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A prediction analysis testing if internet-delivered cognitive-behaviour therapy is most suitable for the milder cases of pediatric obsessive-compulsive disorder

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Abstract

Background Common clinical sense would suggest that individuals with milder obsessive-compulsive disorder (OCD) symptoms should be the most suitable for guided internet-delivered cognitive behaviour therapy (CBT), with more intensive forms of treatment reserved for more severe or complex cases.

Results In this secondary data analysis of a non-inferiority clinical trial comparing internet-delivered CBT with in-person CBT for young people with OCD ($N = 152$), we found that higher baseline symptom severity predicted worse treatment outcomes in the in-person group but not the internet-delivered CBT group. Additional analyses showed that among individuals with milder symptoms, internet-delivered CBT was associated with worse outcomes than in-person CBT.

Conclusions If replicated, these results would question the axiom that internet-delivered CBT is most suitable for milder cases.

Trial registration The original trial was registered at ClinicalTrials.gov ID NCT03263546. Date of registration 2017-08-28.

Keywords Obsessive-compulsive disorder, Cognitive behavior therapy, Digital, Child, Adolescent, Prediction

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Background

The recommended first-line treatment for children and adolescents with obsessive-compulsive disorder (OCD) is cognitive behaviour therapy (CBT) with exposure and response prevention [1–3]. Because CBT for OCD is best delivered in a specialist, multidisciplinary setting, it is seldom available outside large cities or research centres [4]. These centres typically have large volumes of patients and long waiting lists. To solve the problem of accessibility, different models have been suggested, such as the stepped-care model and the staged model. In the stepped-care model, low intensity interventions, such as Internet-delivered CBT (ICBT), are offered to all patients first, and they only step up to more intensive treatment options if needed [5]. Our research group has previously developed a 14-module ICBT protocol that follows the same outline as traditional in-person CBT, primarily focusing on psychoeducation, exposure with response prevention and relapse prevention. The families communicate asynchronously with a dedicated therapist through an email function in the treatment platform. This ICBT protocol was recently evaluated in a non-inferiority trial where 152 children and adolescents with OCD were randomized to either ICBT followed by in-person CBT for individuals who had not responded sufficiently (stepped care), or traditional in-person CBT alone. Results showed that the ICBT stepped-care model provided similar effects as the traditional in-person CBT after 6 months with 68% responders in both groups [6]. A 2-year follow-up study of the same participants showed sustained effects for the ICBT stepped-care model with 66% responders vs. 71% responders in the traditional face-to-face CBT group [7]. The ICBT stepped care model saved 39% of therapist resources, which suggests that ICBT is a cost-effective alternative to in-person CBT when provided in a stepped care fashion [8].

An alternative model to increase efficiency is staged or stratified care, whereby patients are stratified to different treatment options based on their characteristics and symptom severity. In a staged model of care, the form, duration and intensity of the intervention can vary ranging from low-dose prevention interventions to full dose high-intensity treatments based on the clinical indicators for the specific individual [9]. To our knowledge, such model has not yet been formally evaluated in OCD. It has recently been suggested that low-intensity interventions, such as ICBT, should first be offered to all children and youths with sub-clinical/ mild OCD symptoms and that higher intensity options—such as in-person CBT—should only be reserved for individuals with moderate to severe OCD and/or the most complex cases [10]. This is also in line with NICE guidelines, which recommend low-intensity self-help interventions, such as ICBT,

for children and young people with mild OCD-related impairment [1]. While this makes good intuitive sense, evidence supporting the idea that individuals with mild OCD will respond well to guided ICBT is currently modest at best.

In contrast to in-person CBT, where outcome predictors have been frequently explored [11], to our knowledge, there is only one published study on predictors of response to guided ICBT in youths with OCD [12]. That study, including 61 adolescents, suggested that more severe patients responded less well to guided ICBT, thus providing some partial support for the staged model. This finding was well in line with the in-person CBT literature [13].

