075	F (1, 58) = 1.84, p = 0.304	F (2, 116) = 1.88, p = 0.246
ULQUIE	F (2, 116) = 0.83, p = 0.522	F (1, 58) = 13.11, p = 0.007	F (2, 116) = 0.81, p = 0.549

[a] T-values. Significant values, defined as $p \leq 0.001$, are in bold. ME Time, Main Effect Time; ME Group, Main Effect Group. IA Time × Group = Interaction of Time × Group.

in the treatment group. In the waiting list group this was not the case for any participant at the end of the waiting period.

Treatment remission and response

In the treatment group, 18 of the 28 participants (64%) who completed treatment met the remission criteria at the end of treatment (t1). In the waiting list group, none of the participants met the remission criteria after the end of the waiting period (t1), [X^2 (1) = 19.80, $p < 0.001$]. At the same measurement time point, 22 of the 28 participants (79%) in the treatment group met response criteria. In the waiting list group this was not the case for any participant [X^2 (1) = 28.07, $p < 0.001$].

Effectiveness of treatment in the waiting list group

After the participants in the waiting list group received treatment (t2), there was a significant decrease in CY-BOCS scores compared with time point end of waiting period (t1) [t (29) = 5.22, $p < 0.001$]. This change was also evident in the CGI-Severity scores [t (29) = 7.19, $p < 0.001$]. The participant's condition was rated as much better or very much better (CGI-Improvement) in all participants, after receiving treatment (t2). The within-group effect size for the waiting list group (t1 to t2) was d = 1.64.

Secondary outcomes

An overview of the analysis results for all secondary outcome measures for the time points t0 and t1 can be found in Table 3. The significance level was set to p = 0.001 to account for multiple testing.

Only the significant changes are described below, all other analyses revealed no significant effects, while descriptively results indicated a general improvement in mental health.

While the two groups did not differ significantly concerning CGAS scores at t0, the CGAs score of the treatment group increased from t0 to t1 and was significantly higher than that of the waiting list group at t1. A graphical representation of the CGAS scores for every assessment time point is shown in Figure 3.

TABLE 6 Rates of perceived benefit from treatment by patients (client satisfaction questionnaire—CSQ-8).

Item		M (SD)
(1)	How would you rate the quality of care you have received?	3.61 (0.62)
(2)	Did you get the kind of help you wanted?	3.55 (0.67)
(3)	To what extent has the program met your needs?	3.52 (0.59)
(4)	If a friend needed similar help, would you recommend the program to him/her?	3.60 (0.54)
(5)	How satisfied are you the amount of help you have received?	3.67 (0.68)
(6)	Has the help you have received helped you to deal more effectively with your problems?	3.64 (0.53)
(7)	In overall, general sense, how satisfied are you with the help you have received?	3.64 (0.57)
(8)	If you were to seek help again, would you come back to our program?	3.45 (0.81)

Anchors for Likert scale by question were as follows: Question (1) 4 = Excellent, 3 = Good, 2 = Fair, 1 = Poor; Questions (2), (4), and (8) 1 = No, definitely not, 2 = No, not really, 3 = Yes, generally, 4 = Yes, definitely; Question (3) 4 = Almost all of my needs have been met, 3 = Most of my needs have been met, 2 = Only a few of my needs have been met, 1 = None of my needs have been met; Question (5) 1 = Quite dissatisfied, 2 = Indifferent or mildly dissatisfied, 3 = Mostly satisfied, 4 = Very satisfied; Question (6) 4 = Yes, it helped a great deal, 3 = Yes, it helped somewhat, 2 = No, it didn't really help, 1 = No, it seemed to make things worse; Question (7) 4 = Very satisfied, 3 = Mostly satisfied, 2 = Indifferent or mildly dissatisfied, 1 = Quite dissatisfied.

For the COIS-R child-rated and parent-rated version, as well as for the CBCL total score, there was a significant decrease in the scores from t0 to t1 independently of the group.

Stability of treatment effects

Primary outcomes

Children's Yale-Brown Obsessive Compulsive Scale

A mixed two-way ANOVA with group (treatment group, waiting list group) and time (post-treatment, follow-up I, follow-up II) for CY-BOCS scores showed a significant effect of time [F (2, 80) = 78.76, p = 0.020], whereas the effect of group [F (1, 40) = 3.20, p = 0.081] and group × time interaction [F (2, 80) = 13.78, p = 0.432] were not significant. The effect of time was due to a decrease in CY-BOCS scores at follow-up II compared to follow-up I [t (41) = 2.68, p = 0.011] and at follow-up II as compared to post-treatment [t (41) = 2.15, p = 0.037]. The difference between post-treatment and follow-up I was not significant [t (41) = 0.11, p = 0.915].

Clinical global impressions-severity

The mixed two-way ANOVA with group (treatment group, waiting list group) and time (post-treatment, follow-up I, follow-up II) for CGI-Severity scores showed no significant effect of time [F (2, 80) = 1.85, p = 0.175], group [F (1, 40) = 2.96, p = 0.093], or group x time interaction [F (2, 80) = 0.07, p = 0.888].

Clinical global impressions-improvement

In the treatment group, participants' condition was rated as much better or very much better at follow-up I in 20 of 28 (71%) and at follow-up II in 20 of 28 (71%). In the waiting list group, this was the case for 17 of 19 (89%) at follow-up I, and also at follow-up II (17/19; 89%).

Treatment remission and response

Table 4 shows participants' response and remission rates in both groups for the measurement time points post-treatment to follow-up II for those who completed treatment.

Secondary outcomes

Again, p was set at 0.001 for these analyses. An overview of the analysis results for all secondary outcome measures for the time points post-treatment, follow-up I and follow-up II can be found in Table 5.

No significant effect of time, group, or time x group interaction was found in any of the outcome measures in the ANOVAs.

Treatment satisfaction, feasibility, and implementation

For both groups together, the mean score for participants' satisfaction with the treatment, measured with the CSQ-8, was M = 28.69 (SD = 3.78). Information on the individual items of the CSQ-8 can be found in Table 6.

Based on the Final Therapy Evaluation Questionnaire conducted after the treatment, more than 90% of parents and participants reported that they liked that the therapy was conducted *via* the internet. All parents reported having a good understanding of what to do to support their children against OCD. Similarly, at the end of the treatment, all children reported having a good understanding of how to manage their OCD symptoms and how the exposure exercises work. Regarding the usability of the video conferencing program, approximately 90% stated that it worked well. The results of the final therapy evaluation can be found in detail in Table 7.

The assessment of the feasibility and implementation of the therapy from the therapists' perspective is shown in Table 8.

Adverse events

During treatment, one participant experienced a significant increase in OCD symptoms. Due to the associated severe impairment in everyday life, inpatient treatment was initiated, ending the study intervention. A more direct relationship

TABLE 7 Final therapy evaluation.

Item	Evaluation topic	Parents agreed in % (n/assessed sample)	Children agreed in % (n/assessed sample)
	Acceptance internet-based therapy		
1)	I liked it, that the therapy was carried out via the internet.	98% (40/41)	90% (36/40)
2)	I think a therapy without the internet, where I had face-to-face contact with the therapist, would have suited me better.	9% (4/43)	19% (8/41)
3)	I found it useful that the worksheets were exchanged and edited via the cloud.	100% (41/41)	90% (36/40)
4)	I found it useful to have the app for feedback.	66% (27/41)	77% (30/39)
	Satisfaction		
5)	If a child from my circle of acquaintances also had a problem with OCD, I would recommend the internettherapy to him/her/the parents.	93% (38/41)	98% (39/40)
	Therapy scope		
6)	My child/I had just the right number of therapy sessions, to learn how to conquer the compulsions.	60% (25/42)	79% (33/42)
7)	My child/I would have needed more therapy sessions to learn how to get rid of OCD.	45% (19/42)	38% (15/42)
8)	The amount of parent counseling was spot on.	86% (36/42)	-
9)	I would have liked to have more parent counseling.	21% (9/42)	-
	Psychoeducation		
10)	I have a good understanding of what I can do to support my child against OCD.	98% (40/41)	-
11)	I have well understood how the exposure exercises work.	100% (42/42)	100% (42/42)
12)	I understood well what OCD is.	98% (41/42)	100% (42/42)
	Change		
13)	The OCD-symptoms are weaker than before the treatment.	90% (38/42)	93% (39/42)
14)	Family life has improved since the treatment.	91% (39/43)	82% (31/38)
	Therapeutic alliance		
15)	I was able to trust the therapist.	100% (43/43)	100% (42/42)
16)	The therapist was interested in me/us and my/our problems.	100% (43/43)	100% (42/42)
	Usability technical equipment		
17)	I found it difficult to use the program for video calls on the computer.	12% (5/43)	10% (4/42)
18)	The videoconference program worked well.	91% (39/43)	90% (38/42)
19)	We had to interrupt therapy or started later because the videoconference program didn't work.	11% (5/43)	24% (10/42)

Items rated on a four-point Likert scale where 1 = "I agree," 2 = "I rather agree," 3 = "I rather disagree," and 4 = "I don't agree." We have taken the answers 1 and 2 as agreement as shown in the table.

10.3389/fpsyt.2022.989550

TABLE 8 Implementation of manual content—Summary therapist feedback form (STFF).

Item	M (SD)
How easy was it to understand the content of the manual?	6.59 (0.60)
How easy was it to conduct the treatment as outlined by the manual?	5.90 (1.07)
How user-friendly were the treatment materials?	5.87 (0.66)
Did the manual allow for enough flexibility?	4.79 (0.98)
Did you feel the 14 sessions were sufficient to accomplish all of the treatment goals?	4.62 (2.06)
Where there any unnecessary elements included in the manual?	1.51 (0.68)
Where there any important elements missing from the manual?	2.87 (1.28)

Items rated on a seven-point Likert scale where 1 = "Not at all," 4 = "Somewhat," and 7 = "Very much".

between the deterioration and the treatment could not be established. In all other participants who had undergone the treatment, there were no incidents that could be classified as adverse events.

Discussion

The primary focus of our study was to examine the effectiveness of internet-based CBT for children and adolescents with OCD. The results of previous studies suggest that videoconferencing therapy for pediatric OCD is feasible (26, 27, 54). However, as we noted in more detail in the introduction, previous work has used neither a sample of this size nor such a long follow-up period. The largest sample consisted of 31 participants (27), and the longest follow-up period was 6 months (26). Although other studies used innovative ideas for using computer-based techniques (e.g., interactive computer games to enhance children's understanding of treatment concepts) (26), both the use of technological devices (e.g., a tablet) and digital applications (therapy documents in the cloud, a mobile assessment application) in our study go far beyond the scope of previous ones. Finally, the transformation of a face-to-face therapy manual into a feasible online version is also a novel feature of the current study.

To assess the effectiveness of this approach, CY-BOCS outcomes of a group of participants who began treatment immediately after enrolment in the study were compared with those of a waiting list control group after the end of the waiting period. As we expected, OCD symptoms significantly decreased in the treatment group compared to the waiting list group over the same period. The effect size for the between-group comparison of CY-BOCS scores at time t1 (treatment group = post-treatment; waiting list group = end of waiting period) was large, with a value of $d = 1.63$. After having received treatment, participants in the waiting list group also showed a significant decline in OCD symptoms. Indeed, in both groups, after treatment, the mean CY-BOCS scores were well below the cut-off value (CY-BOCS total score ≥ 16). This decline in symptoms continued in both groups after the completion of the study as demonstrated by a decrease in OCD symptoms from post-treatment to follow-up II. Immediately after treatment, 64% of participants in the treatment group met the criteria for remission, in the waiting list group, this was 63%. This rate also remained stable during the follow-up examinations, and even increased in the waiting list group. The response criteria were met by 79% of participants in the treatment group at the post-treatment measurement time point, and by all participants in the waiting list group.

The treatment approach we adopted was found to be effective for treating mild to moderate OCD. The decrease in OCD symptoms in our study align with the results from two other randomized controlled trials which review the effectiveness of internet-based CBT in children and adolescents with OCD, where therapy sessions were conducted *via* video conferencing (26, 27). E/RPs were a central treatment element and, as far as technically possible, were accompanied therapeutically in all three studies in real time in the home environment on a computer screen. The severity of OCD symptoms at pre-treatment assessment was also comparable. Nevertheless, before further discussing the comparison of OCD symptom change, it is important to first mention the differences between interventions. In Storch et al. (27), the treatment was more compressed (14 sessions in 12 weeks) compared to our approach, and in Comer et al. (26), the involvement of parents in the therapy and their training as coaches for their children was significant due to the participants' young age.

In the study from Storch et al. (27), the between-group effect size (treatment vs. waiting list) was $d = 1.36$ at the post-treatment measurement time point, and the remission rate was 56% (criteria: severity rating ≤ 3 on Anxiety Disorders Interview Schedule for DSM-IV (55) and CY-BOCS total score ≤ 10). Eighty-one percent were classified as treatment responders (criteria: CGI-Improvement = 1 or 2 and $\geq 30\%$ reduction in CY-BOCS total score). The within-group effect size (pre- vs. post-treatment) reported in Comer et al. (26) was $d = 1.53$. The rate of those who no longer met the criteria for an OCD diagnosis after the end of treatment was slightly over 63% (determined *via* Anxiety Disorders Interview Schedule for DSM-IV). Almost 73% were classified as responders (criteria: CGI-Improvement = 1 or 2). Therefore, in the current study, we actually achieved slightly greater improvements in terms of the magnitude of change in OCD symptoms, although comparability is not entirely given for the reasons stated above. This improvement is even more valid when compared with a study using an internet-based form of CBT in which the children and adolescents largely

completed treatment modules independently over a period of 12 weeks but had regular contact with a clinician by mail or telephone (56). The average time spent by the clinician per patient per week, was 17.5 min, much less than for the video-based approaches (56). The effect size in this study between the treatment group and wait-list group was d = 0.69 at the measurement point at post-treatment/end of the waiting period. The remission rate was 15% (criteria: CGI-Severity = 1 or 2 and CY-BOCS total score $\leq$ 12), as responders classified were 27% (criteria: CGI-Improvement = 1 or 2 and $\geq$ 35% reduction in CY-BOCS total score). As a first interim conclusion, it can be stated that our study adds substantial evidence to support the effectiveness of internet-based CBT for children and adolescents with OCD. Finally, these results align with other studies on internet-based psychotherapy in adults with OCD (57, 58).

A comparison of our results on OCD symptom decrease to those from face-to-face interventions, where CY-BOCS baseline scores were in a similar range, yields further remarkable insights. In the Pediatric OCD Treatment Study (POTS (59), the effect-size within the CBT treatment arm (pre- vs. post-treatment) was 1.35 (60). The remission rate at the same time point was nearly 40% (criterion CY-BOCS total $\leq$ 10); information on the number of responders was not available for us. In the Nordic Long-term OCD Treatment Study NordLOTS (60) the within-group effect size from baseline to post-treatment was d = 1.58. and the remission rate for the same time point was 39% (criterion CY-BOCS total score $\leq$ 10). Almost 73% were classified as treatment responders (criterion: CY-BOCS total score $\leq$ 15). Overall, it can be concluded that the effectiveness shown in our study is at least on the same level as that found in the face-to-face treatment studies.

Beyond the observation of the treatment effectiveness, the course of change is also interesting. The fact that the CY-BOCS scores once again decreased significantly after the post-treatment measurement time point is not a phenomenon found consistently in the literature and is therefore noteworthy. It is possible that the 3 months to follow-up measurement frequently chosen in studies is too short and that further reductions in OCD symptoms do not become significant until after this time. Our own results, in addition to those of other studies (26, 61), support this interpretation. Therefore, the question of the follow-up periods required for internet-based treatments to fully capture the long-term treatment effects should be further explored.

Due to the severe impairment in various areas of daily life in subjects with OCD, the level of psychosocial functioning of the patients is of particular interest. After treatment, the psychosocial functioning level of the participants improved in both groups of this study. The improvement in psychosocial functioning in addition to the decrease in OCD symptoms is a consistent finding that has been reported in other studies of technology-based CBT for pediatric OCD (26, 49, 62). The effects found in our study are in the upper range of what has been observed in these studies.

Unlike OCD symptoms, the child- and parent-rated secondary outcome measures showed few significant changes. From pre- to post-treatment/end-of-waiting period, there was a significant decrease in scores on the COIS-R and CBCL independently of treatment. We would have expected this specifically with the COIS-R. One possible explanation is the version of this measure we used. The items were translated into German by our group, but no values on validity and reliability of this German version are available. It is noteworthy that the average baseline values, rated by participants and parents, compared to our own preliminary study (28) and the study of Storch et al. (27) are below the values collected there. However, the other parameters used to determine the severity of OCD (CY-BOCS, CGI-S) are comparable to the current ones. A review of the German-language version seems reasonable.

Even though our treatment approach focused exclusively on OCD symptoms, the absence of these effects was not necessarily expected. Studies have shown that depressive symptoms (63, 64), in addition to anxiety symptoms (65) decrease under face-to-face CBT for children and adolescents with OCD. On the other hand, in a video-based CBT for OCD comparable in treatment approach and sample, the treatment group did not outperform a waiting list control in reducing anxiety and depression symptoms after having received treatment (27). Furthermore, the course of improvement in secondary anxiety and depression symptoms appears to differ from each other and, most importantly, to be independent of the reduction in OCD symptoms (66). There is also a lack of conclusive understanding of which components of CBT for OCD address anxiety and depression symptoms and to what extent. There is a need for further research to develop a more advanced understanding of the mechanisms underlying the transfer of CBT techniques to non-OCD symptoms. This is even more true for video-based treatments. Regarding our study, it can be noted that on a purely descriptive level, there is a treatment-associated decrease in mean scores for the self- and parent-rated outcome measures capturing anxiety and obsessive-compulsive symptoms (see **Table 2**).

Accordingly, our study delivers insights into the effectiveness of internet-based CBT for OCD. Nevertheless, the limitations of our study should also be noted. The choice of a waiting group as a control condition enables us to demonstrate that our approach led to a reduction in OCD symptoms. Furthermore, the results can be compared descriptively with those of face-to-face studies. However, a statement as to whether the internet-based treatment is actually equal to the well-established face-to-face CBT for OCD in terms of efficacy cannot be made. The next step is to conduct studies in which the treatment with face-to-face CBT is the control condition or other therapy approaches such as medication or self-help.

But more effective or not, we think that internet-based CBT delivers treatment access for the patients and also the option to treat symptoms at home which has often the highest relevance for these patients.

Furthermore, it must be noted that, even though the majority of participants stated that they had sought inclusion in the study due to a lack of local therapy offers, it can nevertheless be assumed that these families were more open than average to internet-based therapy and that the sample was, thus, not fully representative of all children with OCD concerning their attitudes toward digital elements in therapy. The generalizability of the results to all children and adolescents with OCD may therefore, be limited. However, it is conceivable that the group of participants for whom digital treatment approaches represent something normal may become larger in the future. Indeed, the COVID-19 pandemic has acted as a catalyst for digitalization in healthcare (67), and this will most likely lead to digital interventions becoming an integral part of treatment and participants becoming more familiar with them.

It should also be mentioned that, despite extensive prior advice not to do so, families very occasionally made statements during follow-up assessments that revealed their group membership to the investigator.

The educational level of the parents in our sample was very high, and this was even more true for the mothers. In determining socioeconomic position, the educational level of parents is usually included as one aspect. Although studies on the association between socioeconomic position and health service utilization have reached different conclusions (68), there is evidence that families with a high socioeconomic position are more likely to visit specialized centers such as ours (69). In light of this, it makes sense to apply and evaluate our approach in routine health care as well.

The transfer of our approach into clinical practice is possible in principle. However, it should be noted that the purchase of the tablets and smartphones we distributed to the families is associated with not inconsiderable costs. Most healthcare institutions would presumably lack the corresponding financial resources. This represents a major hurdle, for the implementation of our treatment approach in routine care. To overcome this, it is necessary to design the applications technically in such a manner that they can be used on the families‘ end devices and no additional devices have to be purchased. According to our experience so far, this appears technically feasible.

It should be noted that there are also challenges during internet-based psychotherapy. Due to the limited screen area and the reduced visual channels, it is more difficult for the therapist to assess to what extent the participant is emotionally impaired or if the participant shows avoidance behavior. This could be resolved by the use of 180°C or even 360°C webcams, which offer a larger field of view. Furthermore, by using different sensors, the therapist could receive comprehensive and synchronous information regarding the participant's current level of arousal or discomfort and react to it. Specifically, the measurement of heart rate and heart rate variability *via* ECG sensors should be considered. These can be worn by the participant *via* a chest strap and transmitted *via* Bluetooth to a mobile device that would then forward the values to the therapist. Another sensor element could be eye-tracking glasses, which could provide information about the participant's gaze focus *via* a field camera and could help to prevent avoidance behavior during exposures. A corresponding project has already been planned in our department and is currently in the trial phase.

Technology-based treatment approaches might also be useful for other psychiatric conditions. Further studies investigating blended designs with a combination of face-to-face and internet therapy may be a beneficial next step. Furthermore, studies focusing on stepped-care designs to unravel the optimized and individualized therapy conditions for participants, including more or less intensive modules of face-to-face psychotherapy, internet-based psychotherapy, self-help elements, or medication, are warranted.

In summary, this study has demonstrated that internet-based CBT is effective for treating children with mild to moderate OCD. It enables these children to receive specialized state-of-the-art therapy regardless of their place of residence- and even enables the treatment of symptoms by therapist-guided exposures with response prevention at the location the symptoms typically occur, which is frequently at the child's home. The implementation of exposure exercises in the living environment may increase the ecological validity of the therapy (70), which may, consequently, have a reinforcing effect on the effectiveness of the treatment. Further studies are necessary to draw conclusions regarding this reinforcing effect.

Overall, our study extends the evidence for internet-based CBT approaches to be effective for treating OCD in children and adolescents, making it a viable method for providing access to adequate treatment.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the Medical Faculty of Tübingen, Germany. Written informed consent to

participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

KH, CH, AH, AA, JK, AP, UW, RA, HL, TR, and AC made substantial contributions to the conception and design of the work, contributed to the analysis of the data, and contributed to the interpretation of the data. KH was mainly responsible for the first draft of the manuscript which was then revised by all other authors. All authors approved the final manuscript.

Funding

This study was evaluated and funded by the Ministry of Social Affairs, Health and Integration Baden Württemberg, Germany (funding code AZ53-5400.1-004/44). The ministry was not involved in any other steps of the study, including the original design, study analyses, data interpretation, or the paper preparation.

Acknowledgments

We thank David Friedrich and Jule Beck for their support in organizational tasks related to the study implementation and data entry. We acknowledge support by Open Access Publishing Fund of University of Tübingen.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Appendix

TABLE A1 Original data of primary and secondary outcome measures.

	Unadjusted mean ± standard deviation (sample)								
	Treatment group				Wait-list group				
Measure	**Baseline assessment (t0)**	**Post-treatment (t1)**	**Follow-up 1 (t2)**	**Follow-up 2 (t3)**	**Baseline assessment (t0)**	**End of waiting period (t1)**	**Post-treatment (t2)**	**Follow-up 1 (t3)**	**Follow-up 2 (t4)**
Clinician-rated measures									
CY-BOCS	24.03 ± 2.54 (30)	9.96 ± 9.04 (28)	10.48 ± 8.46 (27)	8.35 ± 8.26 (26)	25.07 ± 2.07 (30)	23.64 ± 3.37 (22)	8.80 ± 8.38 (20)	6.85 ± 6.39 (20)	4.88 ± 6.54 (24)
CGAS	60.20 ± 10.48 (30)	83.04 ± 14.48 (28)	82.07 ± 11.53 (27)	83.62 ± 14.81 (26)	60.03 ± 10.05 (30)	64.23 ± 10.46 (22)	85.60 ± 11.78 (20)	86.55 ± 8.20 (20)	90.04 ± 8.87 (24)
CGI-S	4.93 ± 0.52 (30)	2.29 ± 1.56 (28)	2.33 ± 1.54 (27)	2.12 ± 1.48 (26)	5.07 ± 0.37 (30)	4.77 ± 0.53 (22)	2.05 ± 1.47 (20)	1.90 ± 1.07 (20)	1.50 ± 0.72 (24)
CGI-I		1.89 ± 1.17 (28)	1.81 ± 1.18 (27)	1.62 ± 1.02 (26)		3.86 ± 0.89 (22)	1.50 ± 1.15 (20)	1.35 ± 0.67 (20)	1.21 ± 0.42 (24)
Child-rated measures									
YSR	61.92 ± 19.91 (25)	47.27 ± 15.46 (22)	44.35 ± 15.90 (17)	42.56 ± 22.97 (16)	58.44 ± 17.98 (25)	54.10 ± 17.08 (20)	47.69 ± 17.35 (16)	47.87 ± 23.22 (15)	45.83 ± 23.86 (12)
SCARED	21.00 ± 13.44 (27)	13.56 ± 10.81 (25)	14.84 ± 9.10 (19)	12.88 ± 10.43 (16)	21.03 ± 11.52 (27)	17.48 ± 11.24 (21)	16.18 ± 10.10 (16)	14.93 ± 14.46 (15)	11.60 ± 10.54 (15)
COIS-RC	19.70 ± 17.04 (30)	7.24 ± 9.95 (25)	4.79 ± 6.89 (19)	6.44 ± 12.27 (16)	17.46 ± 10.90 (28)	11.76 ± 8.46 (21)	4.19 ± 3.83 (16)	4.07 ± 7.21 (15)	1.93 ± 4.35 (15)
DIKJ	14.36 ± 10.11 (28)	10.46 ± 8.59 (26)	7.84 ± 7.85 (19)	7.07 ± 6.65 (15)	14.85 ± 7.62 (27)	10.95 ± 8.53 (19)	8.86 ± 7.47 (14)	6.71 ± 5.68 (14)	7.42 ± 5.70 (12)
KINDL	70.40 ± 12.64 (30)	73.91 ± 11.26 (26)	72.81 ± 12.91 (18)	73.58 ± 13.68 (15)	68.69 ± 10.93 (28)	73.84 ± 11.31 (21)	77.59 ± 10.70 (16)	76.41 ± 12.39 (15)	78.94 ± 10.41 (12)
Parent-rated measures									
CBCL[a]	63.77 ± 7.75 (30)	56.70 ± 11.13 (27)	56.35 ± 10.47 (20)	52.53 ± 12.31 (17)	64.22 ± 6.97 (27)	60.67 ± 8.46 (21)	55.00 ± 8.49 (16)	52.29 ± 8.71 (14)	52.00 ± 7.07 (14)
SCARED	20.28 ± 13.21 (29)	15.52 ± 10.37 (25)	15.35 ± 10.89 (20)	12.76 ± 13.20 (17)	20.44 ± 8.35 (27)	17.00 ± 9.15 (20)	14.56 ± 10.27 (16)	11.60 ± 10.07 (15)	10.87 ± 7.60 (15)
COIS-RP	25.87 ± 18.10 (30)	11.32 ± 12.75 (25)	12.10 ± 18.99 (20)	8.63 ± 12.58 (16)	22.70 ± 11.98 (27)	14.86 ± 11.97 (21)	11.81 ± 18.25 (16)	6.47 ± 7.51 (15)	3.13 ± 6.07 (15)
KINDL	64.72 ± 12.68 (29)	72.41 ± 11.71 (26)	71.63 ± 12.46 (20)	74.48 ± 11.01 (17)	62.07 ± 14.13 (28)	69.41 ± 13.30 (21)	71.58 ± 8.87 (16)	78.58 ± 6.90 (15)	77.02 ± 10.43 (15)
ULQUIE	75.89 ± 16.69 (28)	75.42 ± 16.08 (24)	71.11 ± 24.04 (18)	75.53 ± 19.15 (15)	75.56 ± 15.28 (27)	82.53 ± 6.77 (19)	86.63 ± 10.48 (16)	86.69 ± 10.40 (16)	86.07 ± 15.75 (15)

[a] *T*-Values.

10.3389/fpsyt.2022.989550

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TYPE Original Research
PUBLISHED 09 January 2023
DOI 10.3389/fpsyt.2022.1039849

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Anxiety and Stress Disorders, a section of the journal Frontiers in Psychiatry

RECEIVED 08 September 2022
ACCEPTED 16 December 2022
PUBLISHED 09 January 2023

CITATION
Wang PC, Yan ZJ, Chen T, Cao WW, Yang XY, Meng FQ, Liu YQ and Li ZJ (2023) Visuospatial working memory capacity moderates the relationship between anxiety and OCD related checking behaviors. *Front. Psychiatry* 13:1039849. doi: 10.3389/fpsyt.2022.1039849

Visuospatial working memory capacity moderates the relationship between anxiety and OCD related checking behaviors

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Background: Compulsive checking behavior is the most prevalent compulsive behavior in patients with obsessive-compulsive disorder (OCD). While some studies have shown that anxiety and executive function influence compulsive checking behavior, the relationship between these constructs is inconclusive. Hence, we sought to explore the interplay between executive function, anxiety and compulsive checking behavior.

Materials and methods: 47 healthy participants (HC) and 51 patients with OCD participated in the study. Symptoms and emotional states were assessed using the Yale-Brown Obsessive Compulsive Scale, the Obsessive-Compulsive Inventory-Revised, the Beck Anxiety Inventory, and the Beck Depression Inventory. Participants also completed three tests of neuropsychological functioning: the Stop Signal Task, the Spatial working memory Task, and the Wisconsin card sorting test. We analyzed the relationships between anxiety, executive function, and compulsive checking symptoms.

Results: Patients with OCD showed significantly greater anxiety ($p < 0.001$) and impairments in visuospatial working memory function ($p = 0.030$) compared to HC participants, while inhibition and set-shifting were not significantly different between the two groups. Visuospatial working memory was negatively related to compulsive checking behavior ($p = 0.016$). Visuospatial working memory also played a moderating role in the positive relationship between anxiety and compulsive checking behavior ($\beta = -0.281$, $p = 0.022$).

Conclusion: Anxiety symptoms play an important role in explaining compulsive checking behavior in patients with OCD who have relatively weak

visuospatial working memory ability. These findings provide a foundation for further research regarding the roles of emotion and cognitive inflexibility in compulsive checking behavior in patients with OCD.

KEYWORDS

obsessive-compulsive disorder, checking behavior, cognitive flexibility, anxiety, moderation

1. Introduction

Obsessive-compulsive disorder (OCD) is a condition characterized by persistent, intrusive obsessions, and repetitive compulsions. Symptoms of OCD are heterogeneous (1) and various subtypes of the condition have been identified (2), such as checking, washing, ordering, and hoarding. Compulsive checking behavior is the most prevalent compulsive behavior in individuals with OCD (3). Numerous studies have shown that repetitive checking behavior breeds doubt (4), uncertainty (5), reduces memory confidence (6, 7), and impairs inhibition (8). Although the consequences of compulsive checking behavior have been widely studied, the factors inducing or maintaining checking behavior remain unclear (9).

According to the dimensional account of OCD (10), subtypes of OCD arise from the interaction of three main factors: emotional vulnerability (typically anxiety and depression), cognitive inflexibility, and an imbalance in goal-directed behavior and habitual control. This interaction is assumed to be at the core of all OCD subtypes. However, the interaction between these factors and the role they play in compulsive checking behavior is unclear, and requires consideration. Based on the cognitive theory of compulsive checking (11) and the cognitive flexibility hypothesis (12), anxiety and cognitive inflexibility are the typical emotional and cognition vulnerability factors of OCD and are closely related to compulsive checking behavior. Therefore, a better understanding of these factors' interaction underlying compulsive checking subtype may provide insights into the mechanisms underpinning OCD.

1.1. Anxiety and compulsive checking behavior

Anxiety symptoms are the central element of OCD and may affect the development and maintenance of obsessive-compulsive symptoms in several ways. For instance, anxiety disorders are one of the most frequently found comorbid psychiatric disorders in OCD (13, 14), and anxiety is significantly associated with more severe obsessive-compulsive symptoms and other key OCD symptoms (i.e., negative appraisals of intrusive thoughts) (15).

Furthermore, anxiety symptoms may also contribute to reassurance-seeking behaviors, such as compulsive checking. According to cognitive theory of checking (11), the perception of possible harm results in increased anxiety or discomfort, which leads patients with OCD to engage in compulsive checking to obtain relief from their distress and/or anxiety. For instance, Wake et al. (16) reported that greater self-reported anxiety was associated with higher subjective ratings of check-up impulsivity during the Visual Discrimination and Checking Task. Similarly, anxiety symptoms have also been shown to significantly affect checking behavior (17), while evidence from network analysis suggests that doubting/checking symptoms are linked to generalized anxiety symptoms (i.e., worry, rumination).

1.2. Cognitive flexibility and compulsive checking behavior

Cognitive flexibility is a mental ability to adjust to change by switching or shifting from thinking about one conceptual representation to another (18). The researchers found that impaired cognitive flexibility can worsen symptoms by affecting the regulation and control of the mind (10).

Both clinical observation and neurocognitive studies demonstrate behavioral and neurobiological deficits in cognitive flexibility in OCD patients, and the impairment of cognitive flexibility in OCD may result from deficits in a range of executive function components, such as inhibition (12), working memory and set-shifting (19).

Recent studies have suggested compulsive checking symptoms are associated with impairments in executive function subcomponents. It has been reported that compulsive checking was significantly associated with poorer inhibition on the Trail Making test (20). Several studies have also reported that patients with OCD have impaired visuospatial working memory (VWM) (5, 21), especially in those with compulsive checking symptoms (4). Based on the outcome of a meta-analysis, Leopold and Backenstrass (22) reported that checkers were significantly more impaired in set-shifting than washers. Conversely, some studies have not found impaired set-shifting in patients with checking behavior (23, 24).

These findings underscore that anxiety symptom and cognitive inflexibility may play as important vulnerability factors in checking subtype of OCD, however, their individual and shared impact on compulsive checking symptoms have rarely been studied.

1.3. The interplay between anxiety and cognitive flexibility

Traditionally, compulsive checking behavior is viewed as an anxiety-driven behavior that could neutralize, prevent, or reduce anxiety immediately. More recently, however, Hirsch and Mathews (25) indicated that pathological anxiety is largely sustained by impairments in cognitive control, particularly within the context of negative emotional information (26). Similarly, Pruessner et al. (27) have proposed the cognitive control framework of emotion regulation flexibility, which suggests that emotion regulation is associated with inhibition, updating, and shifting functions.

Evidence has also been reported to show that anxiety can interfere with cognitive functioning (28) and affect goal-directed or impulsive behaviors. Working memory plays a key role in the cognitive problems experienced by anxious people by limiting the resources needed to perform goal-directed tasks (28–30). Yu et al. (31) reported that cognitive flexibility played a mediating role between anxiety and impulsivity, and moderated the effects of anxiety on motor impulsivity. Given that compulsive checking behavior is associated with both anxiety and cognitive flexibility, it is conceivable that there might be an interplay between anxiety and cognitive flexibility in the pathophysiology of compulsive checking behavior.

Previous studies have shown that anxiety can predict the severity of compulsive checking behaviors, and the severity of the symptoms is related to executive function. It also suggests that executive function may moderate the relationship between anxiety and compulsive checking behaviors. But a definitive conclusion is still lacking. To further our understanding of these relationships, we assessed the three core components of executive function and anxiety symptoms in the present study. We sought to explore cognitive flexibility in patients with OCD and assess which components might interact with anxiety to affect the severity of compulsive checking behavior.

2. Materials and methods

2.1. Participants

Considering the impairment of executive function in adolescents and elder is different from that in adults, to prevent the influence of age, only adult healthy participants (HC) and patients with OCD were invited to participate in present study. Patients were recruited from the outpatient department of Beijing Anding Hospital. The inclusion criteria for patients with OCD were: (1) Age 18–45 years, and a junior high school education or above; (2) meeting the diagnostic criteria for obsessive-compulsive disorder as specified in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV); (3) With at least mild level of symptom severity, the Yale-Brown obsessive compulsive scale (Y-BOCS) total score $\geq$ 8; (4) right-handedness, normal or corrected vision, no color blindness or weakness. The exclusion criteria were: (1) meeting the DSM-IV diagnostic criteria for any comorbid mental disorder such as schizophrenia or mood disorder, (2) having received convulsion-free electroconvulsive therapy, neuromodulation, and other physical therapy within the last 4 weeks; (3) a history of brain organic disease and/or major somatic disease; and (4) evidence of drug dependence and use of psychoactive substances.

Healthy participants were recruited *via* advertising. The inclusion criteria for HC were (1) age 18–45 years old, junior high school education or above; (2) Without clinically significant anxiety or depression symptom, a Beck Anxiety Inventory (BAI) score $<$ 15 points, a Beck Depression Inventory (BDI) score $<$ 15 points; (3) right handedness, normal or corrected vision, no color blindness or weakness. The exclusion criteria were: (1) a DSM-IV diagnosis of obsessive-compulsive disorder, schizophrenia, mood disorder, and other mental disorders or a previous diagnosis of OCD; (2) a history of brain organic disease and/or major somatic disease; and (3) evidence of drug dependence and use of psychoactive substances.

2.2. Procedure

In the current experiment, three executive function tasks were designed using E-Prime 2.0 software (Psychology Software Tools Ltd., Pittsburgh, PA, USA). Visual stimuli were presented using a screen resolution of 800 $\times$ 600 with a 60 Hertz refresh rate. Participants sat approximately 60 cm from the computer screen. After completing the clinical assessments, participants were asked to complete the executive function tasks on the computer. In addition to the three executive function tasks, participants also performed sustained attention to response tasks and other interventions. The study was completed in March 2021–April 2022.

2.3. Measurements

The Mini-International Neuropsychiatric Interview (MINI) was used to screen out other mental diseases by one trained researcher. The severity of obsessive-compulsive symptoms was evaluated by the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS), which includes two aspects of OCD: obsessions (Items

1–5) and compulsions (Items 6–10) (32). The Chinese version of the Y-BOCS has good interrater reliability (r = 0.75) and test-retest reliability (r = 0.91), as well as good construct validity (33). Obsessive-Compulsive Inventory-Revised (OCI-R) (34) was used to measure self-reported obsessive compulsive symptom, which includes 18 items, such as washing, obsessing, hoarding, ordering, checking, and neutralizing, mixed with six dimensions to assess obsessive-compulsive symptoms. The Chinese version of OCI-R shows good internal consistency (Cronbach's α = 0.84) and test–retest reliability (r = 0.96) (35). BAI (36) and the BDI (37) were applied to measure self-evaluated anxiety and depression level. The Chinese version of the BAI has demonstrated excellent internal consistency (Cronbach's α = 0.95) (38), and the Chinese version of the BDI-II has demonstrated good internal consistency (Cronbach's α = 0.94) and test-retest coefficients (r = 0.55) (37).

2.4. Executive function assessment

2.4.1. Stop signal task

The SST includes response and stop tasks to measure cognitive flexibility (39). A fixation point "+" initially appeared on the center of the screen, which was quickly followed by (after 500 ms), a square or circle (response signal) which appeared for 1,000 ms. Participants were asked to make a quick and selective response, and abort the answer previously displayed when a subsequently presented red star (stop signal) was displayed. The time between the presentation of the imperative stimulus and the presentation of the stop signal is termed the "stop signal delay" (SSD); SSD values range from 50 to 950 ms, with the initial SSD time being 250 ms. The delay time was adjusted according to participants' responses, with correct responses increasing the delay by 50 ms, and incorrect responses decreasing the delay by 50 ms. SST consist a total 160 trials: the ratio of go trial to stop trial is 3:1. SSD after reaction (minimum 50, maximum 950) vary according to the correct or wrong stop times of the subject, correct + 50, error − 50, initial value 250. The stop signal reaction time (SST_{SSRT}) is the index of inhibitory control.

2.4.2. Spatial working memory task

Participants were also asked to perform a computerized spatial working memory task (40). A 5 × 5 gray square was initially displayed on the screen, followed by the presentation of red squares that appeared randomly at each of 25 positions. Participants were asked to remember and click in the sequence where the red squares had appeared. The number of the target red square increased in turn from 2. After three consecutive selections, the span of the target square increased by 1, with a maximum of 6. The number of red squares selected correctly (i.e., the capacity of VWM) was recorded. The working memory index in this task is visuospatial memory capacity ($VWM_{capacity}$).

2.4.3. Wisconsin card sorting test

The WCST was used to measure cognitive flexibility, and includes four stimulus cards and 128 response cards, each painted with 1–4 triangles, stars, crosses, or circles in red, green, blue, and yellow, respectively (41). Among them, four stimulus cards are pictures with one red triangle, two green stars, three yellow crosses, and four blue circles. According to the rules, participants are asked to accurately sort every response card according to one of four stimulus cards by providing feedback regarding their response (correct or incorrect). The sorting rule changes after ten correct matches, which occurs without warning to the participant. The test will automatically end when the subject has completed three groups (color, shape, quantity) of classification, or has used up all 128 cards. The whole test is 128 times, about 10 min. The WCST's index of set-shifting is the rate of perseverative errors ($WCST_{Rpe}$).

2.5. Data analysis

IBM SPSS Statistics 26.0 software and Mplus8.3 were used for statistical analysis. The demographic and clinical data of the two groups were compared by independent sample t-tests and chi-square tests. The Pearson correlation coefficient was used to analyze the relationship between each of the three task indices and the severity of compulsive checking symptoms. Mplus8.3 was used to analyze whether the various executive functioning components (SST_{SSRT}, $VWM_{capacity}$, $WCST_{Rpe}$) moderated the relationship between anxiety symptoms and compulsive checking symptoms. Two-tailed tests were performed in all analyses, and the significance level was 0.05. Pauta criterion was applied to outlier detection of reaction time on task, and it is assumed that data exceeding three standard deviation of the sample mean is outlier. Cohen's d was calculated to reflect the effect sizes of statistical result (42).

3. Results

3.1. Demographic and clinical data analysis

A total of 47 HC and 51 patients with OCD were enrolled in the study. One OCD and one HC participant was excluded as they could not complete the Wisconsin card sorting test; one OCD and two HC participants were excluded as reaction time scores were below or above three SD of the group's mean, resulting in a final sample size of n = 49 for OCD group and n = 44 for HC group.

The average age of OCD was 29.33 and of HC was 28.89 years, and the number of male and female participants in each group was approximately equal. There were no significant differences in gender, age, and education level between HC and

patients with OCD ($p > 0.05$). Of the 49 OCD participants, 20 (40.8%) had never been prescribed medications or had stopped taking medications for at least 4 weeks before participating in this study, 18 (36.7%) have been receiving the SSRI therapy and 11 (22.4%) have been receiving multi type of prescribed medications.

The mean score of Y-BOCS in patients with OCD was 19.73 ± 7.25, and the scores for depression and anxiety were significantly higher than those of HC ($p < 0.001$) (Table 1).

3.2. Comparison of executive function between the two groups

There were no significant differences in SST_{SSRT}, and $WCST_{Rpe}$ between the two groups ($p > 0.05$), although the capacity of VWM was significantly lower in the group with OCD than in the HC group ($p < 0.05$) (Table 2).

3.3. Correlation analysis between anxiety, executive function indicators, and checking symptoms

The BAI scores were positively correlated with the severity of general compulsion symptoms measured by Y-BOCS ($p = 0.007$) and checking symptoms as measured by the OCI-R ($p = 0.011$). The three components of executive function were not related to the severity of general compulsion symptoms ($p > 0.05$). VWM capacity was found to negatively correlate with the severity of checking symptoms ($p = 0.016$), while the SST_{SSRT} and $WCST_{Rpe}$ were not related to the severity of checking symptoms ($p > 0.05$) (Table 3).

3.4. Moderate effects of executive function on the relationship between anxiety and general compulsion symptom

Hierarchical regression was utilized to explore which components of executive function have moderation effect on the relationship between anxiety and general compulsion symptom.

Data were first standardized. Then, gender, age, and education level were included as covariables. We used levels of anxiety (BAI) as independent variables, the severity of general compulsion symptoms as dependent variables, and three indicators of executive function as moderators. In Model 1, SST_{SSRT} was used as the moderator. $VWM_{capacity}$ was used as the moderator in Model 2, and $WCST_{Rpe}$ was used as the moderator in Model 3.

The results showed that the main effect of anxiety on general compulsion symptoms measured by the Y-BOCS was significant ($p < 0.05$), but the main effects of three components, and their interaction with anxiety level were not significant ($p > 0.05$). It suggested that there were no moderating effects of three components of executive function between anxiety level and general compulsion symptoms ($p > 0.05$) (Table 5).

3.5. Moderate effects of executive function on the relationship between anxiety and specific checking symptom

Considering that executive function components were found has no moderate effect on the relationship between anxiety and compulsion symptoms. We further validate whether the $VWM_{capacity}$ could moderate the relationship between anxiety and specific checking symptoms.

Hierarchical regression was utilized to explore the moderation effect of executive function. Data were first standardized. Gender, age, and education level were controlled as covariables. We used levels of anxiety (BAI) as independent variables, the severity of checking symptoms as dependent variables, and three indicators of executive function as moderators. In Model 1, SST_{SSRT} was used as the moderator. $VWM_{capacity}$ was used as the moderator in Model 2, and $WCST_{Rpe}$ was used as the moderator in Model 3.

The results of regression analysis showed that the main effect of anxiety on checking symptoms as measured by the OCI-R was significant ($p < 0.010$), but the main effects of SST_{SSRT} and $WCST_{Rpe}$, and their interaction with anxiety level were not significant ($p > 0.05$). No moderating effects of SST_{SSRT} and $WCST_{Rpe}$ were found between anxiety level and compulsive checking symptoms. However, the interaction between anxiety and $VWM_{capacity}$ was significant in the VWM task ($\beta = -0.281$, $p = 0.022$) (Table 5).

To further reveal the interaction effect, a simple slope test was performed. The results showed that the anxiety levels of patients with OCD with medium (M) and low (M-1SD) VWM capacity significantly predicted the severity of checking symptoms ($\beta_L = 0.171$, $p_L = 0.001$; $\beta_M = 0.105$, $p_M = 0.009$), and the effect was more significant in patients with low visuospatial memory capacity (Figure 1).

4. Discussion

The primary objective of the current study was to model the relationship between executive function, anxiety and checking behavior. The major results can be summarized as follows: (1) Compared with HC, patients with OCD showed more severe anxiety symptoms and significant impairment in VWM capacity, although there was no significant impairment in inhibition and set-shifting function; (2) Anxiety symptoms were positively ($r = 0.361$, $p = 0.011$) and $VWM_{capacity}$ ($r = -0.343$,

10.3389/fpsyt.2022.1039849

TABLE 1 Demographic characteristics and clinical symptoms of the two groups.

Variables	HC (n = 44)	OCD (n = 49)	t/χ^2	p	Cohen's d
Gender			0.164[a]	0.686	0.084
Male	22 (50%)	26 (53%)			
Female	22 (50%)	23 (47%)			
Age, M (SD)	28.89 (8.57)	29.33 (6.39)	−0.283	0.778	0.059
Education			6.487[a]	0.090	0.548
Junior high school	0	2			
Senior high school	5	5			
Undergraduate	31	24			
Master's degree or above	8	18			
BAI	2.18 (2.90)	13.63 (10.48)	−7.010	< 0.001	1.455
BDI	3.66 (4.52)	13.78 (9.87)	−6.236	< 0.001	1.295
OCI-R	2.34 (3.35)	22.02 (14.32)	−8.894	< 0.001	1.848
OCI-R-checking	0.34 (1.01)	3.57 (3.29)	−6.260	< 0.001	1.298

HC, healthy participants; OCD, obsessive-compulsive disorder participants; BAI, the Beck Anxiety Inventory; BDI, the Beck Depression Inventory; OCI-R-checking, the checking item of Obsessive-Compulsive Inventory-Revised.

TABLE 2 Executive function indicators of the two groups.

Variables	HC (n = 44)	OCD (n = 49)	t	p	Cohen's d
SST_{SSRT} (ms)	207.11 (84.34)	221.23 (65.10)	−0.908	0.366	0.189
$VWM_{capacity}$ (n)	46.02 (17.31)	38.63 (14.96)	2.208	0.030	–0.459
$WCST_{Rpe}$ (%)	15.95 (14.07)	19.18 (19.45)	−0.908	0.366	0.189

HC, healthy participants; OCD, obsessive-compulsive disorder participants; SST_{SSRT}, the stop signal reaction time; $VWM_{capacity}$, visuospatial memory capacity; $WCST_{Rpe}$, the rate of perseverative errors.

TABLE 3 Correlations between anxiety, executive function indicators, and checking symptoms.

	YBOCS-C	Checking	BAI	SST_{SSRT}	$VWM_{capacity}$
BAI	0.380** (0.007)	0.361* (0.011)	/	/	/
SST_{SSRT}	−0.261 (0.070)	−0.041 (0.778)	−0.152 (0.298)	/	/
$VWM_{capacity}$	−0.083 (0.572)	−0.343* (0.016)	−0.193 (0.183)	−0.122 (0.405)	/
$WCST_{Rpe}$	0.126 (0.388)	0.041 (0.778)	−0.059 (0.688)	0.162 (0.265)	−0.393** (0.005)

Checking, the checking item of Obsessive-Compulsive Inventory-Revised (OCI-R); BAI, the Beck Anxiety Inventory; SST_{SSRT}, the stop signal reaction time; $VWM_{capacity}$, visuospatial memory capacity; $WCST_{Rpe}$, the rate of perseverative errors; YBOCS-C, the compulsion item score of the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS). $^{**}P < 0.01$ and $^{*}P < 0.05$.

p = 0.016) was negatively related to compulsive checking behavior. (3) Anxiety symptoms showed significant direct predictive validity for compulsive checking behavior ($p < 0.01$), and the VWM function played a moderating role in the positive relationship between anxiety and compulsive checking behavior ($\beta = -0.281$, $p = 0.022$).

An initial objective of the study was to identify which components of executive function were significantly impaired in patients with OCD. According to the results of meta-analysis, effect sizes were medium in set-shifting, medium and medium-low in inhibition, while medium-to-large in visuospatial memory (43, 44). Our findings suggest that patients with OCD had impaired VWM capacity which is consistent with previous work in this area (5, 21, 45). Martínez-Esparza et al. (46) reported patients with OCD performed more poorly on measures of visuospatial working memory than control groups. Moreover, a meta-analysis showed that impairments in visuospatial memory are more pronounced in patients with OCD than are deficits in inhibition and set-shifting (43). The results that the observed no impairment of inhibition and set-shifting function in the current study is broadly consistent with previous research (20, 24). According to the cognitive theories of compulsive checking in OCD patients, the checkers are deficient in inhibiting misleading information and tolerating uncertainty,

TABLE 4 The moderating effect of executive function on anxiety and general compulsion symptoms.

	Variables	Standardized β	S.E.	p	Cohen's d
Model 1	BAI	0.353	0.119	0.003	0.881
	SST_{SSRT}	−0.215	0.121	0.076	−0.440
	BAI × SST_{SSRT}	−0.031	0.122	0.802	−0.062
Model 2	BAI	0.398	0.110	< 0.001	1.002
	$VWM_{capacity}$	0.144	0.117	0.218	0.396
	BAI × $VWM_{capacity}$	−0.196	0.114	0.085	−0.400
Model 3	BAI	0.368	0.126	0.003	0.920
	$WCST_{Rpe}$	−0.030	0.147	0.840	−0.060
	BAI × $WCST_{Rpe}$	0.006	0.131	0.963	0.112

BAI, the Beck Anxiety Inventory; SST_{SSRT}, the stop signal reaction time; $VWM_{capacity}$, visuospatial memory capacity; $WCST_{Rpe}$, the rate of perseverative errors.