In this secondary data analysis of a non-inferiority clinical trial comparing ICBT with in-person CBT for young people with OCD [6], we aimed to evaluate whether baseline symptom severity was a reliable predictor of treatment outcome in both guided ICBT and in-person CBT. We also tested the hypothesis that milder symptom severity at baseline would predict better outcomes with guided ICBT.

Methods

We analyzed data from a previously published trial [6]. The trial included 152 children and adolescents aged 8–17 years who were randomized to either receiving guided ICBT or in-person CBT. Regardless of group allocation, participants who were classified as non-responders three months after treatment completion were offered additional in-person CBT up to the 6-month follow-up, which was the primary end point in the original trial. In the current study, data up to the 3-month follow-up was used, in order to ensure that the guided ICBT arm was not contaminated with additional in-person treatment. The trial was approved by the regional ethical review board in Stockholm, Sweden (DNR 2017/1070–31/1) and registered at ClinicalTrials.gov (ID NCT03263546). All participants and their caregivers gave written informed consent prior to inclusion.

Participants randomized to guided ICBT received treatment for 16 weeks, delivered through a secure web page. The content of the treatment is similar to in-person CBT with the main focus being exposure and response prevention. There are two age adapted versions of the treatment, one for children 7–12 years and one for adolescents 13–17 years, as well as two corresponding programmes for the caregivers. The participants had asynchronous contact with their therapist throughout the treatment period. In the in-person CBT group, participants received up to 14 sessions delivered over 16 weeks. For a more detailed description of the two interventions, see Aspvall et al. [6].

OCD symptom severity was measured with the masked assessor-rated Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS; [14]). Following established benchmarks, mild OCD was defined as 14–21 points on the CY-BOCS, moderate OCD as 22–29 points and severe OCD as 30–40 points [15]. Treatment response was defined as $\geq 35\%$ reduction on the CY-BOCS and a Clinical Global Impression-Improvement (CGI-I) score of 1 or 2 [16]. Remission was defined as a score of ≤ 12 on the CY-BOCS plus Clinical Global Impression—Severity (CGI-S) rating of 1 or 2 [16].

Linear regression models were used to predict CY-BOCS scores at posttreatment and 3-month follow-up, while logistic regression models were used to predict responder and remission status in the same time points. In these models, the predictor was CY-BOCS severity at baseline (as a continuous variable). The regression models were done separately for participants randomized to each of the treatment arms.

To analyse the main treatment effect stratified by baseline OCD severity, additional analyses were conducted with mixed-effect regression including fixed effects of time and group, group \times time interaction effects, as well as a random slope and random intercept. Two such models were fitted, one for patients classed as mild at baseline and another for patients classed as moderate/severe at baseline. There were insufficient cases with severe OCD for a separate analysis. Because this is a secondary analysis of a published RCT, we did not perform a priori power calculations for the analyses included in this report. Significance level was set to $p < .05$ for all analyses. All statistical analyses were conducted using Stata, version 16.1.

Results

Data were available for 151/152 participants at the posttreatment assessment, and for 150 participants at the 3-month follow-up. The number and proportion of participants who were classified as treatment responders and remitters in each of the groups is shown in Table 1. Symptom severity at baseline was not significantly associated with comorbid diagnoses (yes/no) or onset of OCD symptoms ($p > .05$).

Baseline OCD symptom severity did not predict OCD severity at either posttreatment ($\beta = 0.216$, $SE = 0.188$, $p = .254$) or 3-month follow-up ($\beta = 0.182$, $SE = 0.216$, $p = .403$) in the guided ICBT group. By contrast, higher baseline symptom severity was associated with worse outcome in the in-person CBT group at both posttreatment ($\beta = 1.051$, $SE = 0.183$, $p < .001$) and the 3-month follow-up ($\beta = 0.567$, $SE = 0.212$, $p < .01$).