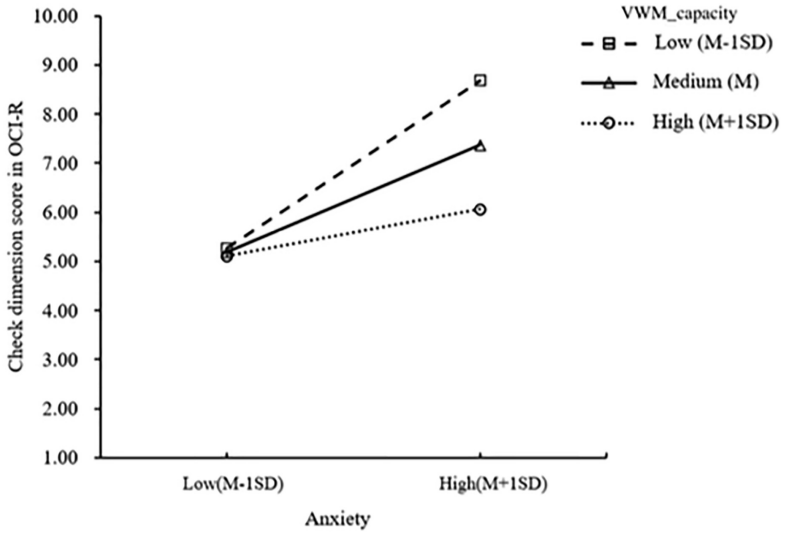

FIGURE 1
Simple slope test of visuospatial memory capacity ($VWM_{capacity}$).

which may motivate reassurance-based checking of memory (7). Several studies have confirmed that (47, 48). Lambrecq et al. (5) used Corsi block-tapping test and delayed matching-to-sample task to find that it showed an opposite temporal direction in the relationship between abilities in visuospatial memory and uncertainty. However, there is no clear conclusion on whether pathological uncertainty leads to the decline of visuospatial working memory ability in patients with OCD, or whether compulsive checking behavior reduces confidence in memory and increases uncertainty, which still needs further research in the future.

Importantly, we also found significant correlations between VWM capacity and anxiety symptoms and compulsive checking behavior, which is consistent with previous reports that impaired VWM function and symptoms of anxiety are correlated (49, 50). Other researchers have also reported that anxiety consumes resources for goal-oriented behaviors (e.g., spatial attention, executive function), thus disrupting spatial working memory performance (51). According to the attention control theory, anxiety could occupy cognitive resources and interfere with the updating functions of the central executive system (52). The encoding of spatial information by VWM depends on the allocation of attention to the storage location, while anxiety is related to the consumption of central executive resources, which may undermine the efficient allocation of spatial attention (30).

A strong relationship between VWM and compulsive checking symptoms was reported in our study. Previous studies have showed that patients with OCD have lower reading and location working memory scores and longer checking times than HC, suggesting that insufficient VWM may increase uncertainty, leading to an increase in checking behavior (5, 48). This result may be explained by the cognitive theory of compulsive checking, which states that patients with

TABLE 5 The moderating effect of executive function on anxiety and checking symptoms.

	Variables	Standardized β	S.E.	p	Cohen's d
Model 1	BAI	0.350	0.127	0.006	0.873
	SST_{SSRT}	−0.017	0.134	0.898	−0.034
	BAI × SST_{SSRT}	−0.046	0.134	0.730	−0.092
Model 2	BAI	0.344	0.123	0.005	0.857
	$VWM_{capacity}$	−0.220	0.133	0.099	−0.451
	BAI × $VWM_{capacity}$	−0.281	0.123	0.022	−0.586
Model 3	BAI	0.366	0.132	0.005	0.915
	$WCST_{Rpe}$	−0.008	0.159	0.962	−0.016
	BAI × $WCST_{Rpe}$	0.099	0.141	0.479	0.301

BAI, the Beck Anxiety Inventory; SST_{SSRT}, the stop signal reaction time; $VWM_{capacity}$, visuospatial memory capacity; $WCST_{Rpe}$, the rate of perseverative errors.

OCD have deficits in inhibiting misleading information and tolerating uncertainty (7), and they have impaired memory of performing an action, and reduced confidence in their memory (48). The practice of repeated checking gives patients more information and reduces uncertainty. Thus, checking behavior can be viewed as a strategy to compensate for deficits in working memory (6, 7). Another possible explanation is that patients with OCD have deficits in balancing goal-directed and habitual behavior, while the ability to develop a plan individual to achieve a goal requires working memory function (10). Working memory could maintain goal-directed representations so individuals could respond to the problem without relying on previously learned associations (49). Moreover, functional neuroimaging evidence has shown that the orbitofrontal cortex (OFC), especially the medial OFC, appears to mediate executive control functions underlying the coordination of multiple working memory processes (53). This has been viewed as the neural basis of compulsivity behavior and is critical for the cognitive control of behavior (54, 55). Hence, it could conceivably be inferred that OFC dysfunction might disturb the capacity of VWM to hold goal-oriented representations, or reduce its capacity to maintain detailed characteristics of actions so that patients with OCD are required to resolve problems by relying on habitual checking behavior.

It is interesting to note that the moderate models showed that VWM had a valid moderating effect on the positive impact of anxiety on the severity of compulsive checking symptoms, and this effect has not been described previously. Patients with OCD with medium and lower VWM capacity showed a significant increase in checking symptoms with increased anxiety levels. However, this moderating effect was not observed in patients with higher visuospatial capacity. Thus, it seems that higher VWM ability might work as a protective factor for compulsive checking behavior in the face of substantial anxiety. A possible explanation for this might be that impaired VWM gives rise to an imbalance in the habit and goal-directed system and accordingly, leads to compulsive checking to alleviate anxiety.

Moreover, anxiety also interferes with the ability to filter out irrelevant information from VWM (56). Lower VWM capacity means that individuals are more disturbed (57), have less ability to regulate emotions (58), and also cannot appraise negative emotional stimuli well in an unemotional manner and require more neural resources in higher-order cognitive regions (59). There was also evidence showed that anxiety could alters self-control on memory, which change the self-confidence in memory, thus increasing the severity of compulsive checking symptoms (60). From a cognitive control framework (27), emotion regulation strategies (i.e., stopping, switching, and maintenance) are assumed to demand sound working memory updating ability. The impairment in stopping or switching ineffective emotion regulation strategies may lead to an overly rigid, inflexible, or repetitive use of regulatory strategies (61).

The results suggest that compulsive checking symptoms may be reduced by training to increase the capacity of VWM to improve working memory (6, 62). Shin et al. (63) performed a lateralized change detection task, and the results showed that the improvement during training was positively correlated with an increase in VWM capacity. However, studies of VWM training have not yielded consistent results, with some studies showing no significant increase in memory capacity (64), although this may be due to the use of different training methods. However, the results show that long-term training often shows a positive training effect although additional research is required to verify these findings.

5. Limitations

There are several limitations to this study. First, the sample size was relatively small, and whether our findings are generalizable to other patients with OCD requires validation.

Second, the patients with OCD included in the study were not categorized into specific symptom dimensions and whether there are differences in the performance and moderation of cognitive function in different OCD subtypes needs further exploration. Third, this is an exploratory study. It may be due to the use of different measurement tools and paradigms, and the selection of different indicators, which may result in different results from other similar studies. It is suggested that future studies employ larger sample sizes and group OCD according to different subtypes to more thoroughly explore these relationships. Moreover, repeated validation should be performed using these measurement tools and paradigms. It can provide a foundation for the development of effective clinical interventions.

6. Conclusion

Taken together, the results presented in this paper offer an exciting opportunity for further research regarding how cognitive inflexibility and emotional factors interact to induce or maintain different subtypes or dimensions of OCD symptoms. To our knowledge, this is the first study to explore the moderating effect of executive function on the relationship between anxiety and compulsive checking behavior. That is, anxiety symptoms play a negligible role in explaining compulsive checking behavior in individuals with relatively strong VWM ability, but a substantial role in explaining compulsive checking behavior in individuals with relatively weak spatial visual working memory ability.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Research Ethics Committee of Beijing Anding Hospital, Capital Medical University, Beijing, China. The patients/participants provided their written informed consent to participate in this study.

Author contributions

PW: designed the study, performed literature searches, drafted the manuscript, critically reviewed, and revised the manuscript. ZY: performed literature searches, collected dated, and drafted the manuscript. TC: conceptualized the study, reviewed, and revised the manuscript. WC: collected data and revised the manuscript. XY, FM, and YL: contributed to collected data. ZL: contribute to conceptualized and designed the study, reviewed, and revised the manuscript, and as corresponding author. All authors contributed to the article and approved the submitted version.

Funding

This study was supported by National Natural Science Foundation of China (No. 82171542), Beijing Municipal Administration of Hospitals Incubating Program (code: PX2020075), and Beijing Municipal Administration of Hospitals Clinical Medicine Development of Special Funding Support (code: XMLX202129).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 03 February 2023
DOI 10.3389/fpsyt.2022.1035469

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Anxiety and Stress Disorders, a section of the journal Frontiers in Psychiatry

RECEIVED 02 September 2022
ACCEPTED 28 December 2022
PUBLISHED 03 February 2023

CITATION
Di Ponzio M, Makris N, Tenerini C, Grassi E, Ragone S and Pallanti S (2023) rTMS investigation of resistant Obsessive-Compulsive Related Disorders: Efficacy of targeting the reward system. *Front. Psychiatry* 13:1035469. doi: 10.3389/fpsyt.2022.1035469

rTMS investigation of resistant Obsessive-Compulsive Related Disorders: Efficacy of targeting the reward system

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Introduction: Repetitive Transcranial Magnetic Stimulation (rTMS) is not only a therapeutic option but also an investigational tool to explore circuits and subjective dimensions in pathological conditions. Obsessive-Compulsive Related Disorders (OCRDs) shared similarities with Substance Use Disorder (SUD), suggesting the involvement of the reward system. This study aimed to verify the efficacy of targeting the reward system with rTMS in OCRDs.

Methods: Patients with trichotillomania, hoarding disorder and skin picking disorder were treated with rTMS over the left DorsoLateral PreFrontal Cortex (DLPFC) at 15 Hz, targeting the reward system via the connection with the nucleus accumbens and the ventral tegmental area. All patients were administered with psychometric scales assessing depression symptoms and severity of OCRDs symptoms at the baseline, at the end of the treatment and a 1-month follow-up.

Results: Analysis of the results showed a reduction in symptom severity at the end of the treatment in all three groups ($p < 0.0001$) as well as a reduction in depression symptoms ($p < 0.01$). Improvements at 1-month follow-up were maintained only in younger patients. Indeed, when changes in scores at the follow-up were analyzed separately for younger (<30 years) and older patients (>60 years), the elderly showed again an increase in symptoms severity, suggesting that the stability of TMS effects over time reduces with age, possibly as an effect of age-related reduction in brain plasticity.

Discussion: This study adopted with promising results a protocol (15 Hz over the left DLPFC) targeting the reward system, typically employed in addictions. These results can be in line with the view of OCRDs as behavioral addictions, suggesting the implication of common circuits, such as the reward system, in the mechanisms at the basis of these disorders.

KEYWORDS

rTMS (repetitive transcranial magnetic stimulation), Obsessive-Compulsive Related Disorders, OCD (obsessive-compulsive disorder), reward system, brain plasticity, brain stimulation, behavioral addictions

1. Introduction

The Diagnostic and Statistical Manual-Fifth Edition [DSM-5; (1)] introduced the new diagnostic category of Obsessive-Compulsive and Related Disorders (OCRDs). It comprises trichotillomania (TTM; hair-pulling disorder), excoriation disorder (skin picking; SPD), obsessive-compulsive disorder (OCD), body dysmorphic disorder (BDD), and hoarding disorder (HD). Obsessions (repeated, upsetting, intrusive thoughts, visions, or desires) and compulsions (ritualized acts performed to relieve discomfort from obsessions) are the key symptoms of OCD (1). HD refers to the difficult in discarding, also worthless, possessions (1). Recurring hair pulling, which causes hair loss, is a defining feature of TTM (1). SP entails regular skin picking, which causes lesions (1).

All these disorders share compulsive behaviors as a cardinal feature, which are also typical of addictions (2). Based on this and other analogies, OCD has been proposed to be considered a behavioral addiction (3). Furthermore, an addiction model of TTM (4) and of SPD (5) has been proposed mainly based on similar clinical manifestations, including compulsivity, diminished inhibitory control, urge or craving state before the engagement in the hair pulling and the hedonic quality of performing hair pulling or skin picking. Furthermore, all compulsive behaviors indicate impaired reward processing, lack of inhibitory control, and cognitive inflexibility (2). Patients with OCD as well as with SPD and TTM (6) showed impaired motor and cognitive inhibitory mechanisms, suggesting impairment of frontostriatal circuitries which regulate inhibitory control (7). At the same time, reward processing dysfunction, which is one of the main feature of addictions (8), has been implicated in the etiology and sustention of SPD and TTM (9), suggesting that the intense craving and pleasure experienced during the behavior could be the result of abnormal brain reward processing (10).

Repetitive Transcranial Magnetic Stimulation (rTMS) has emerged as a valid therapeutic option for the treatment of OCD. Furthermore, its application might work as an investigational tool exploring circuits and subjective dimensions involved in the impulsive-compulsive phenomena. Mainly, four brain areas have been the different targets of rTMS in OCD, as emerged from a literature review (11): the DorsoLateral PreFrontal Cortex (DLPFC), the Supplementary Motor Area (SMA), the OrbitoFrontal Cortex (OFC) and the Anterior Cingulate Cortex (ACC). Positive outcomes have been reported for all the aforementioned targets. This evidence highlights the heterogeneity of OCD. In the specific case of OCRDs, only two studies have reported the effect of rTMS. One study was a case series report (12), in which patients with TTM were treated with low-frequency rTMS over the pre-SMA. Then, a prospective study failed to report the effects of rTMS over the pre-SMA in SPD (13). Concerning hoarding, only one case study reported the efficacy of prefrontal direct current stimulation (14). At our knowledge, no study investigated the effect of TMS in hoarding. Furthermore, no study specifically targeted DLPFC in OCRD, although encouraging results have been shown in OCD both with TMS (11) and direct current stimulation (15, 16). However, controversial results emerged concerning the optimal frequency of stimulation. Different studies have chosen to treat OCD patients with rTMS over the left DLPFC at 10 hz or 20 Hz (17–20). Then, rTMS over left DLPFC at 15 Hz has been previously shown to be effective in addiction to reducing craving and compulsive behaviors (21, 22), due to its involvement in reward circuitries (23, 24). No FDA-approved treatment for OCRD exists.

In light of the addiction hypothesis of OCRD and given the negative results of pre-SMA stimulations, we have proposed rTMS over the left DLPFC at 15 Hz for the treatment of patients with OCRD in our center (Istituto di Neuroscienze, Florence, Italy). In our center, we use rTMS for different disorders and all the data are collected in our databases. Herein, data are reported and analyzed retrospectively, to examine the clinical profile of patients with TTM, SPD, and HD treated with rTMS at 15 Hz over the left DLPFC before, after treatment and at 1-month follow-up, with the aim also to propose the possibility that OCRDs are linked with addictions. Moreover, the potential effect of age was analyzed.

2. Materials and methods

2.1. Participants

In this retrospective study, clinical data of patients with a diagnosis of Obsessive-Compulsive Related Disorders (SPD, TTM, and HD) according to DSM-5 criteria were extracted from databases containing information on patients of the psychiatric clinic at the Istituto di Neuroscience, Florence (Italy). Patients' age ranged from 16 to 76 years old. All patients had a history of cognitive-behavioral therapy, but no one was under psychotherapy while treated with TMS. Moreover, all patients were resistant to treatment, based on the operational definition by Pallanti and Quercioli (25). It is important to mention that the database used for the analysis contained only the data of patients who accepted treatment among all the ones to which was proposed during the normal clinical practice: 41 accepted out of 60 to which was proposed (information obtained from the clinic's internal system). The reason for the ones who did not accept to start the protocol, despite the indication for treatment with rTMS, were the choice for other types of medications or their inability (for personal reasons) to follow the entire cycle of TMS. rTMS was added to ongoing pharmacological treatments. All patients were treated stably for 2 months with Selective Serotonin Reuptake Inhibitors (SSRIs) at a fluoxetine equivalent dosage of 30 mg. Demographical data are reported in **Table 1** (see also **Supplementary Table 1**). After the complete description of the study to participants, written informed consent was obtained from each one for the inclusion of their data in this study.

2.2. Procedure

Repetitive Transcranial Magnetic Stimulation was administered with the Magstim Rapid Stimulator (Magstim Company Ltd., Whitland, UK) using a 70-mm, 8-shaped coil. Stimulation parameters were 15 Hz, 2,400 pulses/day at 100% of resting motor threshold (MT), once a day, 6 days/week for 4 weeks (24 sessions total). Stimulation was applied on the left DLPFC, identified for each subject through neuronavigation. Resting MT was defined as the minimum magnetic flux needed to elicit a response in a resting target muscle (abductor pollicis brevis) in 5/10 trials using single-pulse TMS administered to the contralateral primary motor cortex.

2.3. Psychometric measures

Baseline assessments were performed before the first rTMS session and repeated at the end of the treatment. Follow-up

TABLE 1 Descriptive statistics for each group, reporting sample size, age mean and standard deviation, and male/female ratios.

Group	Sample size	Age	Gender	Comorbidities
Hoarding	14	48.7 (18.5)	5 M, 9 F	5 MDD, 2 ADHD, 1 SUD, 4 GAD
Skin picking	13	43.5 (20)	4 M, 9 F	3 SUD, 7 MDD, 2 ADHD, 3 GAD, 1 bipolar disorder
Trichotillomania	14	41 (19.5)	2 M, 12 F	7 MDD, 2 ADHD, 4 GAD, 1 bipolar disorder

MDD, major depressive disorder; ADHD, attention deficit hyperactivity disorder; SUD, substance use disorder; GAD, generalized anxiety disorder.

assessments were performed 1 month after the end of the treatment. The assessment has been performed by a panel of trained raters but blind to the treatment administered.

The Massachusetts General Hospital Hair pulling Scale (MGH) (26) assesses the frequency, intensity, and distress of trichotillomania behavior. It consists of seven items with a maximum score of 28. A score between 0–7 refers to subclinical symptomatology, between 8–14 to mild symptomatology, between 15–21 to moderate symptomatology, and between 22–28 to severe symptomatology. Since the questionnaire was not available in the Italian, two independent native Italian speakers fluent in English translated the original scale into Italian. This translated version was then translated back into English by two separate native English speakers who were also fluent in Italian. No significant differences were found between the original and the newly translated version. The Cronbach's alpha of the Italian version of the scale administered here was 0.89, indicating excellent internal consistency.

The Hoarding Rating Scale-Interview [HRS-I; (27)] is a 5-item semi-structured interview that assesses clutter, difficulty discarding, acquiring, distress, and impairment. Each item is rated on a 9-point scale from 0 to 8, and the item scores are summed to create a total score (range = 0–40). A score higher than 14 is associated with significant impairment in daily life due to difficulty discarding. The Italian version, validated by Faraci et al. (28) was used.

The Yale-Brown Obsessive Compulsive Scale Modified for Neurotic Excoriation (NE-YBOCS) is valid and reliable scale used to evaluate the severity of SPD. Responses to the 10 items were coded on a 4-point scale and summed to produce a composite score ranging from 0 to 40, with higher scores reflecting greater illness severity. Since the questionnaire was not available in the Italian, two independent native Italian speakers fluent in English translated the original scale into Italian. This translated version was then translated back into English by two separate native English speakers who were also fluent in Italian. No significant differences were found between the original and the newly translated version. The Cronbach's alpha of the Italian version of the scale administered here was 0.92, indicating excellent internal consistency.

The Italian version of the Symptoms of Depression Questionnaire [SDQ; (29)] was used in this study. It is a 44-item, Likert-type, self-report scale developed for measuring symptom severity across several subtypes of depression. SDQ encloses five subscales, investigating the following dimensions: lassitude, mood, cognitive/social functioning; anxiety, agitation, anger and irritability; the desire to be dead; disruptions in sleep quality; changes in appetite and weight.

2.4. Statistical analysis

The baseline demographic and clinical characteristics of the sample were tabulated with descriptive statistics. Parametric (*t*-test) and non-parametric (Wilcoxon) tests were used according to variables' distribution (tested with the Shapiro-Wilk test) to analyze changes in scores over time and to compare scores at the baseline between those who accepted to be treated with TMS and those who refused. A regression analysis (Pearson's correlation) was used to test the effect of age and to verify whether the change in symptoms severity (score of each symptomatologic scale) was dependent to the change in SDQ scores between the pre- and post-treatment. For all statistical analyses, the alpha level of significance was set at 0.05. All the statistical analyses were performed using the statistical programming language R (version 4.0.5) (30).

3. Results

The study included 41 patients, which were dived into three groups based on the diagnosis. The SPD group consisted of 13 patients (9 females; mean age: 43.5; SD: 20). The TTM group consisted of 14 patients (12 females; mean age: 41; SD: 19.5). The HD group consisted of 14 patients (9 females: mean age: 48.7; SD: 18.5) (see Table 1). Scores statistics are reported in Table 2. For detailed score report, please see Supplementary Tables 2–4.

Baseline scale measures were compared between the 41 patients who accepted to be treated and the ones who refused TMS treatment as well as age distribution, in order to verify whether there were differences between these two groups. No statistically significant differences were found.

As HRS scores in the HD group were normally distributed (verified through the Shapiro–Wilk test), a multiple paired *t*-test was used to determine whether there were differences in scores between pre-and post-treatment and between post-treatment and follow-up. All patients improved at the end of the treatment (Table 2), with a mean percentage of improvement of 52%. HRS scores before and after treatment were statistically different ($p < 0.0001$), while there was no statistically significant difference between post-treatment and follow-up scores.

As MGH scores in the TTM group were normally distributed (verified through the Shapiro–Wilk test), a multiple paired *t*-test was used to determine whether there were differences in scores between pre- and post-treatment and between post-treatment and follow-up. All patients improved at the end of the treatment (Table 2), with a mean percentage of improvement of 58%. MGH scores before and after treatment were statistically different ($p < 0.0001$), while there was no statistically significant difference between post-treatment and follow-up scores.

As NE-YBOCS scores in the SPD group were normally distributed (verified through the Shapiro–Wilk test), a multiple paired *t*-test was used to determine whether there were differences in scores between pre- and post-treatment and between post-treatment and follow-up. All patients improved at the end of the treatment (Table 3), with a mean percentage of improvement of 62%. NE-YBOCS scores before and after treatment were statistically different ($p < 0.0001$), while there was no statistically significant difference between post-treatment and follow-up scores.

As SDQ scores, for all groups, were normally distributed (verified through the Shapiro–Wilk test), a multiple paired *t*-test was used to determine whether there were differences in scores between pre-and post-treatment and between post-treatment and follow-up for each group. In the hoarding group, the mean reduction corresponded to 20%; in the TTM group, 17% and in the SPD group, 23%. SDQ scores before and after treatment were statistically different ($p < 0.0001$), while there was no statistically significant difference between post-treatment and follow-up scores for each group.

Linear regression was performed to verify a potential age effect in all three groups, due to the wide range of ages in this sample. Linear regression was performed before between the score difference between pre- and post-treatment and age, then between the score difference between the post-treatment and the follow-up. Regarding the HD group and TTM group, no age effect was found in the score difference between pre- and post-treatment. While the correlation between age and the difference in scores between post-treatment and follow-up scores was significant with a *p*-value of < 0.01. Regarding the SPD group, no age effect was found in the score difference between pre- and post-treatment. While the correlation between age and the difference in scores between post-treatment and follow-up scores was significant with a *p*-value of < 0.001.

To further investigate the effect of age, given the results obtained with the correlation, participants in each group were divided into two subgroups based on their age. The young adult group included patients younger than 35 years of age and the older adults group included patients older than 60 years of age (see Table 3).

The comparison (see Figure 1) between the HRS scores between post-treatment and follow-up was significant only in the old group ($p < 0.01$). The comparison (see Figure 2) between the MGH scores between post-treatment and follow-up was significant only in the old group ($p < 0.01$). The comparison (see Figure 3) between the NE-YBOCS scores between post-treatment and follow-up was significant only in the old group ($p < 0.05$).

In order to verify whether the improvement in symptoms severity was due to the improvement in comorbid depression, a linear regression was used to assess whether there was a relationship between the change between the pre and post treatment in SDQ scores and the change in HRS, NE-YBOCS, and MGH scores. No significant results were obtained for any measure. Importantly, no side effects were reported by the patients.

4. Discussion

This is the first study to report the effects of high-frequency (15 Hz) rTMS over the left DLPFC in OCRD. The main finding of this retrospective study was the positive response of OCRD patients to treatment with a reduction of symptoms severity of more than 35%, which is the conventional threshold to discriminate between respondents and not respondents to treatment in OCD (25). Moreover, an improvement in depression symptoms was also observed. Therefore, given the lack of approved treatments for OCRD and the promising results here reported, this study suggests that this protocol can be a possible treatment for OCRD, that could open a new therapeutic pathway as already occurred in Substance Use Disorder.

There is no consensus on the optimal target and protocol of TMS in OCD. Low-frequency TMS of the supplementary motor cortex has been shown to alleviate OCD symptoms in many but not all studies (11). Studies investigating high-frequency (10 Hz) stimulation over the DLPFC also showed controversial results (11), as well as studies adopting 20 hz frequency stimulations

TABLE 2 Mean scores (and standard deviations) of the psychometrics scale are reported for each group at the pre- and post-treatment timepoints, as well as the percentage of score reduction after treatment.

Group	Scales	Pre-test	Post-test	Percentage of change	*p*-value	Effect size
Hoarding	HRS	26 (4.3)	12.4 (3.5)	52.4 (12.1)	<0.0001	3.61
	SDQ	136 (16.7)	108 (14.8)	20.4 (9.5)	<0.0001	1.87
Trichotillomania	MGH	21 (4.1)	9.1 (4.32)	58.2 (17.1)	<0.0001	3.52
	SDQ	130 (9.6)	107 (9.4)	17.1 (8.5)	<0.0001	1.78
Skin picking	NE-YBOCS	26.8 (6.15)	10.2 (4.86)	63 (13.8)	<0.0001	3.77
	SDQ	131 (14.8)	99.7 (11.9)	22 (6.5)	<0.0001	3.66

P-value and effect sizes of each comparison (*t*-test) between pre- and post-treatment scores are also reported. HRS, Hoarding Rating Scale; SDQ, symptoms of depression questionnaire; MGH, Massachusetts General Hospital Hair pulling Scale; NE-YBOCS, Neurotic Excoriations Yale-Brown Obsessive-Compulsive Scale.

TABLE 3 Demographical data (sample size, age mean and standard deviation) are here reported for each group (Hoarding, Trichotillomania, and Skin Picking) in the subgroups: older (>60 years of age) vs. younger adults (<35 years of age).

Group	Subgroup	Sample size	Age	Pre-test	Post-test	Follow-up
Hoarding	Old	6 (4 female)	66.7 (5.4)	27.2 (5.78)	12.5 (4.55)	16.3 (4.37)
	Young	5 (3 female)	28 (7.2)	24.6 (2.51)	13 (2.24)	12.2 (0.84)
Trichotillomania	Old	5 (3 female)	63.2 (2.3)	20 (3.8)	10.4 (4.3)	14 (4.36)
	Young	8 (8 female)	25.1 (5.8)	22.1 (4.3)	8.5 (4.7)	7.6 (3.6)
Skin picking	Old	5 (4 female)	63.6 (2.4)	27.8 (7.7)	11 (6.8)	16.4 (7.8)
	Young	6 (3 female)	23.5 (6.1)	28 (4.9)	10.3 (4)	9.17 (2.8)

Mean scores and standard deviations of psychometric scales are reported: Hoarding Rating Scale (HRS) for the hoarding group; Massachusetts General Hospital Hair pulling Scale (MGH) for the trichotillomania group; Neurotic Excoriation Yale-Brown Obsessive-Compulsive Scale for the Skin Picking Disorder.

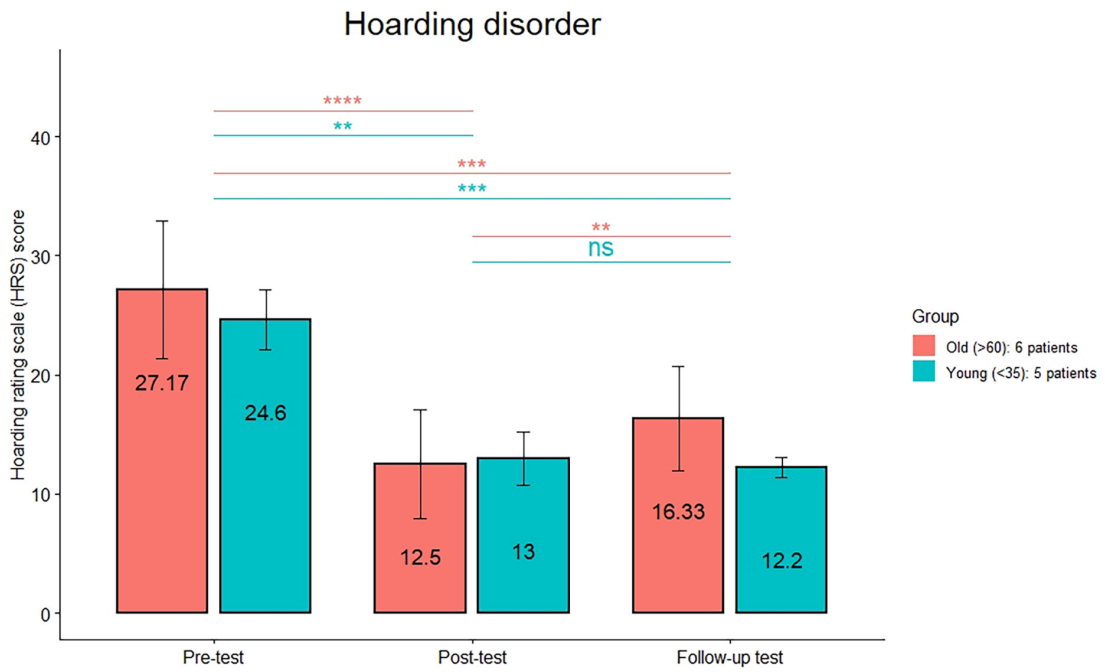

FIGURE 1
Hoarding Rating Scale mean scores are reported for the young and old subgroups in the hoarding group at the three timepoints (pre-treatment, post-treatment, and 1 month follow-up). ****$p < 0.0001$; ***$p < 0.001$; **$p < 0.01$; n.s.: not significant.

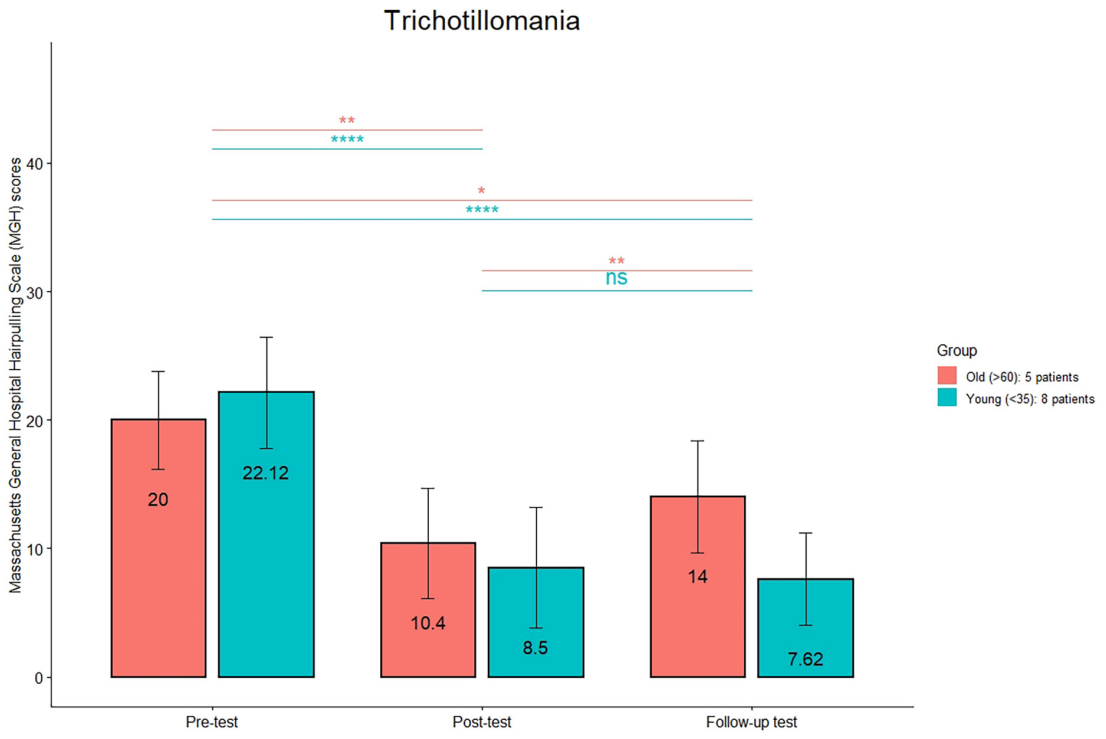

FIGURE 2
Massachusetts General Hospital Hair pulling Scale (MGH) mean scores are reported for the young and old subgroups in the trichotillomania group at the three timepoints (pre-treatment, post-treatment, and 1 month follow-up). ****$p < 0.0001$; **$p < 0.01$; *$p < 0.05$; n.s.: not significant.

(19, 20). Recently, Khurshid (31) hypothesized that high-frequency rTMS of pre-SMA can reduce OCD symptoms. Here, instead, we tested the efficacy of high-frequency (15 hz) stimulation over left DLPFC. High-frequency 15 HZ rTMS over DLPFC is a treatment for addictions, such as cocaine (21, 22), due to the modulation of activity in subcortical reward circuitry involving the dopaminergic midbrain ventral tegmental area and nucleus accumbens (23, 32). One study provided strong evidence that

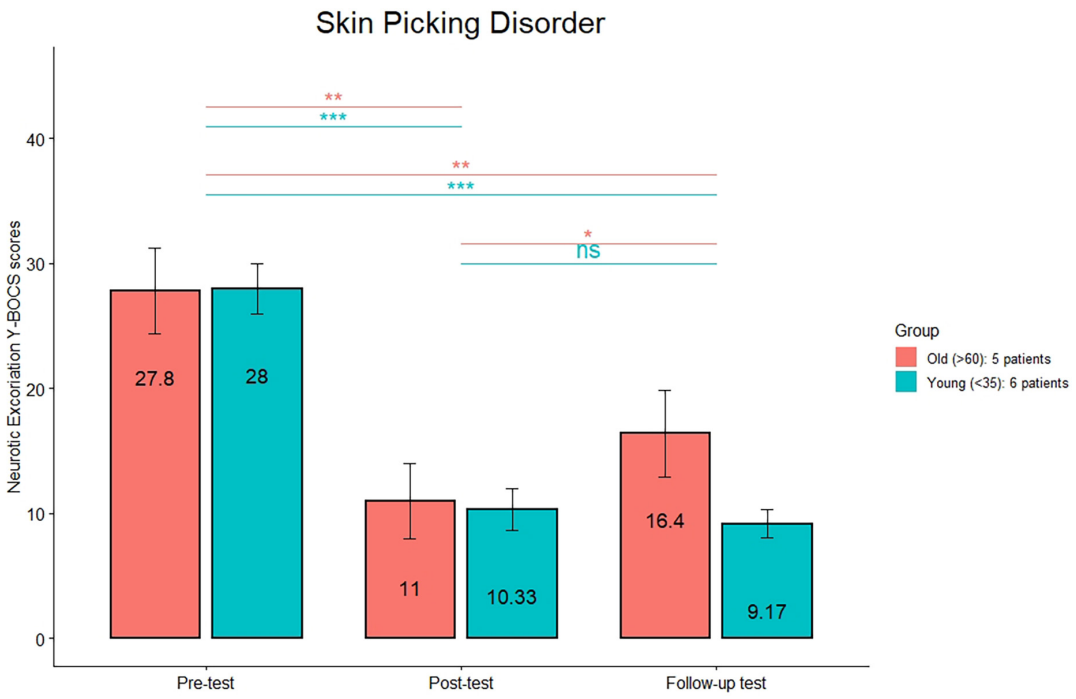

FIGURE 3
Neurotic Excoriations Yale-Brown Obsessive-Compulsive Scale mean scores are reported for the young and old subgroups in the trichotillomania group at the three timepoints (pre-treatment, post-treatment, and 1 month follow-up). ***$p < 0.0001$; **$p < 0.01$; *$p < 0.05$; n.s.: not significant.

stimulation of left DLPFC influences the ACC (33), which has a specific role in reward decision-making (34). ACC shows alterations in OCD and also in skin picking (35). Therefore, the positive outcomes here reported in OCRD suggested an implication of reward circuits. It can be hypothesized that, given the positive outcomes of a protocol usually employed for addictions, our results are consistent with the emerging view of OCD as a behavioral addiction (36), a conclusion that could be spread to the entire spectrum. As a matter of fact, people with OCRDs have an high comorbidity rates of addiction (37) and are more likely than controls to have first-degree relatives with Substance Use Disorder (38). Furthermore, double-blind placebo-controlled trials have shown that pharmacological treatments targeting the reward processing by modulating glutamate and dopamine are effective in OCRDs (39). Moreover, the involvement of reward circuitry in OCRDs has been supported by a fMRI study which found alterations in reward circuitry (9).

The hypothesis is that there is a continuum that goes from impulsivity through compulsivity to addiction and the transition to addiction involved a shift from hyperactivation of the ventral striatum to the dorsal striatum (40) and also a progressive loss of top-down, executive control resulting from a loss of PFC and cingulate cortex function (36).

Concerning the controversial results of HF l-DLPFC in OCD (11), it is reasonable to believe that since OCD is an heterogeneous disorder, the individuals who benefited the most from that treatment were the one with features more similar to OCRD. In this sense, they could be clustered into a "reward deficiency group," adopting the terminology by Lochner et al. (41). Again, this could result in a different neurocircuitry involvement, with a preferential involvement of the complex DLPFC/ACC in "reward deficiency group" and a pre-SMA involvement in the "impulsive" group. Furthermore, it could be that these two groups experience differently their symptoms, with a different level of awareness. The same explanation could apply to the differences in outcomes between the TTM and SPD groups and HD group. The last one showed a percentage of improvement inferior to the ones obtained in the other two groups. Reasonably, HD could be characterized by features, such as the attentional component (42), that may not match perfectly the ones of the "reward deficiency group."

These results are in line with a multidimensional perspective of OCD (43), which lies in the middle between a lumping and a splitting view. According to the lumping view, OCD is a unitary disorder; while, the splitting perspective claims that different subtypes of OCD exist which all represent different disorders, with different causes and different treatments. But, according to an intermediate view, OCD is a spectrum of overlapping disorders, which have their specificities but share also some similarities. Accordingly, they can share the same neural substrates, such as DLPFC alterations. Although this speculation is beyond the actual implications of this study, the fact that the previous study (13) failed to replicate for SPD the same results that have been obtained for OCD and the fact that instead the study here presented replicated them for DLPFC can mean that the common link could be an alteration of DLPFC. Indeed, considering that compulsive behaviors are a cardinal feature of the OCD spectrum, recently, Fremont et al. (44) have found that reductions in the left DLPFC were associated with the development of compulsive behaviors not accompanied by obsessions. Coherently, in TTM and SPD compulsions are not necessarily triggered by obsessional thoughts, as they are not in the DSM–5 diagnostic criteria (1).

Regarding the other results of this study, no difference was found between scores at the end of the treatment and 1-month

follow-up, suggesting that the rTMS effect can last beyond the end of the treatment. Interestingly, when patients were divided into two groups based on their age, differences emerged concerning the maintenance of beneficial effects of rTMS at the follow-up. Indeed, results showed that in older adults symptoms severity at the follow-up worsened again, while in young adults the results were stable over time. Reasonably, this result can be a consequence of a reduction of plasticity in older brains. This result is coherent with other findings (45). For example, in a study with an adult age ranging from 19 to 81 years, Freitas et al. (46) found the duration and magnitude of corticospinal excitability modulation by rTMS were inversely and significantly correlated with age. Furthermore, a recent study by D'Urso et al. (47) found an inverse correlation between age and clinical response to TMS treatment in resistant-depression. These data provide direct experimental evidence that, in humans, long-term plasticity becomes increasingly less efficient with advancing age.

The present study has some limitations, including its retrospective nature, the lack of a control group, addressing the potential placebo effect (although blind raters were involved to minimize the confounding effects) and the low sample size. Furthermore, although the inclusion of a follow-up assessment and the stability of effects in younger participants, it is a relative short term follow-up, considering that Aydin et al. (12) found a re-worsening of symptoms in TTM patients after TMS at a 3-month follow-up. In this sense, we believe that, based on unpublished data in our possession, a monthly follow-up booster session could be helpful in the stability of the effects over time. Furthermore, right DLPFC has also been implicated in reward functioning. We cannot conclude about the potential effect of targeting right DLPFC at high-frequency in OCRDs. Future research should overcome these limitations and should prospectively analyze the effects of rTMS in OCRD over the DLPFC and should also investigate the neuroimaging correlates, in order to corroborate the hypotheses here formulated. Being a naturalistic study, it was not possible to control for comorbidities, such as ADHD, which appeared to be frequent in our sample, as reported in the methods section. ADHD is characterized by frontal dysfunctions, but, as Cardullo et al. (48) reported, ADHD comorbidity with psychiatric disorders did not interfere with rTMS application.

Recognition that neural networks are interconnected and communicate at different levels can facilitate a better understanding of the neurobiological concepts related to psychiatric disorders and also of treatment with rTMS. In the future, targets for rTMS should be no more anatomical but should look at the functional connections of the target. In this sense, the target should be chosen depending on its connectivity (49). Our study points in this direction. Indeed, its positive outcomes acquire sense only by looking at the connections and at the neural networks in which the left DLPFC is involved.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from each participant for the inclusion of their potentially identifiable data in this study.

Author contributions

SP and MD: conceptualization. MD: formal analysis. SP, EG, and MD: investigation. EG, CT, and SR: data curation. SP, MD, EG, CT, SR, and NM: writing—original draft preparation. SP and NM: supervision. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2022.1035469/full#supplementary-material

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frontiers | Frontiers in Psychiatry

TYPE Brief Research Report
PUBLISHED 07 July 2023
DOI 10.3389/fpsyt.2023.1157710

OPEN ACCESS

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RECEIVED 03 February 2023
ACCEPTED 06 June 2023
PUBLISHED 07 July 2023

CITATION
Rocha S, Fernández XM, Castro YR, Ferreira S, Teixeira L, Campos C and Rocha NB (2023) Exploring the associations between early maladaptive schemas and impulsive and compulsive buying tendencies.
Front. Psychiatry 14:1157710.
doi: 10.3389/fpsyt.2023.1157710

Exploring the associations between early maladaptive schemas and impulsive and compulsive buying tendencies

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The main purpose of this preliminary study was to investigate a potential relationship between early maladaptive schemas (EMSs) and impulsive and compulsive buying tendencies in a sample of young adults (college students). This research adds to the cognitive perspective of consumer behavior that the cognitive schemas putatively associated with early experiences may have a strong impact on impulsive and compulsive buying. Data was obtained from 365 participants in a cross-sectional study design. Participants completed an online survey with the following instruments: Young Schema Questionnaire; Impulsive Buying Tendency Measurement Scale; Richmond Compulsive Buying Scale; and Hospital Anxiety and Depression Scale. Using multiple linear hierarchical regressions, we confirmed that the domain of over vigilance and inhibition schemas was positively associated with impulsive and compulsive buying tendencies, while an opposite association was found for the domain of impaired limits. Being a female was also a predictor of impulsive buying and compulsive buying. The results were discussed in terms of the coping mechanisms to deal with negative emotions, as a way to obtain rewards, or as a way to escape painful self-awareness. Other mechanisms related to the internalization of perfectionist expectations and the propensity to shame were also explored.

KEYWORDS

early maladaptive schemas, impulsive buying, compulsive buying, buying addiction, consumer behavior

1. Introduction

Impulsivity and compulsiveness are behavioral domains that are usually considered in the context of psychopathology. They are present in a wide range of mental disorders, such as obsessive–compulsive disorder, attention deficit hyperactivity disorder, autism spectrum disorders, addictions, among others (1). In general, impulsiveness is related to the devaluation of risk and obtaining immediate gratification. On the other hand, compulsiveness is related to learning a repetitive and maladaptive way of responding, with a low level of control in the presence of certain stimuli.

Impulsive buying is a product acquisition behavior that is done suddenly, immediately, and without planning or pre-purchase intention (2–4). The impulsive buying tendency is a buying

pattern characterized by the propensity to feel spontaneous and sudden impulses to make purchases decided at the moment, based on the influence exerted by external stimuli, with reduced deliberation, cognitive control, and evaluation of the consequences (2). Usually, the post-purchase ends up degenerating into negative emotions and cognitive dissonance in which there is a general feeling of guilt for not being able to stop the impulse to buy.

When this way of buying becomes repetitive and causes negative consequences, such as financial, social, and psychological problems, it often degenerates into compulsive buying (5, 6). Existing evidence points to a 5 to 8% prevalence of compulsive buying in the general population, with other studies suggesting even higher numbers (7–13). This variation is explained by differences in the criteria used and in the target populations.

In general, compulsive acts relate to actions that are carried out in a persistent and repetitive manner, despite their adverse consequences (14). In the particular case of compulsive shopping, also called oniomania, there are three core elements: a maladaptive concern related to shopping, in which consumers feel an uncontrollable irrepressible and repetitive need to make purchases, even if they do not need those products; a noticeable loss of control over consuming behavior; and a continuation of excessive consumption, despite the negative consequences (5, 15, 16). In fact, the consequences are very negative for the person, who goes through the distress associated with the lack of control, the negative feelings that arise when they are not shopping, and the interference in their social, financial and occupational life (6, 17).

Although external factors are important for impulsive and compulsive buying, individual variables play a crucial role. Certain personality traits seem to be more related to the tendency for compulsive buying. Compulsive consumers usually show high extraversion (18), lower social cooperation and self-directedness (19), and increased neuroticism (20). Furthermore, there is strong evidence to support the idea that factors related to maladaptive beliefs serve as a background for compulsory shopping. Thoughts such as "if I shop will be more appreciated by others," "shopping makes me feel that I am successful in my life" or "this product is unique and will help to improve my life" have an important impact on the etiology and maintenance of compulsive buying (17, 21, 22). These beliefs can be organized into the belief that the purchase of objects can compensate or neutralize negative emotions; emotional reasons to buy; the perception of objects as something unique; and the fear of losing good opportunities if the purchase is not made (22).

Within this cognitive perspective, we hypothesize that schema theory may offer a useful framework for compulsive buying. Young proposed a model that supported the development of therapy focused on schemas that constituted a significant development of the cognitive approach and that comes to integrate cognitive, emotional, relational, and behavioral variables (23, 24). Early cognitive schemas are the organizing construct of this conceptual model; they will allow a better understanding of the problems of individuals and enable the definition of therapeutic intervention strategies. According to Young, Klosko and Weishaar (25), p. 7 early maladaptive schemas are "broad, pervasive themes… regarding oneself and one's relationships with others, which are developed during childhood or adolescence, elaborated throughout one's lifetime, and dysfunctional to a significant degree." These schemas result from core emotional needs that are not met and that lead to the perpetuation of dysfunctional patterns of thinking, decision-making, bodily sensations, behavior, and affect throughout life (26).

Currently, 18 major maladaptive schemas have been identified, organized into five domains: (1) Disconnection and rejection domain, which is related to the inability to create secure connections, based on the belief that the need for affection, love and belonging will not be met; (2) Impaired autonomy and performance domain, which is characterized by expectations about oneself and the environment that interfere with one's perceived ability to function or perform successfully in an independently way, which are anchored in family functioning and overprotection and entanglement; (3) Impaired limits domain, which refers to serious difficulties in internal limits related to respecting others or achieving realistic personal goals, and which is believed to be associated with permissive and indulgent family functioning; (4) Other-directedness, which is defined by a constant and excessive cognitive focus on the approval by others, to the detriment of their own desires and feelings, which can be linked to a family pattern with relationships based on conditional approval; and (5) Overvigilance and inhibition, which is characterized by an excessive effort of self-control and suppression of feelings, as well as internalization of rigid patterns, possibly structured in a rigid and perfectionist family functioning.

We propose that individuals who have dysfunctional schemas are more likely to engage in compulsive and impulsive buying. We hypothesize that the overvigilance and inhibition maladaptive schema may underly excessive self-control and suppression of feelings, leading to rigid patterns and perfectionism, which are often associated with compulsive and impulsive buying. Compulsive and impulsive buying may be seen as a compensatory mechanism to alleviate negative situations or emotions, triggered by a need to overcome a negative self-perception (27, 28). Additionally, internalized perfectionist expectations (29–31) and materialistic values (32) are known to be associated with compulsive and impulsive buying. We believe that dysfunctional overvigilance and inhibition can lead to maladaptive self-approval and protection through impulsive and compulsive buying.

The main purpose of this preliminary study was to investigate a potential relationship between the EMSs and impulsive and compulsive buying in a sample of young adults (college students). In this study, we will rule out the role of adaptive cognitive schemas that could relate positively to impulsive or compulsive buying. This research adds to the cognitive perspective of consumer behavior, namely by discussing how cognitive schemas putatively associated with early experiences may have a strong impact on impulsive and compulsive buying.

2. Materials and methods

2.1. Participants

Four hundred and eighteen subjects completed the survey. Of these, 1 respondent was excluded for being aged below 18 years old; 6 who indicated they did not have Portuguese nationality, because there was no question in the survey regarding the degree of understanding of the Portuguese language; and 46 who did not respond "totally disagree" to the following control question: "I'm responding randomly to this survey." The final sample comprised 365 participants, of which

36.4% were students in the area of health sciences, 55.6% were students of business sciences and 7.9% were students of engineering. The mean age was 22.41 years old and 72.1% were females. The demographic characteristics of the participants are shown in Supplementary Table S1.

2.2. Instruments

2.2.1. The Young Schema Questionnaire – short form 3 SF3 (YSQ-S3)

The Young Schema Questionnaire – short form 3 (YSQ-S3) is a 90-item randomized version of the Young's Schema Questionnaire assessing the 18 EMSs (33). Each item is rated using a six-point Likert scale, ranging from 1 = Entirely untrue of me to 6 = Describes me perfectly. For this study, we focused on five schema domains: Disconnection and Rejection; Impaired Autonomy and Performance; Impaired Limits; Other-Directedness; Overvigilance and Inhibition.

The only existing study of the Portuguese version of the scale confirmed the original factor structure and found good internal consistency, both for the total scale ($\alpha = 0.97$) and for its subscales (between 0.571 and 0.861) (34). The internal consistency in our sample for the total scale was high ($\alpha = 0.96$).