The stratified analyses (Fig. 1 and Table 2) showed that, among the mild cases, there was a statistically

Table 1 Response and remission rates

	Internet-delivered CBT (n = 74)	In-person CBT (n = 78)
Response at posttreatment	39 (53%)	42 (55%)
Response at 3-month follow-up	40 (54%)	53 (70%)
Remission at posttreatment	26 (35%)	33 (43%)
Remission at 3-month follow-up	25 (34%)	38 (50%)

Abbreviation: CBT Cognitive behaviour therapy

significant interaction effect between group and time at posttreatment ($\beta = 3.762$, $SE = 1.285$, $p < .01$) and at the 3-month follow-up ($\beta = 3.479$, $SE = 1.766$, $p < .05$), favouring in-person CBT. Such effect was not observed in the moderate/severe OCD group, either the posttreatment ($\beta = -0.935$, $SE = 1.296$, $p = .471$) or the 3-month follow-up ($\beta = 1.240$, $SE = 1.719$, $p = .471$). We next conducted a series of follow-up analyses to explore whether any treatment process variables could explain these findings. A series of t-tests comparing mild to moderate/severe participants in the ICBT group found no significant differences in treatment credibility, assessed with the Treatment Credibility and Expectancy Scale (TCES; [17]), clinician-rated adherence, captured with the internet interventions Patient Adherence Scale (iiPAS; [18]) or therapist support time per patient (Table 3).

In line with the linear regression analyses, baseline OCD symptom severity did not predict response status at posttreatment (OR = 1.10, 95% CI 0.97 to 1.25, $p = .151$) or 3-month follow-up (OR = 1.08, 95% CI 0.95, $p = .259$) in the internet-delivered CBT group. However, it significantly predicted worse response status in the in-person CBT group at posttreatment (OR = 0.85, 95% CI 0.74 to 0.97, $p < .05$), but not at the 3-month follow-up (OR = 0.89, 95% CI 0.78 to 1.02, $p = .089$). Similarly, baseline OCD severity did not predict remission status at posttreatment (OR = 0.89, 95% CI 0.77 to 1.02, $p = .098$) or at 3-month follow-up (OR = 0.94, 95% CI 0.82 to 1.08, $p = .38$) in the ICBT group. By contrast, in the in-person CBT group, higher baseline OCD severity predicted significantly lower odds of being in remission at both posttreatment (OR = 0.81, 95% CI 0.70 to 0.94, $p < .01$) and at the 3-month follow-up (OR = 0.81, 95% CI 0.70 to 0.93, $p < .01$).

Discussion

A limitation that has been raised with stepped-care models is that all patients are offered a treatment option that may not lead to a positive treatment response. This would not only increase the risk of long-term suffering but also of health care and societal costs. Therefore it is important