2.2.2. Impulsive Buying Tendency Scale

The Impulsive Buying Tendency Scale (IBTS) (35) is a 20-item instrument comprising two facets: cognitive (IBTS-C) and affective (IBTS-A). The cognitive scale contains items related to the lack of planning and deliberation in purchasing decisions, and the affective scale addresses feelings of enthusiasm, lack of control, and urge to buy. Answers are given on a Likert scale ranging from 1 (Strongly disagree) to 7 (Strongly agree), with a higher score indicating a stronger tendency toward impulsiveness in purchasing. In the original study, the internal consistency values were $\alpha = 0.82$ for the cognitive scale and $\alpha = 0.80$ for the affective scale. In our sample, the internal consistency values were $\alpha = 0.88$ for the cognitive scale and $\alpha = 0.81$ for the affective scale.

2.2.3. Richmond Scale for Compulsive Purchasing

The Richmond Scale for Compulsive Purchasing (RSCP) is an obsessive buying scale that was developed based on the rationale that compulsive is a disorder of the obsessive–compulsive spectrum, which includes a dimension of obsessive concern with the purchase and lack of control over the impulse to make a purchase (36). It consists of six questions, of which four are answered on a scale ranging from 1 (Strongly disagree) to 7 (Strongly agree) and two are answered on a scale ranging from 1 (Never) to 7 (Very often). A higher score is indicative of a greater compulsive buying tendency. The internal consistency for the full scale in the original study had a value of $\alpha = 0.84$. In our sample, we obtained $\alpha = 0.82$ of internal consistency.

2.2.4. Hospital Anxiety and Depression Scale

Considering findings from Miltenberger et al. (37) that negative emotions, including anxiety and depression, are relevant antecedents of compulsive buying, we opted to control the effect of these variables on predictive models, using the Portuguese version of the Hospital Anxiety and Depression Scale (38). This instrument was developed to briefly assess the levels of depression and anxiety, and consists of 14 items, seven of which are for the assessment of anxiety (HADS-A) and seven for depression (HADS-D). Items are scored from zero to three, totaling a maximum score of 21 points for each subscale. The internal consistency of the Portuguese version for the two scales is good: $\alpha = 0.76$ for the anxiety scale and $\alpha = 0.81$ for the depression scale.

2.3. Procedures

The study was approved by the Ethics Committee of the ESS-P. PORTO. Participants were recruited from three schools from the North region of Portugal that gave authorization for the data collection. The participants answered the questionnaires in an online survey. They were informed about the purpose of the study and consented to participate in an online informed consent form written according to the Helsinki Declaration (39). Participants were not paid for their participation.

2.4. Data analysis

We conducted a hierarchical multivariate linear regression analysis with the tendency for impulsive and compulsive buying as dependent variables (impulsive buying – total score, impulsive buying – affective, impulsive buying – cognitive, and compulsive buying). For each model, block 1 included sociodemographic variables (age and sex), block 2 included anxiety and depression as state variables, and finally block 3 included the schema domains (Disconnection and Rejection, Impaired Autonomy and Performance, Impaired Limits, Other-Directedness, and Overvigilance and Inhibition).

Concerning the impulsive tendency variables, 16 participants' z-score values were not between −3.29 and +3.29 in each analysis and were removed from the data. The remaining data ($n = 349$) showed that the Mahalanobis distances ranged between 0.808 and 29.113. In the case of compulsive buying, 21 participants' z-score values were not between −3.29 and +3.29 in each analysis and were removed from the data. The remaining data ($n = 344$) showed that the Mahalanobis distances ranged between 0.798 and 29.404.

The critical value at the significance level of 0.001 for degrees of freedom 9 is 27.877. Thereby, two subjects with Mahalanobis distances higher than the critical value were excluded from the analysis. The final sample included in the impulsive buying models had 347 participants and in the compulsive buying model 342. Concerning multicollinearity, VIF values were lower than 10, and tolerance values higher than 0.20. The highest correlation between independent variables was 0.799 for impulsive buying models and 0.795 for the compulsive buying model.

We also checked the independence of residual assumptions, and the values of the Durbin–Watson statistic for the regression models for impulsive buying tendency ranged from 1.900 to 2.258, and for compulsive buying tendency the value was 0.297. The assumptions of linearity and homoscedasticity were verified by examining whether the residuals' scatterplot resembles the shape of a rectangle and that the residuals were randomly scattered around the zero point and displayed a fairly even distribution. Finally, the normality assumptions were checked by observation of the normal probability plot, in which we confirmed that cases were distributed along a fairly straight diagonal line.

TABLE 1 Hierarchical linear regression analyses predicting the Impulsive Buying Tendency Scale – Total Score.

Predictors	Step 1		Step 2		Step 3	
	β	*t(p)*	*β*	*t(p)*	*β*	*t(p)*
Sex	−0.087	−1.599 (0.111)	−0.076	−1.399 (0.163)	−0.124	−2.425 (0.016)
Age	−0.090	−1.654 (0.099)	−0.076	−1.402 (0.162)	−0.065	−1.278 (0.202)
HADS anxiety			0.133	2.164 (0.031)	−0.006	−0.098 (0.922)
HADS depression			−0.004	−0.058 (0.954)	−0.064	−1.027 (0.305)
YSQ disconnection rejection					−0.045	−0.521 (0.603)
YSQ impaired autonomy performance					−0.063	−0.676 (0.500)
YSQ impaired limits					−0.225	−3.296 (0.001)
YSQ other-directedness					−0.030	−0.453 (0.651)
YSQ overvigilance and inhibition					0.627	6.537 (0.000)
F (df, df $_{error}$)	F (2, 346) = 3.280, p = 0.039		F (4, 346) = 3.162, p = 0.014		F (9, 346) = 9.562, p = 0.000	
R	0.137		0.189		0.451	
R^2	0.019		0.036		0.203	
ΔR^2	0.019		0.017		0.168	

TABLE 2 Hierarchical linear regression analyses predicting the Impulsive Buying Tendency Scale – Affective Domain.

Predictors	Step 1		Step 2		Step 3	
	β	*t(p)*	*β*	*t(p)*	*β*	*t(p)*
Sex	−0.103	−1.910 (0.057)	−0.086	−1.606 (0.109)	−0.134	−2.625 (0.009)
Age	−0.121	−2.243 (0.026)	−0.100	−1.881 (0.061)	−0.095	−1.876 (0.062)
HADS anxiety			0.219	3.626 (0.000)	0.083	1.333 (0.184)
HADS depression			−0.023	−0.385 (0.700)	−0.079	−1.283 (0.200)
YSQ disconnection rejection					−0.057	−0.669 (0.504)
YSQ impaired autonomy performance					−0.135	−1.449 (0.148)
YSQ impaired limits					−0.093	−1.358 (0.175)
YSQ other-directedness					−0.055	−0.832 (0.406)
YSQ overvigilance and inhibition					0.611	6.395 (0.000)
F (df, df $_{error}$)	F (2, 346) = 5.369, p = 0.005		F (4, 346) = 6.718, p = 0.000		F (9, 346) = 9.796, p = 0.000	
R	0.174		0.270		0.455	
R^2	0.030		0.073		0.207	
ΔR^2	0.030		0.043		0.135	

3. Results

3.1. Hierarchical linear regression models for impulsive buying tendency

The results regarding the regression model for Impulsive Buying Tendency Scale – Total Score (IBTS-TS) are presented in Table 1. The model for block 1 was significant, F (2, 346) = 3.280, p = 0.039, as well as the model for block 2, F (4, 346) = 3.162, p = 0.014. HADS – A was a significant predictor (β = 0.133, p = 0.031). In block 3 the model was significant F (9, 346) = 9.562, p < 0.001, and explained 20.3% of the variance on IBTS-TS. Sex (β = −0.124, p = 0.016), impaired limits (β = −0.225, p = 0.001) and overvigilance and inhibition (β = 0.627, p < 0.001) were significant predictors.

The results for IBTS-A are presented in Table 2. The model for block 1 was significant, F (2, 346) = 5.369, p = 0.005, and age was a significant predictor (β = −0.121, p = 0.026). The model for block 2 was also significant, F (4, 346) = 6.718, p < 0.001, and HADS-A was a significant predictor (β = 0.219, p < 0.001). In block 3 (schema domains), there were significant changes in R^2, F (9, 346) = 9.796, p < 0.001, which explained 20.7% of the variance on IBTS-A. Sex (β = −0.134, p = 0.009) and overvigilance and inhibition (β = 0.611, p < 0.001) were significant predictors.

The results of the regression model for IBTS - C are presented in Table 3. Blocks 1 and 2 did not produce a significant model, F (2,

TABLE 3 Hierarchical linear regression analyses predicting the Impulsive Buying Tendency Scale – Cognitive Domain.

Predictors	Step 1		Step 2		Step 3	
	β	*t(p)*	*β*	*t(p)*	*β*	*t(p)*
Sex	−0.049	−0.898 (0.370)	−0.048	−0.863 (0.389)	−0.083	−1.568 (0.118)
Age	−0.037	−0.669 (0.504)	−0.034	−0.606 (0.545)	−0.019	−0.361 (0.719)
HADS anxiety			0.016	0.251 (0.802)	−0.092	−1.423 (0.156)
HADS depression			0.017	0.267 (0.790)	−0.032	−0.501 (0.616)
YSQ disconnection rejection					−0.021	−0.238 (0.812)
YSQ impaired autonomy performance					0.023	0.240 (0.810)
YSQ impaired limits					−0.299	−4.218 (0.000)
YSQ other-directedness					0.002	0.031 (0.976)
YSQ overvigilance and inhibition					0.485	4.870 (0.000)
F (df, df $_{error}$)	F (2, 346) = 0.772, p = 0.463		F (4, 346) = 0.450, p = 0.772		F (9, 346) = 6.133, p = 0.000	
R	0.067		0.072		0.375	
R^2	0.004		0.005		0.141	
ΔR^2	0.004		0.001		0.136	

346) = 0.772, p = 0.463, and F (4, 346) = 0.450, p = 0.772. Block 3 produced a significant model, F (9, 346) = 6.133, p < 0.001, which explained 14.1% of IBTS - C. Impaired limits (β = −0.299, p < 0.001) and overvigilance and inhibition (β = 0.485, p < 0.001) were significant predictors.

3.2. Hierarchical linear regression model for compulsive buying tendency

The results for the RSCP are presented in Table 4. The model related to block 1 was significant, F (2, 341) = 5.796, p = 0.003. Sex was a significant predictor (β = −0.154, p = 0.005). Block 2 also produced a significant model, F (4, 341) = 3.329, p = 0.011, and sex remained a significant predictor (β = −0.146, p = 0.008). On block 3 there were significant changes in R^2, F (9, 341) = 7.552, p < 0.001, which explained 16.2% of the variance in RSCP. Sex (β = −0.194, p = 0.000), impaired limits (β = −0.182, p = 0.010), and overvigilance and inhibition (β = 0.468, p < 0.001) were significant predictors in this model.

4. Discussion

To the best of our knowledge, this is the first study associating early maladaptive schemas with impulsive and compulsive buying tendencies. Overall, we confirm that early maladaptive schemas appear to play an important role in impulsive and compulsive shopping. Furthermore, this association was still significant despite broad domain psychopathology variables such as anxiety and depression.

Schemas are cognitive structures that develop over time in the interaction with the environment, which are installed in our autobiographical memory, and that explain how experiences that occurred in the past influence the processing of new information and its assimilation in the existing belief structure and, consequently, the way in which decisions are usually made (40, 41). In maladaptive schemas, one acts in a dysfunctional way, generating automatic dysfunctional thoughts, as well as unregulated emotional states, which can manifest themselves in different ways (26).

These can be an overwhelming or unregulated sadness, including the feeling of emotional emptiness, loneliness, and the feeling of not being loved; severe anguish, associated with an extreme fear of being abandoned; exaggerated shame; deregulated anger; impulsiveness and lack of control, with difficulty in postponing gratification and inability to predict the consequences of actions; and other dysfunctional emotional manifestations. At the same time, dysfunctional forms of coping can be activated (26, 42–44), such as avoiding situations, suppressing feelings, depersonalization, compulsive commitment to distracting and relief activities, breach of rules, acting without consideration for others, attack and bullying, ceaseless seeking for attention and approval, extravagant behavior, over-perfectionism, manipulation, among many others.

The application of the concept of maladaptive schemas is widely comprehensive and has been used to explain and predict results in conditions as diverse as personality traits and disorders (45–51), emotional regulation and attachment (52–55), suicide risk (56), sexual disorders (57–59), substance abuse (60, 61), and mental disorders (62–66).

Firstly, we found that the domain of the overvigilance and inhibition schema is the main predictor of both impulsive and compulsive buying. This finding that the same maladaptive schema domain is the main influence on both impulsive and compulsive buying reinforces the argument of relative overlap between impulsivity and compulsiveness. From a clinical point of view, it appears to be a relative overlap of endophenotypes in various disorders of the impulsive and compulsive spectrum (Impulsive Compulsive Spectrum Disorders), despite their different characteristics and the distinct manifestations of impulsiveness and compulsiveness. Impulsiveness is the propensity to respond without much thought or the inability to inhibit a response, while compulsion is repetitive, rigid, and perseverative behavior (67–72). This same relative overlap, which is obviously not complete, also seems to happen in the relationship between impulsive and compulsive buying (73, 74).

TABLE 4 Hierarchical linear regression analyses predicting the Richmond Scale for Compulsive Purchasing.

Predictors	Step 1		Step 2		Step 3	
	β	*t(p)*	*β*	*t(p)*	*β*	*t(p)*
Sex	−0.154	−2.833 (0.005)	−0.146	−2.681 (0.008)	−0.194	−3.688 (0.000)
Age	−0.073	−1.341 (0.181)	−0.067	−1.230 (0.220)	−0.066	−1.262 (0.208)
HADS anxiety			0.078	1.267 (0.206)	−0.020	−0.321 (0.749)
HADS depression			−0.018	−0.301 (0.764)	−0.053	−0.836 (0.404)
YSQ disconnection rejection					−0.130	−1.475 (0.141)
YSQ impaired autonomy performance					−0.037	−0.386 (0.699)
YSQ impaired limits					−0.182	−2.592 (0.010)
YSQ other-directedness					0.109	1.588 (0.113)
YSQ overvigilance and inhibition					0.468	4.743 (0.000)
F (df, df $_{error}$)	F (2, 341) = 5.796, p = 0.003		F (4, 341) = 3.329, p = 0.011		F (9, 341) = 7.552, p = 0.000	
R	0.182		0.195		0.402	
R^2	0.033		0.038		0.162	
ΔR^2	0.033		0.005		0.124	

At first glance, our hypothesis proposing an association between overvigilance and inhibition schema with compulsive and impulsive buying may seem counterintuitive. It would be expected that excessive control of spontaneous impulses, avoidance of mistakes, and strict adherence to rules while being hypercritical would prevent these buying behaviors. However, there is evidence showing that people with a predominance of dysfunctional schemas tend to exhibit dysfunctional, immature and compensatory forms of coping (75). In addition, the continuous suppression of emotional expression can prepare a fertile ground for episodes of greater lack of control (76).

Thus, it is possible that the use of buying as a source of obtaining pleasure or without much reflection works as a compensatory mechanism in the case of excessive overvigilance and inhibition schemas. One possibility is that compulsive and impulsive buying behaviors work as a compensatory mechanism for these schemas, which can function as a coping strategy to bring some relief from negative situations or emotions or as a way to obtain satisfaction and reward, particularly triggered by a need to escape from a negative self-awareness (27, 28, 77, 78). In fact, there is evidence that people who shop compulsively have low self-esteem (79). Also, there are positive results from the use of antidepressants in the treatment of people with compulsive buying, which further highlight the potential role of negative emotions in these buying tendencies (80). According to Faber's escape theory (2004), the involvement in immediate and concrete tasks, which is the case of buying, could help to escape from or compensate for painful self-awareness.

In this scenario, the action of these schemas would thus be paradoxical. By directing information processing toward the negative aspects of life and negative emotions and making the person afraid of a negative assessment by others, someone with these schemas would be more vulnerable to situations where obtaining rewards is more immediate or in which they understand that they can find an increased personal appreciation using external objects, as with shopping. Existing evidence shows that compulsive shoppers feel better and have a reduction in negative emotions after making a purchase (37, 81).

Another possible explanation comes from the existing evidence that impulsive and compulsive behaviors, as well as the obsessive–compulsive disorder itself, are often associated with the internalization of perfectionist expectations, the fear of making mistakes, increased responsibility, and high standards (29–31, 82–85). At the same time, a greater materialist appreciation for the signs of wealth and luxury (32), narcissistic traits (86–89), and perfectionism (21, 90) are present in impulsive and compulsive buying.

The cognitive schemas underlying the establishment of excessive patterns, self-depreciation, and high self-criticism are associated with forms of perfectionism (91–94) and even grandiose narcissism (95). Thus, it is possible that a mechanism exists in which the schemas that cause the suppression of positive impulses and the excessive inhibition of emotions (especially negative ones such as anger) contribute to a dysfunctional perfectionism that results in the adoption of behaviors that promote a maladaptive approval and protection of the self, which could be the case in impulsive and compulsive shopping, in addition to other external strategies for regulating negative emotions (e.g., alcohol abuse, overeating).

In addition to our main hypothesis, we have also found evidence of a negative association between impaired limits and impulsive/compulsive buying tendencies. Regarding impulsive buying tendency, we found that the deteriorated limits were associated with the cognitive domain, but not with the affective. The affective processes of impulsive shopping are related to an irresistible urge to buy, to the emotions of pleasure and excitement that one feels when buying, and to the possible guilt after buying. The cognitive domain of impulsive buying concerns whether the purchase is made in a thoughtful, planned, and deliberate way, whether it is only carried out according to needs and whether it is made with a comparison of alternatives (35).

The core beliefs associated with impaired limits are lack of responsibility, avoidance of discomfort, and feelings of superiority. These themes are apparently irreconcilable with the high levels of internalization of expectations and self-criticism that seem to promote impulsive and compulsive buying (21, 90). Thus, a certain degree of relaxation and distraction from responsibilities can provide some

protection against compulsive buying, lack of planning and reflection typical of the cognitive dimension of impulsive buying.

From another perspective, the propensity to shame is an important dispositional risk factor for compulsive buying (96). Interestingly, the propensity for shame is associated with punitive and coercive parenting styles (97–99). The schemas' impaired limits domain is often developed in indulgent and permissive family environments, which, despite being associated with several problems, can provide some protection against the propensity for shame and, consequently, against impulsive and compulsive buying. Despite these explanations, we cannot, however, rule out the possibility that this relationship in the opposite direction could be a multicollinearity statistical artifact.

Finally, sex was a significant variable explaining affective impulsive and compulsive buying, as being a women was a significant predictor in both models, as also indicated by previous evidence (15). Being a female has been found to be a predictor of the affective domain but not the cognitive domain of impulsive buying. This finding supports existing evidence that suggests females may display greater impulsivity due to factors such as being more easily compelled to buy with a strong emotional charge or being more attracted to hedonic purchases (27, 100, 101). Previous studies have examined gender differences in brand commitment, impulse buying, and hedonic consumption, indicating that women may be more prone to engaging in impulsive buying driven by affective factors, such as expressing love for someone close or seeking hedonic experiences (101).

Furthermore, research has identified specific factors contributing to female's impulse buying tendencies. For instance, negative urgency and self-perceived attractiveness have been linked to female's impulse buying behaviors (102). Several studies consistently demonstrate that female are more vulnerable to compulsive buying behavior compared to males. Females score higher on compulsive buying scales, indicating a greater susceptibility to using buying behaviors to regulate emotions and moods (103). Some studies even suggest that female compulsive buyers may resort to excessive buying as a way to cope with stress and negative emotions, while the pleasures and joy experienced in shopping may have a stronger impact on women than males (104, 105).

However, it is important to note that sex differences in compulsive buying are not universally consistent across all studies. Research conducted with adolescent and university student samples in Western countries failed to find significant sex differences in compulsive buying (106, 107). Additionally, a study with German undergraduate students even reported lower levels of compulsive buying among females compared to males (108).

Having this in mind, while females generally exhibit higher levels of brand commitment, hedonic consumption, and impulse buying compared to males, gender differences in compulsive buying behavior are not consistently observed across all studies. Cultural and contextual factors may play a role in shaping these gender differences, and the results presented in this paper reflect the Portuguese reality. Further research is needed to gain a better understanding of the complex interplay between gender, individual traits, and societal influences on buying behaviors.

This study has several limitations. Firstly, the cross-sectional design requires great caution when discussing causality mechanisms. Second, data collection was self-reported, which can increase the effect of social desirability on the responses. Third, the survey was an extensive online form, which may increase the risk of random responses, even though we were careful to insert a control question to reduce this limitation. Fourth, we used a sample of university students, and we had a predominance of female respondents.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Porto's School of Health - Polytechnic University of Porto Ethics Committee (ESS|P.PORTO). The patients/participants provided their written informed consent to participate in this study.

Author contributions

SR: conceptualization. SR, XF, YC, SF, LT, and NR: methodology. SR, CC, SF, LT, and NR: data curation and analysis. XF and YC: supervision. SR, XF, YC, SF, LT, CC, and NR: original draft and review and editing. All authors contributed to the article and approved the submitted version.

Funding

This work is financed by portuguese national funds through FCT - Fundação para a Ciência e Tecnologia, under the project UIDP/05422/2020.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1157710/full#supplementary-material

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frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 21 August 2023
DOI 10.3389/fpsyt.2023.1179257

OPEN ACCESS

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RECEIVED 03 March 2023
ACCEPTED 18 July 2023
PUBLISHED 21 August 2023

CITATION
Aquino SD and Lins S (2023) The personality puzzle: a comprehensive analysis of its impact on three buying behaviors.
Front. Psychiatry 14:1179257.
doi: 10.3389/fpsyt.2023.1179257

The personality puzzle: a comprehensive analysis of its impact on three buying behaviors

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This study aimed at examining the role of personality traits in impulsive buying, compulsive buying, and panic buying simultaneously during the COVID-19 pandemic. At the beginning of the third confinement announced by the Portuguese government, 485 Portuguese answered in this study, mean age of 41.9 years (min = 18, max = 84; SD = 12.9), and 29.9% were men. Analyzes were carried out to investigate the association of Big Five's personality factors with impulsive buying, compulsive buying, and panic buying. Results showed that the three buying behaviors under study have significant and positive correlations between them, and they also correlate with different personality traits. The association of each Big Five factor on buying behaviors differed. While conscientiousness was negatively and openness was positively associated with impulsive buying, conscientiousness was negatively associated with compulsive buying, agreeableness was positively associated with panic buying, and neuroticism correlated positively with all consumer behaviors. Understanding the personality traits that contribute to the development of a disorder may provide valuable insight into preventive measures and effective treatment approaches for some debilitating disorders. This study opens ways for investigating impulsive buying and compulsive buying by relating them to panic buying. It discusses the three different buying behaviors during the COVID-19 pandemic and future consumer research directions involving other variables.

KEYWORDS

Big Five, impulsive buying, compulsive buying, panic buying, consumer psychology, COVID-19, consumer behavior, hoarding behavior

1. Introduction

Factors such as personality traits and individual variables were relevant to investigating and predicting consumer behavior (1–3). The studies of individual differences have provided literature with diverse ways to analyze their effects. The Big Five Model of personality is, probably, the most widely used framework for explaining individual differences in populations and relies on five sharply independent traits (4). The model has also been used extensively in the study of human characteristics that have an impact on purchase behaviors [e.g., (5–12)].

Studies bespeak that personality can be defined by a set of traits that determine psychological predispositions that are stable over time. Such traits are grouped into independent dimensions, according to the Big Five personality factor model (14, 13), namely: Extroversion, which refers to how much people enjoy interpersonal contact and socializing; Conscientiousness, which is the tendency to be disciplined and regimented; Openness to new experiences, which refers to

how much a person appreciates unconventional sensory and intellectual experiences; Agreeableness, which refers to how kind and cooperative a person is; and finally, the Neuroticism factor points to tendencies to demonstrate emotional instability and experience negative feelings (13).

Since these are stable individual traits throughout life and even considering cultural differences, the use of Big Five measurements is necessary for a better understanding of the influence personality traits may have on specific buying behaviors (15, 16). The Big Five model was chosen over other personality models because its widespread acceptance provides a systematic way to measure personality differences at the most basic levels (17). Prior research on consumer psychology has frequently been developed regarding the role of traits [e.g., (18,19)], the effects of hedonic and utilitarian motivation, and subjective norms [e.g., (20–22)], or the role of resources, like time and money (23).

However, individual differences also could predict consumer behavior. Not only attitudes, which are less stable ones, but mainly personality traits may be considered more stable across one's lifespan. In this sense, identifying which personality components are involved with different buying behaviors is a useful way to build a broader understanding of regular purchases and eccentric buying, which occurs and seems to be underrepresented in the literature (15).

Above this, during a disruptive event such as a pandemic, the information overload people receive can contribute to a sense of fearfulness that increases overconsumption and thus the likelihood of product scarcity (24). Critical changes in material conditions arouse gut feelings that influence people's behaviors (25). According to a World Bank Group report (26), the economic outcomes of the COVID-19 pandemic are severe, considering the period from the beginning turning data collection and publications about the first consumer studies during the new coronavirus spread.

During the COVID-19 pandemic, human behavior has been impacted in multiple ways, with consumption one of the most prominent aspects. As a result of the impact of the COVID-19 pandemic, consumers have exhibited a variety of behaviors. According to recent research, the global epidemic of coronavirus disease has provoked psychological distress worldwide, manifesting as pervasive feelings including distress, anxiety, and panic (27, 28). These feelings and emotions may lead to impulsive buying (29, 30), compulsive buying (31); panic buying (32); revenge buying (33).

The uncertainty raised by the health and economic challenges worldwide seems to have affected buying and other decision processes, and these facts push psychological science to understand the role psychological variables play in these behaviors. The COVID-19 pandemic is particularly a challenging environment for advances in areas where findings are not yet definitive.

Covering three different buying behaviors in the same sample during the pandemic could support important findings on personality and shopping and can extend the knowledge about shopping relative to individual tendencies and predispositions (impulsive and compulsive), as well as their relationship to a buying behavior typically impacted by the social context (panic). In this sense, this correlational study aimed to test the role of personality traits on three types of consumer behavior simultaneously (impulsive, compulsive, and panic buying) during the COVID-19 pandemic.

1.1. Impulsive buying

In defining impulse buying, authors tend to emphasize the spontaneity, inconsistency, and emotional state of the individual at the moment of purchase [e.g., (34–36)]. For Rook and Fisher (22), impulsive buying occurs when the consumer makes a spontaneous, unreflected, and immediate purchase. They also emphasize that impulsive buying is dominated by emotional attraction. To explain this behavior, both extrinsic and intrinsic factors could be considered. Among extrinsic factors, there are social visibility, time pressure, and economic availability. The intrinsic ones are, for example, impulsiveness and personality factors, such as neuroticism, extraversion, and conscientiousness (15, 35, 38).

Impulsiveness is considered a basic human trait (22). Therefore, buying impulsiveness should be an individual difference to be considered in studies preoccupied with understanding purchasing behavior during times of crisis (39). Impulsive buying is common among healthy individuals and reflects individual needs and differences related or not to the information to which they have access (40).

Several researchers have found associations between the Big Five personality factors and impulsive buying. Openness explains impulsive buying behavior (41), as do extraversion, achievement, and neuroticism (42). Conscientiousness negatively predicts impulsive buying, and it is also related to other individual personality factors, explained by extraversion or conscientiousness (1, 43). Specifically, neuroticism is the one that recursively comes out as the Big Five factor that is the most significant predictor of impulsive buying tendency (1, 41, 42, 44, 45). Finding new associations between neuroticism and buying behaviors may shed light on the nature of the vulnerability that high neuroticism elicits.

It is known that there are studies with results similar to each other, and others that do not corroborate previous research about the Big Five and buying behaviors. Thus, findings on personality and shopping are still not unanimous since they do not always associate with the same behaviors and are not always in the same direction. Not being consensual, it is crucial to investigate which factor influences more, or less, certain tendencies in diverse contexts.

Considering that impulsive buying is characterized by the urge to buy and stimulated by the affective state, this type of purchase behavior could sometimes surroundings on Compulsive buying–and both are consumer escapism behavior. Impulsive buying may be a signal for loss of self-control and falling into shopping addiction, so, in this aspect, it can predict compulsive buying (23, 46).

Sometimes, impulse buying looks like a synonym for compulsive buying, but it is all-important to distinguish warily these concepts. As seen, the impulse to purchase may be a simple habitual way by anyone, and a low or strong individual tendency. Distinctively, compulsive buying is chronic, and its key characteristics are a repetitive and uncontrollable desire to buy, always preceded by and resulting in negative feelings.

1.2. Compulsive buying (Oniomania)

Negative emotions lead to the tendency toward compulsive buying (48). When Sneath et al. (49) explored the relationship between consumer emotions and compulsive buying, they found a positive

correlation between negative emotions and compulsive buying behavior. Thus, while the typical impulse buyer makes occasional spontaneous, unplanned purchases driven, most of the time, by a positive mood, compulsive buyers may employ impulsiveness and obsessive buying behaviors to cope with and alleviate their undesirable negative emotions like depression or sad feelings (50, 51). Compulsive buying is characterized by excessive shopping and buying ideas that produce distress and damage, including hard-to-control impulsivity (52). Moreover, it is essential to note that compulsive buying-shopping disorder is considered a mental disorder ICD-11 (as are other specified impulse control disorders, 6C7Y).

Evidence has demonstrated that compulsive buying may be a way of compensating for negative emotions (53), which may partially explain excessive consumption during highly uncertain social, economic, or sanitary events and the rise of general anxiety related to them. Despite sharing common traits with impulsive buying, compulsive buying may be considered rather abnormal conduct and is associated with stockpiling behaviors, characterized by the accumulation of goods and the avoidance to abandon unessential ones (54).

Recent studies have found personality factors correlated with this pathological buying behavior (11, 55, 56). Previous studies also reported moderate to high genetic correlations between neuroticism and obsessive–compulsive symptoms (Bergin et al., 2014; Taylor et al., 2011). For explaining compulsive buying, agreeableness, neuroticism, and openness are personality factors that demonstrated significant predictive power. Moreover, impulsive buying plays a mediating role in this relationship (41, 57).

The diversity of cultural contexts in which personality traits have been demonstrated to be relevant to explaining purchasing behaviors makes it reasonable to consider them as timely variables to be investigated. Understanding these variables simultaneously and not in isolation can provide a wide overview of the relationships found so far, broadening findings involving personality and three different purchase behaviors in the same context.

Compulsive buying behavior is cyclical and pathological, characterized by a repetitive and uncontrollable desire to buy, leading to negative feelings such as regret and guilt (47). This is a type of consumer behavior potentially surrounded by negative feelings, as with panic buying, for example. However, panic buying is characterized by other specific negative feelings, such as fear and panic, whose consequence is to buy beyond what is usually bought (39).

1.3. Panic buying

Panic buying occurs when fear and panic influence behavior, leading people to buy more items than usual (39). In previous events and during the COVID-19 pandemic, feelings of fear have been shown to elicit specific consumer behavior patterns, broadly known as panic buying, which is also related to impulsive buying (39).

Both impulsive buying and personality traits are individual differences shown to exert influence on distinct purchasing behaviors, a pattern that has been replicated with samples from different countries and during diverse major events (15, 35, 38, 41, 57). Therefore, evidence from different countries is a valuable contribution to the understanding of these phenomena.

There are other important individual differences in panic buying, like trust in government and money attitudes (15, 35). Consistent with what has been found in other cultures, levels of trust and the willingness to seek information also play a role in explaining panic buying behavior (38, 58). However, studies investigating panic buying and the Big Five are still scarce.

If personality factors may have a significant effect on consumer emotions (59), neuroticism maybe has the most significant one (60). It is generally agreed that neuroticism is the tendency to experience negative emotions such as anxiety, fear, sadness, anger, irritability, loneliness, worry, dissatisfaction, and vulnerability and that this factor is both a response to and a cause of various types of stress and diseases (61–65).

An abundance of studies indicates that neuroticism scores predict stress, psychological distress, emotional disturbance, low subjective well-being, symptoms related to physical tension, and substance abuse. Neuroticism is correlated with most depressive disorders, insomnia, schizophrenia, attention-deficit/hyperactivity disorder, anxiety, bipolar disorder, obsessive–compulsive disorder, and even cardiovascular disease (66–73). High levels of neuroticism reflect similarly high levels of stress that a person regularly experiences. So, individuals tend to behave according to a negativity bias (74) and, during the pandemic, this tendency is often associated with neuroticism scores has shown an insignificant reliance on the valence of the received information (75).

In this sense, when levels of fear, anxiety, panic, and social influence are not maintained to a given level, they may not be beneficial for consumers (76). Depression and stress were predictors of excessive shopping as a coping strategy. Excessive shopping functions as a coping strategy in times of danger, as a way for individuals to protect themselves, reduce anxiety, and alleviate negative feelings (77, 78). An exploratory analysis showed that stockpiling was associated with high scores on extraversion and neuroticism, but with low scores on conscientiousness and openness to experience (35). Behaviors such as hoarding, for example, may occur under other conditions or may be one of the symptoms of different pathologies (79). Moreover, anxiety and stress can also be a precursor to panic buying (77).

As pointed out by the literature, all three types of buying behavior have a strong emotional root. The connection between the affects and impulse buying, compulsive buying, and panic buying is signaled by most studies on each of these themes (see Table 1).

Apparently, what differentiates them is whether it is commonplace behavior, casual and more impacted by positive affects (impulsive buying), whether it is a pathological and uncontrollable behavior that brings negative consequences (compulsive buying), or whether it is behavior driven mainly by challenging and disruptive events (panic buying). These aspects have relevance to the study of consumer psychology involving personality in impulsive buying, compulsive buying, and panic buying.

2. Study design

This correlational study aimed to test the role of personality traits on different buying behaviors (impulsive, compulsive, and panic buying) during the COVID-19 pandemic in a convenience Portuguese sample.

TABLE 1 Overlaps and differences between the three buying behaviors.

	Impulsive	Compulsive	Panic
Predictive emotions involved	Negative or positive (80, 81)	Negative (e.g., guilt, depression) (53, 82)	Negative (fear, uncertainty) (39, 83)
Trigger	The product (22, 84)	The behavior (54, 86)	The crisis context (39, 85)
Frequency	Occasionally (86)	Cyclical (47, 87)	Disruptive events (39)
Behavior assortment	Ordinary (86)	Pathological (54, 86)	Self-protection (88, 89)
Big Five traits associated with	Openness (41), Extraversion (42), Conscientiousness (1), Neuroticism (42)	Openness, Agreeableness, Neuroticism (11, 56)	Neuroticism (35)

3. Method

3.1. Participants

In this study, there were 485 Portuguese participants, with a mean age of 41.9 years (min = 18, max = 84; SD = 12.9), 29.9% being men. The sample included people from all social classes, with 1.6% of the respondents self-reporting as lower class; 14.8% lower middle class; 65.2 middle class; 17.5% upper-middle class, and 0.8% upper class. Of the total participants, 0.6% reported primary education, 4.9% basic education, 36.1% secondary education, 41% undergraduate, 15.5% master's, and 1.9% doctorate.

3.2. Instruments

An online questionnaire was used, available on the Internet. Upon agreeing to answer the survey, the participants were directed to the questionnaire that contained sociodemographic questions (gender, age, education, perceived social class). In addition to these questions, there were psychometric scales to access the Big Five, impulsive buying, compulsive buying, and panic buying to follow:

3.2.1. Mini-IPIP five-factor model personality

Participants' personality traits were measured by the Portuguese version of the Mini-IPIP [(90), adapted for European Portuguese version by Oliveira (16)]. This 20 items version aims to assess the five dimensions of personality briefly using four items for each factor. All items could be answered using a seven-point Likert-type scale, measured from 1 (totally disagree) to 7 (totally agree). Items use specific questions regarding Extraversion ($\alpha = 0.60$; $\omega = 0.61$), Agreeableness ($\alpha = 0.67$; $\omega = 0.68$), Conscientiousness ($\alpha = 0.56$; $\omega = 0.58$), Neuroticism ($\alpha = 0.61$; $\omega = 0.61$), and Openness ($\alpha = 0.62$; $\omega = 0.64$).

3.2.2. Buying impulsiveness scale

It used a shortened version of the Rook and Fisher scale (22), adapted to the Portuguese context by Lins et al. (91), with four items ("Just do it" describes the way I buy things; I often buy things without thinking; "I see it, I buy it" describes me; Buy now, think about it later describes me; $\alpha = 0.88$; $\omega = 0.88$). The scale was measured from 1 (totally disagree) to 7 (totally agree).

3.2.3. Compulsive buying scale

The Brazilian version was adjusted to European Portuguese [Faber and O'Guinn (92) version adapted for a Brazilian Portuguese version by Leite et al. (93)], two native speakers to improve the understanding. To measure shopping compulsivity, a seven-item unidimensional scale measured from 1 (totally disagree) to 7 (totally agree) was used. The items represent behaviors, motivations, and feelings associated with compulsive buying (e.g., Felt anxious or nervous on days I did not go shopping; Felt others would be horrified if they knew of my spending habits; $\alpha = 0.67$; $\omega = 0.74$).

3.2.4. Panic buying scale- PBS

The original PBS is in Brazilian Portuguese (39) and was adjusted to European Portuguese by two native speakers to improve their understanding. A seven-item unifactorial scale was applied. There was the following instruction "During the current outbreak of the COVID-19 pandemic, how would you describe your buying behavior?." For each statement, participants indicated a degree of disagreement or agreement considering recent behavior during the coronavirus pandemic, with 1 = strongly disagree and 7 = strongly agree (e.g., Fear drives me to buy more than I usually do; Panic makes me buy more things than I usually do; $\alpha = 0.93$; $\omega = 0.94$).

It is necessary to observe that the α and ω presented refer to the current data. Additionally, the score for the three types of consumer behavior was calculated using the average of the items, and higher scores indicate high levels of impulsive, compulsive, and panic buying.

3.3. Data collection and analysis

Participants were recruited by invitations on social networks. In terms of disclosure, this was done through social networks, specifically Facebook, Instagram, and WhatsApp. The snowball sampling method was used, in which participants are asked to share this questionnaire with other individuals who fall within the target population of the study (94, 95). The invitations explained the research and provided the link to access the questionnaire. On the first page of the questionnaire, an Informed Consent Form was available, complying with all the guidelines and standards regulating research involving human subjects in Portugal.

The questionnaires were administered between November 9th and November 30th, 2020, coinciding with the beginning of the third state of emergency decreed to contain the advance of the COVID-19 pandemic. During this period, Portugal adopted strict social measures,

such as bans on driving on public roads at certain times and on certain days. In addition to banning driving on public roads between 11 p.m. and 5 a.m. on weekdays and 1 p.m. on weekends, the state of emergency included several measures to combat the pandemic, such as taking body temperature in public places such as workplaces, transportation, and commercial facilities, and requiring diagnostic testing for COVID-19 in certain situations.

In total, the research received 534 responses, but only fully completed questionnaires were used ($n = 485$). The sample size was calculated according to Dancey and Reidy (96) and Green (97) $\geq 104 + M$, where M represents the number of predictors. The appropriate number of participants was based on the psychometric literature, which recommends a minimum of 10 respondents per item for acceptable analysis (98, 99). Thus, the sample size of this study exceeds the minimum recommended in the literature ($N = 124$ or $N = 380$).

Pearson's r correlation analysis was performed to verify correlations between personality factors and buying behaviors. A Student's t-test for independent samples was performed to investigate the extent to which the levels of each buying behavior differed between women and men. Bootstrapping procedures (1,000 resampling, 95% IC BCa) were performed to increase the reliability of the results, to correct for deviations from normality in the sample distribution and differences in the size of the groups, and to provide a 95% confidence interval for differences between means. Multiple linear regression analyzes (*Enter* method) tested the predictive power of the Big Five on the studied behaviors.

TABLE 2 Descriptive statistics.

	n	%
Gender		
Men	145	29.9
Women	340	70.1
Social class		
Lower	8	1.6
Lower middle	72	14.8
Middle	316	65.2
Upper middle	85	17.5
Upper	4	0.8
Education level		
Primary	3	0.6
Basic	24	4.9
Secondary	175	36.1
Undergraduate	199	41.0
Master's degree	75	15.5
Ph.D.	9	1.9
	Mean	**SD**
Age (min = 18, max = 84)	41.9	12.9
Impulsive buying	1.75	1.12
Compulsive buying	2.04	0.87
Panic buying	2.16	1.32
Extraversion	3.87	1.17
Agreeableness	5.09	0.97
Conscientiousness	5.17	0.96
Neuroticism	4.13	1.15
Openness	4.42	0.73

$N = 485$.

4. Results

The sample for the present study comprised 485 Portuguese who replied to all questions and all instruments. Sample characteristics are presented in Table 2.

Initially, correlations were assessed between the five major personality factors and the three buying behaviors, as presented in Table 3. The highest negative correlation was found between conscientiousness and impulsive buying $r\ (485) = -0.18$, $p < 0.01$; while the highest positive correlation was found between neuroticism and panic buying $r\ (485) = 0.16$, $p < 0.01$.

A Student's t-test for independent samples was used to determine the extent to which the levels of each purchase behavior differed between women and men. The results showed no significant differences in the scores between the genders (see Table 4).

A multiple linear regression analysis (*Enter* method) was conducted to investigate which five major personality factors (extroversion, agreeableness, conscientiousness, neuroticism, and openness) impacted buying behaviors. Thus, the results show that there is a significant predictive power of some personality factors on distinct buying behaviors.

While less conscientiousness and less openness predict more impulsive buying and less conscientiousness predicts more compulsive buying, less agreeableness predicts more panic buying. In a different direction, a higher neuroticism factor positively predicts all the buying behaviors in this study.

Finally, the sociodemographic characteristics were included in the regression model with the Big Five factors. Specifically, to test the effect of gender on buying behavior, as the literature reports gender differences in impulsive buying [e.g., (1, 100)], compulsive buying (101), and panic buying (39). Additional demographic variables were also examined. Some correlations between the Big Five factors and purchase behavior remain significant after controlling for demographic variables. The regression coefficients of all predictors are shown in Table 5.

5. Discussion

Personality tends to be stable in a variety of situations (14). In a state of emergency context, the role of the Big Five factors was tested to discern how they were associated with impulsive buying, compulsive buying, and panic buying. By testing the relations between personality factors and three different buying behaviors simultaneously during the COVID-19 pandemic, this study combines a perspective on personality traits and their associations with impulsive buying, compulsive buying, and panic buying in the same sample. Personality is a major determinant of consistent behavioral patterns and can interfere with various everyday situations (102, 104), and the present study indicates significant correlations between some Big Five traits

and different shopping behaviors. The pandemic situation deserves highlighted just because it is a context of exceptional destabilization, not only locally but worldwide at the same time: This is a study realized during a distinct contingency.

First, regarding impulse buying, the correlations found corroborate the literature, indicating that the greater the conscientiousness–and thus the sense of responsibility and planning–the lower the individual's tendency to buy impulsively. Similarly, the tendency to impulse buy increases as neuroticism and openness are also greater, according to previous studies (15, 45, 105). Both reactivity and emotional instability, as well as being more open-minded, imaginative, and curious, make people more prone to impulsive buying behavior.

On compulsive buying, the correlations found in this study were similar to the same personality factors correlated with impulsive buying. Oniomania tends to be higher as people are more cultured or artistically sensitive [characteristics of the openness factor (90)], and as the level of experiencing negative feelings such as anxiety and depression more strongly identified in those with higher averages of neuroticism (106, 107) is also higher. Conversely, individuals who had higher averages in conscientiousness were more likely to exhibit less compulsive buying behaviors. These results indicate that while characteristics related to intellectual and emotional sensitivity are linked to uncontrolled buying behaviors, the ability to balance planning and goal focus distances individuals from compulsive shopping.

As for panic buying, is fundamental to discuss first its correlation with impulsive buying and compulsive buying, even though both behaviors have been examined in several previous studies. Those behaviors so widely studied in other contexts have similarities, emphasized, for example, by the affects that impact each of the buying behaviors presented.

In this way, the positive correlations found between impulsive buying, compulsive buying, and panic buying showed that both individuals who tend to buy impulsively and those who are more compulsive tend to engage more in panic behaviors while shopping. We presume that anxiety about feeling in control during an unstable circumstance is also related to poor emotional regulation of unplanned purchases and to negative feelings that lead to compulsivity. These associations deserve special awareness since panic buying was a specific focal point during the COVID-19 pandemic, which provoked countless feelings of insecurity, anxiety, and fear (108–111).

More on panic buying, it also correlates positively with the neuroticism factor. It is known that individuals with higher averages in this personality factor tend to experience greater emotional instability (112, 113), which may make them more prone to feelings of insecurity and fear (116). Panic buying is preceded by fear (39), and this behavior is related to an individual's emotional instability (114).

An apparently intriguing result is the negative correlation between panic buying with extroversion. It is presumed that this propensity to seek stimulation in interaction with others and to be active is lower when panic buying tendency increases because, to some degree, the social interactions of extroverted individuals may serve the function of appeasing the anxiety and fear driving panic buying. Even with the physical detachment imposed by the COVID-19 pandemic, it is reasonable to conjecture those individuals who seek energy in the presence of other people find ways of interacting that are sufficient to provide some armor that exempts them from engaging in panic buying.

TABLE 3 Correlations between variables.

	M	SD	1	2	3	4	5	6	7	8	9
1. Impulsive buying	1.75	1.12									
2. Compulsive buying	2.04	0.87	0.54**								
3. Panic buying	2.16	1.32	0.34**	0.33**							
4. Extraversion	3.87	1.17	0.02	−0.03	−0.11*						
5. Agreeableness	5.09	0.97	−0.02	0.05	−0.05	0.13**					
6. Conscientiousness	5.17	0.96	−0.18**	−0.16**	−0.08	0.05	0.05				
7. Neuroticism	4.13	1.15	0.09*	0.15**	0.16**	−0.10*	0.47**	−0.17**			
8. Openness	4.42	0.73	0.13**	0.09*	0.03	0.05	0.11*	−0.08	0.07		
9. Age	41.9	12.9	−0.05	−0.04	0.13**	−0.09	−0.08	0.15**	−0.14**	−0.37	
10. Perceived social class	3.01	0.65	0.07	0.00	0.10*	0.00	12*	−15**	0.00	0.10*	0.24**

$N = 485$. $^{**}p < 0.01$; $^{*}p < 0.05$.

TABLE 4 Mean differences in buying behaviors between women and men.

Variables	Women $n = 340$		Men $n = 145$		t-test	p value	Cohen's d
	M	SD	M	SD			
Impulsive buying	1.71	1.05	1.83	1.27	$t(483) = -1.02$	0.154	−0.10
Compulsive buying	2.02	0.85	2.07	0.92	$t(483) = -0.52$	0.301	−0.05
Panic buying	2.20	1.34	2.05	1.24	$t(483) = 1.12$	0.116	0.12

TABLE 5 The predictive power of the Big Five factor on three different buying behaviors.

	Impulsive buying						Compulsive buying						Panic buying					
	b	*t*	Sig.	CI 95%		VIF	*b*	*t*	Sig.	CI 95%		VIF	*b*	*t*	Sig.	CI 95%		VIF
(Constant)	-	2.13	0.475	0.10	2.34			3.96	<0.001	0.89	2.65		-	2.19	0.029	0.15	2.75	
Extraversion	0.03	0.71	0.166	−0.05	0.12	1.07	−0.02	−0.39	0.696	−0.08	0.05	1.07	−0.07	1.56	0.120	−0.18	0.02	1.07
Agreeableness	−0.07	−1,39	0.001	−0.20	0.04	1,40	−0.01	−0.08	0.939	−0.10	0.09	1.40	−0.16	−3.05	0.002	−0.35	−0.08	1.40
Conscientiousness	−0.15	−3,22	0.023	−0.28	−0.07	1,09	−0.13	2.83	0.005	−0.20	−0.04	1.09	−0.07	−1.50	0.135	−0.22	0.03	1.09
Neuroticism	0.12	2,28	0.011	0.02	0.22	1,46	0.14	2.59	0.010	0.03	0.19	1.46	0.24	4.45	<0.001	0.15	0.39	1.46
Openness	0.11	2,54	0.385	0.04	0.31	1,02	0.07	1.57	0.120	−0.02	0.19	1.02	0.03	0.73	0.467	−0.10	0.21	1.02
Age	−0.04	−0.87	0.475	−0.01	0.00	1,13	−0.01	−0.30	0.764	−0.01	0.01	1.13	0.13	2.84	0.005	0.00	0.02	1.13
Gender	0.05	1,14	0.257	−0.10	0.36	1.12	0.05	1.09	0.278	−0.08	0.27	1.12	−0.07	1.48	0.142	0.06	0.07	1.12
Perceived social class	0.11	2.42	0.016	0.04	0.35	1.10	0.04	0.78	0.434	−0.07	0.17	1.10	0.12	2.60	0.010	−0.46	0.42	1.10
R^2			0.07					0.05							0.09			
ΔR^2			0.05					0.04							0.08			
Cohen's f2			0.03					0.02							0.03			
F (6,478)			4.25**					3.63**							6.03**			

$N = 485$. **$p < 0.001$.

But why would various forms of interaction with people protect them from eventual panic buying? Notably, extroversion is a characteristic, among other things, of people who enjoy social interaction (103, 104), and consequently, may be involved by blown-up strong connections and social support. Understanding that highly extroverted people more often participate in interactive and group events (115, 117), these characteristics shield such people from loneliness. A study found consumers with elevated levels of anxiety and loneliness have gotten involved in panic buying behavior during the COVID-19 pandemic (118). Thus, it is conceivable that the possible absence of loneliness in extroverts is related to the absence of anxiety and fear that would lead to panic buying. In this sense, the social interactions and high communication skills of outgoing people may provide more stability in experiencing the negative feelings that lead to panic buying. On the other hand, it cannot be assumed that people lower in the extraversion factor are compulsorily lonelier because other individual characteristics can suppress the anxiety of social isolation.

Similarly, panic buying was the only purchase behavior correlated with participants' age. Unlike the original study that developed the panic buying scale (39), in the present study the older the individuals, the more likely they were to engage in panic buying. This is another result that is thought-provoking from a theoretical point of view and justifies being highlighted. The Big Five literature consistently indicates that emotional instability tends to decrease as people age (119–123), which was not supported by the found correlations in the present study. Thus, the fact that panic buying is more prevalent among older individuals may indicate that this consumer behavior is related both to circumstances or perceptions of current events and to the emotional instability characteristic of people high on the neuroticism factor.

The relatively high correlation between impulsive and compulsive buying deserves discussion. There may be an overlap between some characteristics of impulsive and compulsive buying, especially regarding conceptualization and observable behaviors. However, in the present study, the differential measurement was between the extent to which consumers' buying behavior is repetitive (characteristic of compulsive buying only) or lacks impulse control (characteristic of both impulsive and compulsive buying). Some of the items on both measures may reflect the underlying tendency of consumers to be impulsive, and this may explain the higher correlation found. Lack of impulse control is an undeniable characteristic of the tendency to buy impulsively (22, 124) which may predict compulsive buying disorder (52). Thus, both behaviors are subject to similar antecedents, such as irresistible impulses to buy (23, 46).

Acknowledging some conceptual overlap, it is argued that impulsive buying may involve this uncontrollable urge to buy only once, without necessarily causing distress, while compulsive buying is a repetitive condition that interferes with personal functioning and is considered a spectrum of OCD. Other than that, it is possible to consider both impulse buying and compulsive buying are part of the same continuum and are subject to the same antecedents (101, 125). Nonetheless, each behavior is distinct from the other, and this distinction is well documented in the literature (see Table 1). Although there are certain conceptual overlaps, not everyone exhibits all three buying behaviors. Compulsive buyers, for example, may be highly impulsive and highly involved in panic buying, but not every impulsive buyer must be compulsive.