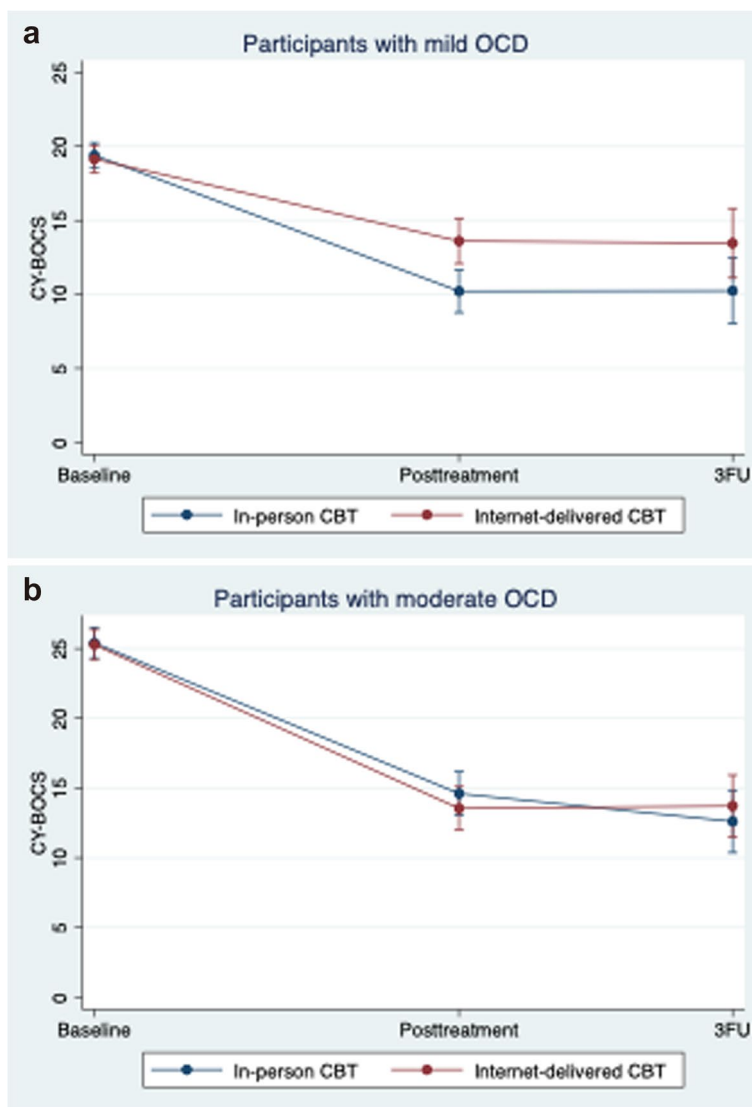


Fig. 1 Treatment outcomes between in-person CBT vs. Internet-delivered CBT, stratified by OCD severity (Panel A displays participants with mild OCD. Panel B displays participants with moderate OCD). Abbreviations: CBT, cognitive behavior therapy; CY-BOCS; Children's Yale-Brown Obsessive-Compulsive Scale; FU, follow-up; OCD, obsessive-compulsive disorder

to ensure that patients are allocated to the most suitable treatment option from the start. The staged or stratified care model potentially solves this issue by offering guided ICBT to individuals with mild symptoms and more intensive treatments to more severe or complex cases [10]. This study formally evaluated the hypothesis that guided ICBT would be most suitable for patients with mild baseline symptom severity. The results did not support our hypothesis. By contrast, we could replicate findings from many previous studies in both adults and children, that higher baseline symptom severity was a predictor of poorer outcomes when CBT is delivered in-person [13, 19].

The reason why mild cases seemed to benefit significantly less from guided ICBT, compared to moderate/severe cases is unclear. We speculated that variables like treatment credibility, adherence to the exposure tasks, or amount of therapist support could potentially explain the findings. However, we did not find support for this in the data. It may be that individuals with mild symptoms are less motivated for change because OCD does not interfere sufficiently with their lives. Physically attending regular sessions with a therapist may somehow compensate for this. However, this is purely speculative and, until reliable moderators of outcome are identified, it will not be possible to confidently stratify

Table 2 Observed CY-BOCS scores stratified by OCD severity

	Mean (SD)	
	Internet-delivered CBT (n = 74)	In-person CBT (n = 78)
Pretreatment		
Mild OCD	19.1 (1.2)	19.4 (1.3)
Moderate-severe OCD	25.3 (2.5)	25.4 (2.6)
Posttreatment		
Mild OCD	13.6 (5.2)	10.1 (4.9)
Moderate-severe OCD	13.5 (6.3)	14.6 (7.7)
3-month follow-up		
Mild OCD	13.5 (5.4)	10.5 (6.7)
Moderate-severe OCD	13.7 (7.4)	12.6 (7.3)

Abbreviations: CBT Cognitive behaviour therapy, CY-BOCS Children’s Yale-Brown Obsessive-Compulsive Scale, OCD Obsessive-compulsive disorder

Table 3 Treatment process variables in internet-delivered CBT stratified by OCD severity (n = 74)