From the correlations found with the Big Five, regressions indicated the association of some personality factors on each investigated buying behavior. The models presented that personality factors predicted 5% of impulsive buying, 4% of compulsive behavior and 8% of panic buying, with some factors differing for each type of purchase. Consumer behavior is known to be multifaceted, resulting from both internal and external factors, from multiple reasons and contingencies (126–129).

So, only personality factors do not fully explain buying behavior, but they can reveal tendencies and patterns. At this point, it is essential to mention that similar studies also found low explained variance or even no impact of the Big Five factors on buying behaviors [e.g., (11, 12)]. In this sense, the current findings both corroborate previous research and add a new perspective.

Impulsive buying was predicted by openness and conscientiousness (beyond neuroticism). The positive predictive power of the openness factor can be understood by the fact that momentary impulsive buying stimuli should be more irresistible to these people who like to try new things (90). On the other hand, the negative predictive power of conscientiousness is explained by the fact that people with high averages in this factor are also more self-controlled (90) and, therefore, less likely to buy thoughtlessly. This same characteristic of people higher in conscientiousness explains the negative prediction power of this factor on compulsive buying. Consequently, if individuals with higher self-control in task performance are more disciplined and organized (90), they are likely to be "protected" from compulsive buying tendencies.

Engaging in panic buying was negatively predicted by agreeableness. This result may indicate that people with a greater tendency to show empathy, altruism, and pro-social behaviors will not tend to be gripped by the fear that drives people to buy more things than usual. Although the pandemic context is overly disruptive for everyone, the negative feelings of uncertainty do not impact people with higher mean scores of agreeableness, perhaps because these people avoid stockpiling by imagining that their excessive consumption could lead to an unnecessary shortage of products and cause a scarcity of items for their peers and their communities. Studies using an experimental approach could deeply investigate these causes in the future.

We identified that high levels of vulnerability, stress, and sensitivity predicted all of the different consumer behaviors tested. High averages of neuroticism were positive predictors of shopping compulsion, which is likely to be enhanced by frequent negative emotion stages that intervene with reasoning and decision-making ability (130). In the case of panic buying, neuroticism also was a positive predictor, strongly indicating how emotional instability and anxiety drive fear and panic that lead to excessive and dysfunctional shopping during challenging events.

The neuroticism factor is like a joker in big five's literature, a wild card in the deck of behaviors associated with emotions. In response to various types of stress, individuals tend to experience negative emotions such as anxiety, fear, sadness, anger, guilt, disgust, irritability, loneliness, concern, self-consciousness, discontent, hostility, shame, reduced confidence, and feelings of vulnerability, and to engage in situations that promote negative affect (62, 131).

A growing body of evidence suggests that neuroticism has a profound impact on mental health (65, 132–138), as high levels of neuroticism reflect similarly high levels of distress and stress that an individual experiences on a regular basis. Thus, while neuroticism is associated with a variety of disorders, we propose that the same may be true for unusual shopping behavior. An individual's propensity to shop may indicate that he or she has a co-occurring disorder or other difficulties with his or her mental and psychological health. Observing this may tell us as much about who we are as it does about how we shop.

Among the commonly used reliability statistics, Cronbach's alpha has been the most frequently cited in the literature. However, consistent studies reveal that tau-equivalence is often violated (139–141). To overcome these limitations, psychometrists recommend using McDonald's Omega (142) as the best index of internal consistency compared to other reliability indices (143–146). Accordingly, the present study presents both indices, emphasizing that McDonald's omega is more suitable for evaluation (139, 147).

Here, it is necessary to briefly discuss some scale indices. Brief assessment measures are helpful for researchers who are faced with limited assessment time (148, 150), but this imposes some measurement challenges. The present study used instruments that are commonly used in the professional literature. Despite their convenience, such brief measures can be criticized for their psychometric quality, especially problems with low reliability (148), which is a real challenge for personality scales, for example, the BFI-10 (146, 149).

In the case of PIP, previous studies have already reported that the trait of conscientiousness has lower reliability compared to other traits (16, 151). This was also observed by Cooper et al. (152), who presented conscientiousness with indices $\alpha = 0.67$, and by Wielkiewicz (151), whose Conscientiousness factor reached α. = 0.64. Also, in adapting the instrument to European Portuguese, the trait showed low values ($\alpha = 0.67$) (16). These results are consistent with the results of this study, in which the trait of conscientiousness had a reliability of 0.57. However, we reiterate that although the alpha values appear unsatisfactory at first glance, it is worth noting that for social science constructs in general, only alphas below 0.50 are considered unacceptable (153). Therefore, it is understood that the results obtained are consistent but should be interpreted with caution (154).

Purchasing goods to a given satisficing threshold, which may vary from individual to individual according to the above-discussed factors, is a way to cope with uncertainty (155, 156). Thus, some kinds of buying behaviors, especially panic buying, may have compensatory roles in human functioning.

Personality is an important variable in the analysis of consumer behavior. The results of the present study, conducted in the context of the pandemic, suggest that other potential individual drivers deserve attention from psychological science. Despite the robustness of previous studies not only of consumer behavior but also of human decisions under uncertain circumstances, the factors that influence purchase and its possible consequences must be further explored, more specifically other individual traits, like impulsive buying tendency (in the present study showed a strong correlation with compulsive and panic buying). Although individual differences contribute to advancing the understanding of buying behaviors, identifying which behavioral variables and habits precede consumption trends and choices in different contexts is also a challenge for psychology.

This research does not ignore additional confounding factors that may influence purchasing behavior. For example, in the present study, we tested age, gender, and perceived social class. Age is not only correlated with panic buying but is also a predictor of it. It is assumed that people naturally take on more household and family responsibilities as they age. Therefore, the tendency to buy more than usual to guarantee high stock levels may have been a way that grown-ups to minimize other insecurities, uncertainties, and the instability of the pandemic scenario (157).

From a socioeconomic point of view, in addition to the changes in daily life, access to information was considered a prominent role (158). The quality of received information and access to data is also linked to social, educational, and economic issues (108). It is conceivable to speculate that the troubled collection data period could have increased panic buying behavior among those who stayed more connected to information that impact emotions–such as the higher social classes.

Considering that panic buying is influenced by fear and the perception of a lack of control over the future (25), this circumstance may have contributed to the growth in feelings of fear and uncertainty. Finally, although the literature has reported gender differences in impulsive buying (1, 100), compulsive buying (101), and panic buying (39), the present study did not confirm these findings.

It should be noted that learning about shopping behavior is as relevant to psychology as it is to management, public policy, and psychiatry. Critical changes in disruptive conditions tend to arouse gut feelings that influence people's behaviors (25). This is especially true because shopping tendencies can wax and wane in intensity over time, leading to varying prevalence rates among people. Moreover, in many countries, there is insufficient awareness of buying behaviors because conclusions about human behavior are based primarily on observations from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) samples, particularly from the United States (159–161). Intending to increase knowledge about various aspects of the disorder, the present study is important to increase the conceptualization and study of buying tendencies in populations other than WEIRD samples.

This study, however, was not without its limitations. First, there are limitations regarding context and sample characterization. There is not much control over this. This study's limitations are the overrepresentation of women and people with higher education from a specific European country. At the same time, although one of the strengths of this study is the data collection during the COVID-19 pandemic, the social desirability bias for answers about making extra purchases, even stronger in times of crisis, cannot be ruled out.

Additionally, the present findings should consider other limitations. We highlight that one of them was to disregard other individual variables such as hedonic motivations, affects, or mood, whose association challenges in-depth studies on consumption, even more so when these purchase behaviors are essentially linked to emotions –such as impulsive buying, the compulsive buying, and the panic buying. Beyond this, the analysis of these phenomena would acquire strength if evaluated also with other psychological factors such as fear or social support. Another limitation was not considering online shopping habits and behaviors, which could extend our understanding of how social media use had affected consumer anxiety and consequently internet responses, where online shopping channels received great attention and greater demands during the COVID-19 pandemic [e.g., (162)].

Presumably, situational, and social variables also may impact a shift in consumer behavior, along with basic individual dispositions. The Big Five perspective is a personality trait model that has a high degree of consensus and stability, encompassing observable, environmental, and biological variables (104). Even though the literature has provided consistent evidence for the organization of personality through the Big Five (163), exclusively adopting a structural model of personality may limit studies of purchase behaviors. Other personality measurement models [e.g., (164, 165)] could enable or collaborate with further studies in Consumer Psychology. Thus, future investigations of individual differences in purchase behavior may incorporate other personality trait models–like HEXACO (164) or 3M (165) more theoretically related to consumption, reflecting stable dispositions, but in a specific way to contexts of purchasing products or services. Future studies could also specify the clusters formed by the psychological variables based on personality models. Cluster analysis must be relevant to classify people into narrow profiles, identifying subgroups or prototypes among buyer behaviors based on their demographic characteristics, habits, and preferences.

Finally, it ought to be warned that the COVID-19 pandemic had a powerful impact worldwide. It should not be overlooked or ignored, that the fear of unknown circumstances caused substantial changes in the lives and behaviors of individuals (158), and society's daily life changed throughout this period, triggering changes also in consumer habits (25). Cases of panic buying, excessive stockpiling, and revenge buying were reported worldwide and were not rare (166–169). The pandemic period implied a noticeable change in shopping habits around the world.

Notwithstanding the conceptual overlaps and differences, buying behaviors could be compensatory and maybe can function as a kind of coping strategy for alleviating the negative feelings caused by the COVID-19 pandemic. Fear–a powerful engine of human behavior, especially in times of crisis like the pandemic–also leads people to hoard goods and products, buying more items than they usually would (39). It is always important to note that hoarding behavior may occur under other conditions or may be a symptom of other pathologies (79).

Studies are addressing only one or two types of purchasing separately, and many of the findings are not consensual and have not been tested extensively in periods of global health and social crisis. Although corroborating previous findings, the present study is relevant also because it was carried out in a European sample. This differentiates it from most similar studies since these were mostly performed with Anglo-Saxon samples. Furthermore, the current study presents the triad behavior of consumers during a disruptive situation, which confirms the role of neuroticism as a wild card in consumer behavior.

In addition to the cited suggestions for further research, the broader implication of this study is to raise possible strategies to reduce dysfunctional buying behaviors. First, impulse buying needs that people be aware of the stimuli in the environment and their impulsivity so that this behavior does not cause any future damage. Pathological compulsive buying and panic buying need to be addressed by provoking the importance of self-awareness about people's personality traits, preferences, and emotions.

This knowledge would give individuals some protection against compulsive and panic buying behavior. For example, even if different personality traits can respond to stress in many ways, it is known that people with high neuroticism deserve special attention from mental health professionals because of the impact of this personality trait on buying behaviors. Last and foremost, especially in times of crisis, self-awareness about emotions and feelings can provide the necessary self-control in buying and the indispensable self-reinforcement in emotional regulation. The shopping bag can contain healthy limits and balance.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SA and SL contributed substantially to the conception and design of the study. SL organized the database. SA performed the statistical analysis and interpretation of the data and wrote the first draft and all sections of the manuscript. All authors contributed to the critical review of the manuscript and read and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 03 October 2023
DOI 10.3389/fpsyt.2023.1214803

OPEN ACCESS

EDITED BY
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RECEIVED 30 April 2023
ACCEPTED 06 September 2023
PUBLISHED 03 October 2023

CITATION
Brennan SN, Rossell SL, Rehm I, Thomas N and Castle DJ (2023) A qualitative exploration of the lived experiences of Body Dysmorphic Disorder.
Front. Psychiatry 14:1214803.
doi: 10.3389/fpsyt.2023.1214803

A qualitative exploration of the lived experiences of Body Dysmorphic Disorder

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Body Dysmorphic Disorder (BDD) is characterized by an intense preoccupation with one or more perceived "defects" in physical appearance. Despite the distress and impairment associated with BDD, the disorder remains understudied and poorly understood. In particular, there are limited studies available which give voice to those with firsthand experiences of the disorder. A qualitative approach was employed to study lived experience of BDD. In-depth semi-structured interviews were conducted with 12 participants with BDD, aiming to understand their subjective experiences of the disorder. Data was analyzed using Interpretative Phenomenological Analysis (IPA). The results identified three superordinate themes; (1) consumed by the disorder, (2) the flawed self, and (3) intolerance of uncertainty about appearance. The qualitative findings of this study are discussed in relation to current conceptual understandings of BDD, including the cognitive behavioral model.

KEYWORDS

Body Dysmorhic Disorder, lived experience, intolerance of uncertainty, qualitative research, the flawed self, consumed by the disorder, interpretative phenomenological analysis

Introduction

Body Dysmorphic Disorder (BDD) is a psychological condition characterized by an intense preoccupation with one or more perceived defects in physical appearance, repetitive appearance-related behaviors (e.g., mirror checking, reassurance seeking, skin picking) or pervasive mental acts (e.g., comparing self-appearance to others), and is marked by clinical levels of distress and functional impairment (1). The Diagnostic and Statistical Manual of Mental Disorder (DSM-V) classifies BDD as an Obsessive-Compulsive Related Disorder [(1); OCDR]. BDD has been conceptualized as an OCRD due to the symptom overlap, high comorbidity, and neuropsychological similarities between BDD and OCD (2). BDD, however, is considered a distinct condition as the persistent preoccupations (obsessive-like thoughts) and repetitive acts (compulsion-like behaviors) seen in BDD are solely focused on appearance-based concerns.

Large epidemiological studies reveal BDD is relatively common affecting approximately 1.7–2.9% of the general population (3–5). BDD tends to affect males and females in similar proportions and typically emerges during adolescence, with a mean age of onset of 16.4 years (6). Despite its high prevalence and early onset, accurate clinical diagnosis and in turn access to

appropriate treatments is delayed several years, contributing to a chronic and debilitating course trajectory (7).

The cognitive behavioral model of BDD proposes that a crucial factor to the development and continuation of the disorder is a process of selective attention [e.g., (8–12)]. This model postulates that a vicious cycle commences when an individual experiences either an external (e.g., seeing image of self in the mirror) or internal (e.g., a 'felt' impression of the body part) trigger, which activates a process of self-focus attention whereby the individual selectively attends to specific aspects of their appearance as opposed to the 'bigger picture' and attaches negative appraisals and maladaptive interpretations to this experience. Although described as a discrete process it is suggested that this process can often be perpetually 'turned on' for these individuals further strengthen this cycle. Veale (8) refers to this process as "self as an esthetic object" and suggests that individuals are consumed by imagery or "felt impressions" of their appearance such that they experience themselves from an observer perspective.

Research, to date, has primarily endeavored to understand the clinical symptoms and underlying constructs of BDD predominantly using quantitative methods. In recent years, there has been a small number of qualitative studies which have approached individuals with BDD to ask about their first-hand experiences. Research of this nature is paramount to evaluating current theoretical models and extending upon gaps in current knowledge. Silver and colleagues interviewed 11 individuals with BDD using participant's self-photographs and used a narrative analysis to understand the way in which they perceived their appearance (13, 14). Identified themes included increased threat perception resulting in disordered interpersonal relationships; a wish for regularity and symmetry in physical appearance; idealization of childhood self; a sense of duty to look good; and a focus on specific details rather than on ugliness. In a follow-up study (15), mirror gazing was explored in 10 individuals with BDD. Participants described mirrors as controlling, imprisoning, and disempowering forces that had a crippling and paralyzing impact on their lives. A further study of eight individuals with BDD used inductive thematic analysis and identified three core themes; routine and repetitive, safety through control, and natural and automatic. Appearance behaviors in BDD were complex and did not appear to follow a straightforward model of reward and punishment, such that some behaviors (such as camouflaging through the use of make-up) provided a sense of relief and reassurance, whereas others (such as mirror checking) could be highly distressing. There was thus a paradoxical pattern, whereby participants were seemingly dissatisfied with BDD behaviors, yet also derived comfort, reassurance and a sense of identity from them (16).

A Swedish study explored experiences of the health care system among people with BDD (17). Six themes emerged; being absorbed in time-consuming procedures, facing tensions between one's own ideal and perceived reality, a sense of becoming the disorder, feeling restricted in one's life, attempting to reduce one's problem's (through avoidance and safety behaviors), and striving to receive care but encountering difficulties with the health care system. Challenges in attempting to access health care included feeling that they were not being taken seriously, a lack of knowledge specific to BDD among health professionals, and a scarcity of referral options.

Finally, a recent qualitative study interviewed 8 individuals who self-identified as living with BDD (18). The study endeavored to understand the developmental origins individuals with BDD attributed their experience to. Four themes were identified: exposure to bullying and external critique of appearance; experiencing rejection, shame, and sense of not being enough; developing an awareness of the solidification of concerns; and learning about and reflecting on triggers. This study called for further qualitative studies to amplify the voices of those living with this condition and better inform conceptual models of BDD.

Interpretative Phenomenological Analysis (IPA) is a qualitative research method (19) that goes beyond thematic descriptions to create a rich analysis of how a sample of individuals perceive, appraise, and "make sense" of their experiences (20, 21). IPA assumes that individuals are self-reflective beings who are not only capable of, but actively seek to, engage in meaningful interpretation of their life experiences. IPA promotes a method of double hermeneutics. Firstly, the participant is making sense of their world, and secondly, the researcher works to decode that meaning (21).

This study employed IPA to examine the lived experiences of individuals with BDD. In line with IPA guidelines this study did not endeavor to test hypothesis but rather to address two broad research questions:

1. What are the subjective experiences of living with BDD and its impacts?
2. How do these experiences fit with current theoretical understandings of BDD?

Materials and methods

Design

A qualitative research design, using IPA (20, 21) was employed. The project was approved by Swinburne University and St Vincent's Hospitals' Human Research Ethics Committees and informed consent was obtained from all participants.

Participants and procedure

Twelve people with BDD (7 female) were recruited via two specialist BDD services. Participants were eligible if they were aged ≥18 years, were proficient in spoken and written English, and had a current and primary diagnosis of BDD according to DSM-IV criteria. Participants were ineligible if they had a neurological disorder, current alcohol or drug abuse requiring clinical attention, and a current or lifetime psychotic disorder. Participants with other psychological comorbidities were included, to support generalizability. Interviews were between 60- and 90-min duration and conducted in-person at a hospital or university mental health research center. The female interviewer (SB) was a clinical psychology doctoral student at the time of interviewing and had no pre-existing relationship with the participants.

Measures

The following measures were administered to participants to characterize the sample. The *MINI International Neuropsychiatric Interview* [MINI 6.0; (22, 23)] and the *Body Dysmorphic Disorder*

10.3389/fpsyt.2023.1214803

Diagnostic Module [BDD-DM; (24)] confirmed DSM-IV diagnosis and comorbidities. The *Yale-Brown Obsessive Compulsive Scale Modified for BDD* [BDD-YBOCS; (25)] is a 12-item semi-structured clinician administered interview that assesses BDD symptom severity during the past week. The BDD-YBOCS produces subscale scores for Obsessions (range 0–20), Compulsions (range 0–20) and Insight/Avoidance (range 0–8), as well as a total symptom severity (range 0 to 48). The *Brown Assessment of Beliefs Scale* [BABS; (26)] is a 7-item clinician-rated scale that measures the degree of conviction and insight associated with a primary obsession or delusional belief over the past week. The *Depression Anxiety Stress Scales-21* [DASS-21; (27)] is a 21-item self-report scale comprised of three subscales: depression, anxiety, and stress.

A *Semi-Structured Qualitative Interview* explored participants' subjective experience of living with BDD. A small set of standard questions and prompts were developed by authors (SB, SR, and NT) which enquired about (1) onset and early course of BDD; (2) thoughts, emotions, and behaviors associated with BDD; (3) impact of BDD on every-day life; and (4) participant's reflections on the causes and function of their experiences. The technique of 'funneling' was used such that the interviewer asked questions about broad topics first to allow the respondent to reflect general views followed by prompts to direct the participant to more specific content. Each interview commenced with the statement and question of *"I am interested in understanding your personal experiences of Body Dysmorphic Disorder and the meaning you attribute to experiencing these appearance-based concerns. Could you start by telling me about what Body Dysmorphic Disorder has been like for you?."* Participants were encouraged to consider their beliefs, explanations, and the meaning they attributed to each aspect of their BDD experience.

Data analysis

All qualitative interviews were audio recorded, manually transcribed verbatim, and analyzed according to IPA methodology (20, 21). A detailed analysis of each participant's interview occurred before moving onto the next participant. The author who conducted the interviews (SB) listened to and re-read the interview transcript several times, while making written annotations. The next step involved developing concise phrases, compatible with theoretical concepts and psychological terminology (i.e., interpretation), to develop a list of initial themes. Next, themes were clustered by looking for connections and a sense of order, such that emerging superordinate (higher order) and subordinate (lower order) themes were developed for the individual participant with reference to key quotations from the source material. The 12 participants' theme tables were then compared and contrasted. Factors such as richness of passages, level of meaning held by the participants, and prevalence (to an extent) were used to guide the decisions about final themes. Following credibility guidelines for qualitative research (28), clean interview transcripts and the corresponding tables of superordinate and subordinate themes were checked by a second author (IR; a clinical psychology academic with experience in IPA). Themes were discarded if they were not supported by rich evidence, had low prevalence within transcripts, or could be subsumed under other themes. Development of themes were periodically reviewed and discussed with a further researcher (NT; a senior clinical psychology academic).

Results

The 12 BDD participants' ages ranged from 19 to 64 years. Participants self-reported a duration of illness ranging between 6 months to 48 years ($M = 16.23$, SD = 14.08); with BDD onset at a mean of 21.75 years old (SD = 12.24). Majority of participants (75%) were currently employed on a fulltime basis; 75% were currently single; and 92% were Australian born. The participants were highly educated with an average total number of years of education of 16.54 (SD = 3.83), and the majority holding higher education qualifications.

Consistent with other BDD samples [e.g., (16)], the majority of the participants (9 out of 12) had at least one other psychiatric condition with the total number of comorbidities per participant ranging between 0 to 3. Comorbidities included Major Depressive Disorder (58%), General Anxiety Disorder (58%), Obsessive Compulsive Disorder (17%) and Trichotillomania (8%). Seven participants (58%) were currently being treated with psychotropic medication, most commonly antidepressants. On average, the participants were preoccupied with 3 body parts of concern, with a range of 1 to 5 (see Table 1). The most common concerns related to skin complexion (e.g., acne, scars, skin conditions, freckles, moles), hair (e.g., head hair loss, excessive or too dark body hair), and facial features (e.g., the shape or size of the nose, eyes, or lips).

TABLE 1 A summary of BDD appearance concerns.

Body part of concern	Number of participants endorsing
Skin Complexion	5 (42%)
Hair	5 (42%)
Head	1 (8%)
Face	4 (33%)
Nose	3 (25%)
Eyes	2 (17%)
Eyebrows	1 (8%)
Teeth	2 (17%)
Mouth	1 (8%)
Cheeks	1 (8%)
Ears	1 (8%)
Lips	1 (8%)
Jaw	1 (8%)
Chin	3 (25%)
Neck	1 (8%)
Breasts	2 (17%)
Genitals	1 (8%)
Body Frame/Body Symmetry	1 (8%)
Body Weight/Body Shape[b]	3 (25%)

[a]No participant was excessively concerned with body shape or weight alone. [b]As participants experienced multiple areas of concerns the total number of participants experiencing these concerns exceeds the total number of participants. All participants with multiple areas of concern were however able to identify their most predominant one.

The BDD-YBOCS scores showed that average BDD symptom severity was 'Moderate–Severe'; total score (M = 23.42, SD = 6.64, Range = 14–36), obsession subscale (M = 11.08, SD = 3.03, Range = 7–16), compulsion subscale (M = 9.08, SD = 1.68, Range = 1–15) and insight/avoidance subscale (M = 3.08 SD = 1.68, Range = 0–7). The average BABS score (M = 11.27, SD = 3.93, Range = 7–19) classified the sample overall as having 'fair' insight into BDD beliefs. Only one participant met Eisen et al.' (26) criteria for 'delusional' conviction associated with their BDD belief (a total score of ≥18 and a score of 4 on item 1, which relates to conviction). The DASS-21 scores for depression were (M = 6.17, SD = 4.17, Range = 2–11), anxiety (M = 3.17, SD = 1.08, Range = 2–5), and stress (M = 6.25 SD = 2.69, Range = 2–9).

The IPA analysis identified three master themes, each reflecting core subjective experiences of living with BDD. The master (superordinate) themes, secondary (subordinate) themes, and example quotes are presented in Table 2.

Consumed by the disorder

This master theme highlights the all-consuming nature of BDD symptoms, the discomfort and distress associated with one's physical embodiment, and the functional impact of these experiences. This is explained further within four sub-themes.

Controlled by one's thoughts and behaviors

Participants described feeling controlled and tormented by obsessive thoughts relating to their body part of concern and associated compulsive behaviors. Some referred to "the BDD" as a distinct entity that had the capacity to hijack or dominate them. In exploring the purpose of BDD behaviors, the participants identified two core functions, one being an attempt to improve or hide the body part of concern, and the other stemming from a strong desire "to know the truth" regarding their appearance; that is, to gather evidence to confirm or disprove their "deformed," "ugly," or "unacceptable" appearance. Participants reported that the latter 'investigative' type of behaviors were associated with higher distress, stronger urges, and that these behaviors often felt illogical.

Participants reported finding themselves stuck in checking routines and feeling compelled to complete every possible option associated with the behavior, such as changing the location, lighting, angle, or the mirror used. They referenced being driven by the need to know exactly how they looked but were often left feeling unsure, not knowing which of the images or impressions they should trust, that is, which represented their 'true' appearance.

The mirror played a central role for many, along with several other visual and tactile methods used to perform checking behaviors. These included taking photographs and videos, with some participants storing files on electronic devises and using zoom and editing functions to evaluate the body part. Some kept diaries including pictures, descriptions, and measurements of the body part(s) of concern.

Trapped within one's body

Participants described the sense of being trapped within their body, with a sense of discomfort with their physical embodiment. They felt their body was "not right" or even fundamentally wrong.

Hopelessness and ruminating about death as an escape

All participants identified experiencing a strong sense of hopelessness and futility as a result of their BDD experiences. They described an inability to experience pleasure or happiness during their most challenging periods; over half had contemplated suicide or had made a previous suicide attempt.

Lost opportunities and impact on relationships

Participants reported that BDD infiltrated most aspects of their lives including work, studies, relationships, and physical intimacy. Many expressed feeling held back in life as a consequence of BDD and unable to pursue their goals and aspirations. Participants expressed guilt and shame associated with believing they were a burden to their partners, family, and friends.

The flawed self

Participants invariably viewed themselves as being fundamentally flawed. They felt acutely self-conscious, had a heightened awareness of their physical body, and were fearful of being seen by others, resulting in them feeling vulnerable, exposed, and wanting to hide from the world. The flawed self was expressed in three ways.

External flaw as a symbol of one's inner flawed self

This theme was so strongly embedded in participants' accounts that they spoke about the qualities of their physical body part and their inner self as if they were one and the same thing. They suggested that people would somehow "know" or be able to "see" inner negative personal qualities such as weakness, inadequacy, inferiority, or badness by simply viewing their appearance concern. It was as though they believed that if others were able to detect the physical flaw, this would somehow be a confirmation of an inner flawed being.

Self as fundamentally abnormal

Participants viewed themselves as fundamentally abnormal, with a strong associated sense of shame and guilt. They did not simply view themselves as imperfect, less attractive than they aspired to be, or as failing to reach a beauty standard, but rather experienced themselves as inherently defective, abnormal, and 'wrong'. Many of the participants reflected that these feelings predated BDD symptom onset.

Objectified and exposed self

Participants described hyper-awareness of their physical body, especially when they were in public settings. They reported feeling like objects which were on display and being evaluated, judged, and ridiculed by others. Many reported visualizing their body or body parts from an observer perspective. Some participants responded by contorting or positioning their bodies in various ways as though sculpting an object which may be better received by others. For a number of participants their experience of intense physiological awareness was so strong that they reported being able to "feel" their body part on a sensory level.

10.3389/fpsyt.2023.1214803

TABLE 2 Superordinate and subordinate themes of the interpretative phenomenological analysis.

Superordinate themes	Subordinate themes	Examples
Consumed by the disorder	Controlled by one's thoughts and behaviors	*I do not even know how they crept back in. But within one week it was back to googling procedures, taking time off work, and just not being able to concentrate on anything else […] When it was really bad I could not drag myself away from the mirror. I would be standing there staring at it for hours, I could not stop, I could not drag myself away because I needed to be looking at it* (Participant 1). *It was the only thought I could think about 24/7. I would go to the mirror 50 times per day. I could not sit still and I just kept checking the mirror, taking videos of myself, photographs on my phone, inside the house, outside the house, in different rooms, different mirrors, different lighting, asking my family, asking my friends* (Participant 2). *It was this obsessiveness of looking at others and then just these constant thoughts over and over, nearly all day long […] I was constantly feeling it, constantly going to the mirror, thinking 'does it look okay here?', and then trying to avoid the mirror. But then I look at other reflections or look at photos close up and it was just constant […]It was the thoughts, it's what I did with it, and everything else involved. It has dominated my life so much*. (Participant 3).
	Trapped within one's body	*I felt ashamed and anxious that I would have to live in my body for the rest of my life, that I wasn't good enough and that I wasn't lovable […] This complete anxiety that I would have to live in this body for the rest of my life; disgusted by the way I look.* (Participant 4). *I feel like I'm trapped in the wrong person's* body […] because my body just will not change* (Participant 5).
	Hopelessness and ruminating about death as an escape	*I just could not enjoy anything. I just stopped enjoying the things I used to enjoy. I just could not concentrate on them because they felt insignificant compared to this […]. I sort of take comfort in knowing that it's not going to last forever. That I am going to die one day, so you know, even if it does last my entire life it's going to be over some day.* (Participant 2). *At its worst, I have not wanted to go on anymore, when feeling it is always going to be like this; it is exhausting […]. I have even thought I just wanted to cut it off completely or that I'd rather not be alive and living with these emotions. I have thought I wish I could just go to bed and not get back up again* (Participant 3).
	Lost opportunities and impact on relationships	*BDD is very debilitating; it holds you back from so many things. I feel I could have been and done so many things […]. I have ruined a lot of friendships because of this* (Participant 6). *I could have done things. I could have got married* (Participant 7). *It has created a barrier between me and other people. It is particularly prominent in relation to romantic endeavors* (Participant 8).
The flawed self	External flaw as a symbol of one's inner flawed self	*I had this bolt out of the blue that I was this bad person, like undeserving and bad and therefore ugly, you know. And for some reason it had to do with my X* (Participant 9). *I believe that if people were looking at me, they would think I'm ugly. Like, that's the first thing they would think 'ugly', and that would somehow also correlate with me being a bad person* (Participant 10).
	Self as fundamentally abnormal	*I just feel different to others […] Just feeling there is something not right. I feel inferior to others in a sense, and that is what I have always felt* (Participant 3). *I think who would want to be with someone like me. Because I am just not, I just do not feel like normal* (Participant 5). *I went out at night once and saw my reflection in a window. I just thought how could I do that to the world, the planet, how could I go out and inflict this on them? I am like this revolting thing […]so I went back home* (Participant 11).
	Objectified and exposed self	*I felt completely on display to the public* (Participant 6). *I remember just driving for the first time, I felt so exposed, so aware of myself […]. Just knowing that people could see me when I was out in public* (Participant 4). *When I am not happy with how I'm feeling or how my body is feeling, I literally can feel the clothes on me and how they feel against my body parts. I'm constantly aware of it* (Participant 12). *It's not just what it looks like, I can also feel my X beings small* (Participant 10).

(Continued)

TABLE 2 (Continued)

Superordinate themes	Subordinate themes	Examples
Intolerance of uncertainty about appearance	Doubt and uncertainty	*A thought would always come into my mind saying 'maybe you missed something'…That feeling of dread. That even if it has not changed for a month, it's not guarantee that it will not change tomorrow. So, I am always dreading it* (Participant 2). *It was awful. Thinking I have seen something and then going back and thinking 'hang on maybe I have not, maybe I imagine it'. Almost like trying to catch myself. Arranging my X in a way to think 'hang on yes there it is'* (Participant 9).
	Just not right	*I became concerned my X was asymmetrical. It has to do with symmetry. I think even when I was quite young, I was concerned with symmetry* (Participant 9). *Sometimes I cannot go out because I've just been – it's just been ruined, I cannot find that right feeling-that feeling I am after* (Participant 12). *Sometimes I see the mirror and things are going good, but then I go out and I will think how did I miss that. So, then it's like how can I capture that feeling again? I'll capture it and then something will happen and it's completely the* opposite (Participant 5). *I'll look really up close at it and if I could just find the time where it does not look so bad then it can give me a bit of that feeling […] It's 'oh hang on, it does not look too bad', and then you walk away with it. So, it's trying to find that feeling.* (Participant 3).
	Focus on detail over the whole	*I get close up to the mirror […] I get up really close and I start scrutinizing each area and then I'll pick or scratch it. I would scan everything for imperfections one bit at a time* (Participant 1). *I'll zone into that area […] I can actually like feel that part of my body. Then you almost zone into that area on your body and you can feel it just being. It's, it's weird. I guess it is a heightened sense of, you know, sensation and things* (Participant 12).
	Seeking certainty and control through confirmation	*I was terrified that there was something visible but at the same time I wanted there to be. It sounds like madness, but it was actually a relief. It was a bit like I wanted the confirmation but at the same time I dreaded it. I was torn between not wanting it to be and needing it to be there. It was a terrible bind […] It gave me something definite rather than the uncertainty. It needed certainty. When I have been unwell what I could not cope with was the uncertainty* (Participant 9). *I keep photos. It's like I want the evidence to say it is there, you are not making it up. There is a flaw there, even though it might be only be tiny, it's that reassurance […] Sometimes I have to go check that it is there. I've got to put my finger over it to feel the unevenness or look at it in the mirror a little bit to make sure that it is there, to know it is there. And then I have felt this sense of, uh, like a bit of a release* (Participant 3).
		It gave me a sense of control and a nice sense of isolation and there was no worry because I did not have to think about the future or jobs or any really big scary things that were out of my control[…] When I am obsessed with my BDD the control that I can get is I can live in my own little world where the only thing that matters is this X and the only thing, I need to do in order to have a successful fulfilling life is to get it fixed" (Participant 1).

Reference to specific body parts of concern have been replaced with the symbol X to protect the anonymity of participants. The symbol * has been used to represent a word replacement used by authors to exclude potentially identifiable data.

Intolerance of uncertainty about appearance

The third master theme captures experiences of incessant doubt, ambivalence, and intolerance toward uncertainty about appearance and "not just right" experiences. Four subordinate themes were identified.

Doubt and uncertainty

A strong experience, which emerged for all participants, was a sense of doubt, uncertainty and ambiguity regarding their perceptions and the true nature of their body parts of concern. Participants reported being stuck and struggling to move forward with daily tasks or life in general in the absence of absolute clarity and certainty about their appearance. Thus, BDD behaviors were often carried out with a goal to investigate and gain a sense of certitude regarding appearance and in turn ease the distress associated with this uncertainty. They described persistent intrusive thoughts driving this sense of doubt and uncertainty; "*How does it look right now?*," "*What if it has changed?*," "*Has it worsened/improved?*" and most frequently "*What if I missed something?*." Several participants articulated that they were more distressed by the enduring uncertainty surrounding the reality and/or existence of the appearance concern than the actual existence of a physical flaw itself. Participants experienced conflicting perceptual information and an inability to trust their perceptual experiences. Although only a few participants believed their body part actually "changed" day to day, many struggled with the concept that it could change at any moment and agonized about not knowing exactly how it looked at any given moment.

Not just right

Connected with the theme of intolerance of uncertainty about appearance were phenomena of "not just right" experiences, coupled with a sense of unease and an urge to perform investigative compulsive acts or to engage in avoidance. Participants additionally expressed craving and longing for a "just-right" feeling. These impressions of rightness or wrongness appeared to be fuelled by felt impressions or ambiguous sensory and perceptual feedback, which the participants relied upon to make decisions, such as whether they could leave their home or when a checking behavior was complete and could be ceased.

Focus on detail over the whole

Participants described engaging with their body and their visual image in a detailed and piecemeal manner, repeatedly referring to practices of "zooming in" or "looking up close" at specific body areas, seemingly lacking a more holistic impression of their body/appearance. This focus on detail was further evident in the way participants listed each specific body part as if it was a fragmented entity disconnected from an overall body. This detailed way of engaging with their body appeared to drive "not just right" experiences through a process of selective attention and hypersensitivity to ambiguous perceptual and sensory bodily feedback.

Seeking certainty and control through confirmation

Experiences of incessant doubt, uncertainty, and "not just right" experiences were associated with high levels of discomfort and distress. In response, participants engaged in compulsive checking, trying to establish certainty and control. A number of participants shared that at times they wanted to establish evidence that they in fact looked "okay"; but in not being able to reach this conclusion they would then turn to search for evidence of the existence and abnormality of their perceived flaw, which in itself could provide some sense of relief and comfort. One participant described this as a "terrible bind" in which they found themself both desperately longing to find the flaw and dreading this confirmation at the same time. Another shared that finding evidence of the flaw not only provide a sense of relief but could at times also foster a sense of hope, as this meant that something could be done to 'fix' the problem. Finally, one participant shared that they found a sense of control through their preoccupation with their body part of concern as it meant they could avoid bigger life decisions and their uncertainty around the future.

Discussion

This study aimed to build upon existing research by using IPA to examine the lived experience of BDD. Specifically, it endeavored to understand subjective experiences of those living with BDD and the ways in which these experienced impacted on those living with this condition. It additionally aimed to explore how these subjective experiences fit within current theoretical models of BD. The analysis identified three superordinate themes; (1) consumed by the disorder, (2) the flawed self, and (3) intolerance of uncertainty about appearance. Each of these themes is discussed with reference to the research literature.

Consumed by the disorder, summarized the subjective experiences of BDD symptomology, reflected some of the most challenging aspects of the condition and how these experiences impact upon the individual and their lives. Participants identified feeling controlled by obsessions and compulsions, feeling trapped in their bodies, and experiencing feelings of hopelessness and a desire to escape themselves. These experiences were reported to significantly impact upon daily living including employment, education, and social functioning. High levels of depression, suicidal ideation and past suicidal behaviors were identified, corresponding with clinical descriptions in the literature and highlighting the significance of suicidality as a major clinical concern for this population (6, 29, 30).

Overall, participants' personal accounts of intrusive appearance-related thoughts and repetitive behaviors captured the obsessive and compulsive nature of BDD. The participants described doubt-based intrusions (i.e., "have I missed something?"), preoccupations with symmetry, "not just right" experiences and use of compulsive checking behaviors to manage uncertainty. The participants identified repetitive behaviors such as checking their body part of concern, comparison with others and seeking reassurance from others as central BDD symptoms. They identified a "need" to know exactly how they looked as a driver of the checking behaviors, albeit they acknowledged that checking often did not make them feel better, could worsen their distress, or at best provided only brief relief. These findings are consonant with those of Veale and Riley (31) who, in a retrospective forced-choice questionnaire, found that individuals with BDD, in contrast to controls, were motivated to check mirrors for three primary reasons; they (1) hoped that they may look different, (2) believed that they would feel worse if they did not check, and (3) desired to know exactly how they looked. Further, Windheim et al. (32) found that people with BDD were distressed both before and after mirror-gazing sessions. Baldock, Anson, and Veale (33) suggested that mirror-checking in BDD may persist despite distress, as individuals with BDD are more likely to use internal goals (e.g., needing to feel "right" about their appearance) compared to control participants who tended to have external goals (e.g., having finished applying makeup), and that in BDD these ambiguous internal goals were relied upon to inform their stop-criteria for mirror-use. Supporting this, the accounts of our participants suggest use of internal goals, for example, pursuing the "just right" feeling. The participants also provided examples of using ambiguous internal feelings to guide decisions, such as whether they could disengage from compulsive behaviors or whether they felt acceptable enough to leave the house. Further research should endeavor to understand better, the nature of distress and relief experiences associated with various BDD behaviors, as this could inform treatment paradigms.

The current results support assertions from previous qualitative research that BDD behaviors might be best understood if differentiated into categories based on their function (9, 16). The current diagnostic criteria for BDD refer to these behaviors as "repetitive behaviors," thus avoiding the term "compulsions" although they evidently do parallel compulsions as seen in OCD. In OCD, compulsions are differentiated from safety behaviors such that safety behaviors are aimed at avoiding adverse experiences whereas compulsions are an attempt to undo or neutralize uncomfortable thoughts and/or feelings (34). Our participants described classic safety behaviors (e.g., camouflaging through makeup, or hiding under hair or clothing), which were not associated with the same level of distress as accompanied compulsive behaviors (e.g., checking behaviors, comparing oneself to others, reassurance seeking) arguably because the former are driven by a more

explicit, external, and thus attainable goal and the individual believes the flaw to exist and that their appearance is being improved or protected by their actions. This is opposed to compulsive behaviors, which appear driven by a search for a sense of certainty, resulting from a core intolerance of the unknown and ambiguity. Perhaps then, these checking behaviors persist because this uncertainty is so insufferable that even a small opportunity to neutralize these feelings and gain a sense of control, even if only temporarily, is enough to reinforce them. The qualitative results of this study suggest that the distinction of 'safety behaviors' and 'compulsive behaviors' as used in OCD is relevant for BDD.

The second master theme was *the flawed self*. Participants invariably viewed themselves as fundamentally flawed. These beliefs went beyond a concern of imperfection, but of viewing themselves as wholly defective, abnormal, and wrong. Participants described self-consciousness and a hyper-awareness of their physical body including strong sensory feedback, resulting in them feeling vulnerable, exposed, and wanting to hide from the world. This master theme supports previous qualitative research, including that of Brohede et al. (17) who identified feelings of abnormality and a longing to be normal. The subtheme, *objectified and exposed-self*, strongly resonates with Veale's (8) cognitive-behavioral model of "self as an aesthetic model," which proposes that BDD is marked by extreme self-consciousness and self-focused attention, leading to a focus on felt impressions and engagement with mental imagery with strong sensory qualities, fuelling a selective-attention bias cycle (8).

The subtheme of *External Flaw as a Symbol of One's Inner Flawed Self* is a novel finding. While it is well accepted that self-esteem is poor in BDD, there has been limited discussion surrounding the idea that the perceived external appearance flaws may be a manifestation of a more global concern regarding their core sense of self. Psychoanalytical theorists have long theorized that in BDD the body part perceived as defective is a symbol of another underlying conflict through a process of displacement (35). Phillips (36), however, notes that such perspectives have no empirical evidence and are difficult to test. Beyond psychoanalytic accounts, Veale (37) asserted that a cognitive behavioral model of BDD must address the role of self-definition and overvalued ideas. Our findings suggest that in BDD the self has become completely entwined with the perceived physical flaw. Thus, psychotherapeutic approaches with BDD clients must endeavor to move beyond targeting of maladaptive behaviors and a focus on appearance concerns to address underlying core beliefs and self-concept.

The final master theme, *intolerance of uncertainty about appearance*, highlights how prominently distress experienced in this population was associated with uncertainty, and participants' identification of this in the development and maintenance of their BDD symptoms. Indeed, several participants felt that "uncertainty" was the most challenging aspect of their experience with BDD. Intolerance of Uncertainty (IU) has been defined as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" [(38), p. 31]. It has been proposed that Intolerance of Uncertainty (IU) is a transdiagnostic construct playing a role in anxiety, depression, eating disorders and OCD (39–41). IU has been postulated as one of the core 6 dysfunctional beliefs contributing to the development and maintenance of OCD (42). IU tends to be highest in OCD patients with checking compulsions as compared to those with other compulsions such as washing. This is noteworthy given repetitive behaviors in BDD largely revolve around checking the body part of concern.

The notion that compulsive behaviors constitute an ineffective attempt to reduce distress associated with uncertainty has permeated the OCD literature for years, but it has scarcely received mention in the BDD literature (43). The authors are aware of only one study which has addressed IU in BDD, showing that BDD participants have high IU and that IU is associated with poorer functioning (44). Perhaps IU has been overlooked in BDD, as individuals with this condition may not immediately present as uncertain or ambivalent; indeed, they often present with a strong conviction and rigidity surrounding a seemingly unwavering belief that they have a very real and noticeable flawed appearance. However, in the late 19th century Morselli wrote, "the dysmorphic patient in the middle of his daily routines is caught by the doubt of his deformity" (45). Thus, it appears at core of the BDD experience is not a robust negative belief regarding one's body, but rather an innately unstable and oscillating sense of the body. Further research into the role of IU in BDD is warranted, specifically to explore the potential role this factor may play for the development and maintenance of symptoms. Further, it would be valuable to explore whether IU in BDD is specific to appearance concerns or whether this represents a more generalized distress and intolerance of the unknown.

Connected to experiences of uncertainty, the subtheme of *'Not Just Right'* revealed participants' experience of strong internal or body-based sensations of abnormality. Bottesi et al. (46) found that Not Just Right Experiences (NJRE) partially mediated the pathway from IU to checking behaviors in OCD. They proposed that IU was a transdiagnostic construct, whereas NJRE represented an OCD-specific mechanism through which IU functioned to shape compulsions. The current study provides preliminary evidence for NJRE in BDD, suggesting that these experiences are not unique to OCD and warrant investigation in BDD and other OCDR disorders.

Finally, the subtheme, *focus on detail over the whole*, describes processes of "zooming in" and focusing on isolated aspects of appearance over the holistic image. This finding provides qualitative support to both the theory proposed by Veale (8) and previous neuropsychological and neuroimaging findings (47–49) that BDD involves a disposition toward a detail-oriented information processing over holistic right hemispheric information processing. Nonetheless, in the current study 'focus on detail' was not limited to visual processing, as participants described this same process with regard to felt impressions and other body based sensory feedback. Future research should explore sensory experiences in BDD more broadly, as the detail-oriented focus in BDD may reflect a broader information processing bias that may not limited to visual mechanisms.

Clinical implications

The results of this study highlight important considerations for psychologists, mental health clinicians, and other professionals working therapeutically with clients with BDD. Currently Cognitive Behavioral Therapy (CBT) including Exposure and Response Prevention (EPR) is the recommended first line treatment for BDD (36). Clinicians working in the field should explore client's attitudes toward uncertainty and

ambiguity, as well as the function BDD behaviors provide clients as solitary attempts to reduce these symptoms may actually increase distress and feelings of lack of control for this population. The current clinical and research interest in IU as a trait specific and transdiagnostic factor has resulted in the development of CBT programs which specifically target IU. For example, Cognitive Behavioral Therapy Targeting Intolerance of Uncertainty [CBT-IU; (50)] and Making Friends with Uncertainty [Making Friends with Uncertainty; (51)]. The developers of MFWU propose that traditional disorder-specific CBT programs target the 'threat' element of disorders, that is the 'worst case scenarios' or 'feared outcome'. Instead, IU specific approaches aim to target the client's relationship with uncertainty itself (51). This is achieved through providing clients with psychoeducation about IU, developing awareness and attunement to body responses to uncertainty, addressing beliefs about uncertainty (i.e., 'I cannot handle uncertainty' and 'I need to know'), and titrated exposure to uncertainty to build tolerance, acceptance, and safety in the face of the unknown. Clinicians working with BDD clients may which to utilize IU measures to assess and explore the relevance of this factor for the individual. Where clinicians and clients identify IU to play an important role in BDD symptomology it may be beneficial to incorporate IU specific interventions as an add-on to standard BDD protocols. Finally, given the profound feelings of shame among this population and the current study's finding of '*External flaw as a symbol of one's inner flawed self*' clinicians may also incorporate adjunct interventions, drawing on Compassion Focused Therapy [CFT; (52)] and Internal Family Systems [IFS; (53)].

Limitations

Our results represent the lived BDD experiences of the 12 individuals interviewed and as with any qualitative research these experiences are not necessarily generalizable. We did include a diverse sample; inclusive of males and females and across a broad age range (19–64 years). It included those who were medicated and unmedicated, as well as those who have undergone cosmetic surgery and those with no such experiences. The group was highly educated, and were treatment-seeking, and these factors might also limit generalizability. Finally, the BDD-YBOCS scores suggest moderately severe symptom severity, and it is therefore possible that individuals with a milder or more severe presentation may have shared different perspectives about their experiences.

Conclusion

In summary, we describe detailed qualitative accounts validating the seriousness and debilitating nature of BDD, with participants feeling dominated by intrusive thoughts and repetitive behaviors, feeling trapped within their bodies, experiencing a sense of hopelessness and a desire to escape, and experiencing significant functional impairment. They experienced strong feelings of defectiveness and shame, extending beyond appearance, to feelings about their core inner person. A key and novel finding is that these individuals experienced high levels of doubt and uncertainty, which represents a possible developmental or maintenance factor fuelling compulsive checking behaviors in BDD. It is recommended that future research explore the role of shame and intolerance of uncertainty further as these factors may present avenues for innovative interventions for those living with BDD.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Swinburne University and St. Vincent's Hospitals' Human Research Ethics Committees. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

SB, SR, and DC jointly conceived and planned research study. SB and NT designed qualitative approach including development of interview schedule. SB carried out data collection including interviews and transcription, conducted initial qualitative analysis, and wrote first version of the study for purpose of doctoral thesis. IR and NT provided secondary qualitative analysis resulting in arrival at final themes. SB and SR jointly wrote manuscript for publication. IR, NT, and DC provided writing edits and input to final version of manuscript submitted to this journal. All authors contributed to the article and approved the submitted version.

Funding

This work was supported by Australian Government Research Training Program Scholarship (SB) and a Senior National Health and Medical Research Council Research Fellowship (GNT1154651 to SR). All funding sources had no role in the study design, collection, analysis or interpretation of the data, writing of the manuscript, or the decision to submit the paper for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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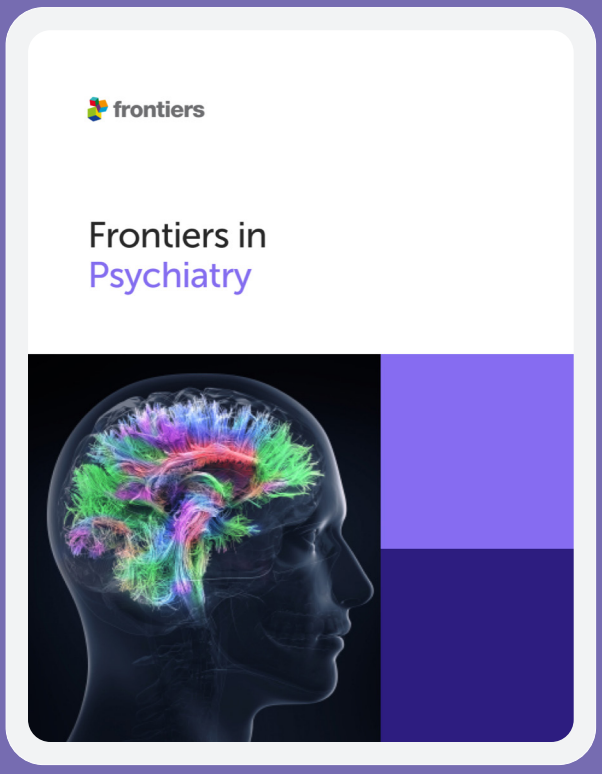

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