	Mean (SD)		t-test (df)	P-value
	Mild OCD	Moderate-severe OCD		
Credibility	37.3 (9.2)	36.8 (9.8)	0.23 (71)	.820
Adherence	12.4 (5.3)	12.1 (5.3)	0.21 (72)	.838
Therapist time	361.6 (228.1)	318.8 (211.1)	0.82 (72)	.416

Abbreviations: CBT Cognitive behaviour therapy, OCD Obsessive-compulsive disorder

young people with OCD to one or another treatment modality. Until then, the stepped-care approach where all, or the majority, of young people are first offered ICBT seems the most reasonable, as we know that this will result in approximately 55% responders and substantial cost savings [6, 8].

The main strengths with the study are that the data originates from a trial with high degree of precision and psychometric validity, and a highly relevant control group that had equal amounts of treatment credibility and adherence as the ICBT group. However, the study study also has limitations. First, the randomized controlled trial was not originally powered for prediction analysis, and there are likely power issues with the stratification based on baseline OCD severity. The results should therefore be considered preliminary and in need of replication. Second, the study sample might not be generalizable to all children and adolescents who have OCD. For example, youths with autism were excluded, the rate of psychiatric comorbidities may have been somewhat lower than in other studies, and

only a few participants had severe OCD. Finally, our follow-up was relatively short; future studies should therefore investigate if the current findings extend to longer follow-up times.

Conclusions

Overall, if replicated, the results would challenge the widely accepted axiom that internet-delivered CBT is most suitable for milder cases.

Abbreviations

CBT Cognitive behaviour therapy
 CY-BOCS Children’s Yale-Brown Obsessive-Compulsive Scale
 ICBT Internet-delivered cognitive behaviour therapy
 OCD Obsessive-compulsive disorder

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Authors’ contributions

KA, EA, DMC, and ES contributed to the initial study design. KA, KM and LN contributed to acquisition of data. KA conducted the statistical analysis. KA drafted the manuscript. All authors have read and approved the final version of the manuscript. KA had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Availability of data and materials

The dataset analyzed during the current study is not publicly available due to Swedish and EU legislation, but can be made available from the corresponding author on a reasonable request on a case by case basis, according to the current legislation and ethical permits.

Declarations

Ethics approval and consent to participate

The study was approved by the regional ethical review board in Stockholm (Regionala etikprövningsnämnden i Stockholm), Sweden (DNR 2017/1070–31/1). All participants and their caregivers gave written informed consent prior to inclusion.

Consent for publication

Not applicable.

Competing interests

Prof Mataix-Cols receives royalties for contributing articles to UpToDate, Inc, outside the submitted work. Dr Andersson receives royalties from Natur & Kultur for a self-help book on health anxiety and worry.

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References

- National Institute for Health and Care Excellence. Obsessive-compulsive disorder and body dysmorphic disorder: treatment 2005. Clinical guideline. 2005. <https://www.nice.org.uk/guidance/cg31>.
- Geller DA, March J. Practice parameter for the assessment and treatment of children and adolescents with obsessive-compulsive disorder. *J Am Acad Child Adolesc Psychiatry*. 2012;51(1):98–113.
- Cervin M, McGuire JF, D'Souza JM, De Nadai AS, Aspvall K, Goodman WK, Andr n P, Schneider SC, Geller DA, Mataix-Cols D, Storch EA. Efficacy and acceptability of cognitive-behavioral therapy and serotonin reuptake inhibitors for pediatric obsessive-compulsive disorder: a network meta-analysis. *J Child Psychol Psychiatry*. 2024;65(5):594–609.
- Mench n JM, van Ameringen M, Dell'Osso B, Denys D, Figeo M, Grant JE, et al. Standards of care for obsessive-compulsive disorder centres. *Int J Psychiatry Clin Pract*. 2016;20(3):204–8.
- Mataix-Cols D, Marks IM. Self-help with minimal therapist contact for obsessive-compulsive disorder: a review. *Eur Psychiatry*. 2006;21(2):75–80.
- Aspvall K, Andersson E, Melin K, Norlin L, Eriksson V, Vigerland S, et al. Effect of an internet-delivered stepped-care program vs in-person cognitive behavioral therapy on obsessive-compulsive disorder symptoms in children and adolescents: a randomized clinical trial. *JAMA*. 2021;325(18):1863–73.
- Lauri KO, Andersson E, Mataix-Cols D, Norlin L, Eriksson V, Melin K, et al. Long-term effect of stepped-care vs in-person cognitive behavioral therapy for pediatric obsessive-compulsive disorder. *Internet Interv*. 2023;32:100613.
- Aspvall K, Sampaio F, Lenhard F, Melin K, Norlin L, Serlachius E, et al. Cost-effectiveness of internet-delivered vs in-person cognitive behavioral therapy for children and adolescents with obsessive-compulsive disorder. *JAMA Netw Open*. 2021;4(7):e2118516-e.
- Hickie IB, Scott EM, Cross SP, Iorfino F, Davenport TA, Guastella AJ, et al. Right care, first time: a highly personalised and measurement-based care model to manage youth mental health. *Med J Aust*. 2019;211(S9):S3–46.
- Farrell LJ, Waters AM, Storch EA, Simcock G, Perkes IE, Grisham JR, et al. Closing the gap for children with OCD: a staged-care model of cognitive behavioural therapy with exposure and response prevention. *Clin Child Fam Psychol Rev*. 2023;26(3):642–64.
- McGuire JF, Piacentini J, Lewin AB, Brennan EA, Murphy TK, Storch EA. A meta-analysis of cognitive behavior therapy and medication for child obsessive-compulsive disorder: moderators of treatment efficacy, response, and remission. *Depress Anxiety*. 2015;32(8):580–93.
- Lenhard F, Sauer S, Andersson E, Mansson KN, Mataix-Cols D, R ck C, et al. Prediction of outcome in internet-delivered cognitive behaviour therapy for paediatric obsessive-compulsive disorder: a machine learning approach. *Int J Methods Psychiatr Res*. 2018;27(1):e1576.
- Garcia AM, Sapyta JJ, Moore PS, Freeman JB, Franklin ME, March JS, et al. Predictors and moderators of treatment outcome in the Pediatric Obsessive Compulsive Treatment Study (POTS I). *J Am Acad Child Adolesc Psychiatry*. 2010;49(10):1024–33; quiz 86.
- Scahill L, Riddle MA, McSwiggin-Hardin M, Ort SI, King RA, Goodman WK, et al. Children's Yale-Brown obsessive compulsive scale: reliability and validity. *J Am Acad Child Adolesc Psychiatry*. 1997;36(6):844–52.
- Cervin M, Consortium OSB, Mataix-Cols D. Empirical severity benchmarks for obsessive-compulsive disorder across the lifespan. *World Psychiatry*. 2022;21(2):315–6.
- Mataix-Cols D, Fernandez de la Cruz L, Nordsletten AE, Lenhard F, Isomura K, Simpson HB. Towards an international expert consensus for defining treatment response, remission, recovery and relapse in obsessive-compulsive disorder. *World Psychiatry*. 2016;15(1):80–1.
- Borkovec TD, Nau SD. Credibility of analogue therapy rationales. *J Behav Ther Exp Psychiatry*. 1972;3(4):257–60.
- Lenhard F, Mitsell K, Jolstedt M, Vigerland S, Wahlund T, Nord M, et al. The internet intervention patient adherence scale for guided internet-delivered behavioral interventions: development and psychometric evaluation. *J Med Internet Res*. 2019;21(10):e13602.
- Keeley ML, Storch EA, Merlo LJ, Geffken GR. Clinical predictors of response to cognitive-behavioral therapy for obsessive-compulsive disorder. *Clin Psychol Rev*. 2008;28(1):118–30.

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