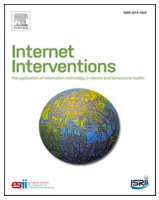
Internet Interventions 35 (2024) 100725

Contents lists available at ScienceDirect

Internet Interventions

journal homepage: www.elsevier.com/locate/invent



Long-term effectiveness and cost-effectiveness of guided internet-based cognitive behavioral therapy for obsessive-compulsive disorder: 24-month follow-up

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ARTICLE INFO

Keywords:
Cognitive behavior therapy
Cost-effectiveness
Internet intervention
Long-term outcome
Obsessive-compulsive disorder

ABSTRACT

This study investigated the long-term effectiveness and cost-effectiveness of guided internet-based cognitive behavioral therapy (ICBT) for obsessive-compulsive disorder (OCD). Twenty-five patients with OCD who had undergone guided ICBT in a randomized controlled trial or a single-arm trial were followed up for 6, 12, and 24 months. Missing data were imputed using the mice package in R, and a one-way analysis of variance with repeated measures was performed. The total Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) score significantly decreased from baseline to all endpoints ($p < 0.001$). OCD remission (the total Y-BOCS score < 14) rates significantly increased from post-treatment (48 %) at the 12 months (80 %) and 24 months (76 %) follow-up ($\chi 2$ (1) = 7.11–11.08, $p < 0.01$) post guided ICBT. Regression analysis predicted the maintenance of remission at 12 and 24 months following post-treatment remission ($z = 2.20$, $p = 0.03$). An incremental cost-effectiveness ratio was calculated to assess the cost-effectiveness of guided ICBT. The incremental cost-effectiveness ratio was JPY 999,495, below the JPY 5 million threshold for willingness to pay in Japan. Our findings demonstrate the long-term effectiveness and cost-effectiveness of guided ICBT for OCD. Guided ICBT can mitigate the severity of OCD even after treatment.

1. Introduction

1.1. Background

Obsessive-compulsive disorder (OCD) is a mental disorder characterized by intrusive obsessions and repeated ritualistic behaviors, with global lifetime and 12-month prevalence rates of 2.3 % and 1.2 %, respectively (Ruscio et al., 2010). Typically, female patients are 1.6 times more likely to experience OCD than their male counterparts (Fawcett et al., 2020). The prognosis for OCD is generally poor, with long-term follow-up studies indicating that 80 % of individuals experience symptoms even 40 years after initial diagnosis (Skoog and Skoog, 1999). Even when treated with Selective Serotonin Reuptake Inhibitors (SSRIs), the remission rate after 10 years remains at 20 % (Bloch et al., 2013). Additionally, the course of OCD is generally chronic, and the risk of developing comorbidities such as major depressive disorder increases over time (van Oudheusden et al., 2018). Given the negative outcomes of OCD, it is important to determine whether treatment effects can be maintained long-term.

1.2. Availability of face-to-face ICBT

In the current National Institute for Health and Care Excellence (NICE) guidelines, cognitive behavioral therapy (CBT) is recommended

Abbreviations: OCD, Obsessive-compulsive disorder; CBT, cognitive behavioral therapy; NICE, National Institute for Health and Care Excellence; ERP, exposure and response prevention; ICBT, internet-based CBT; RCTs, randomized controlled trials; QOL, quality of life; QALY, quality-adjusted life years; ICER, incremental cost-effectiveness ratio; TIC-P, Trimbos/iMTA questionnaire for Costs associated with Psychiatric illness.

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https://doi.org/10.1016/j.invent.2024.100725
Received 28 October 2023; Received in revised form 9 January 2024; Accepted 7 February 2024
Available online 8 February 2024

as first-line treatment (NICE, 2005). The efficacy of CBT, including the exposure and response prevention (ERP) module, in improving OCD severity forms the basis of the recommendations in the NICE guidelines (Skapinakis et al., 2016; Ferrando and Selai, 2021). However, CBT availability remains limited (Lattie and Stamatis, 2022), with practice rates as low as 6.2 % in Japan (Takahashi et al., 2018) and 5.0 % in the United Kingdom (Torres et al., 2007). The implementation rate of CBT for depression is 1 % at psychiatric facilities in Japan (Iida et al., 2020). The significantly low implementation rates of face-to-face CBT are attributed to the shortage of healthcare providers and insufficient time available (Takahashi et al., 2018).

1.3. Effectiveness of guided ICBT

Due to the limited availability and low implementation of CBT, psychotherapeutic interventions delivered via the Internet have become more common. Internet-based CBT (ICBT) is a therapeutic approach that utilizes self-help programs implemented on websites, often accompanied by guidance from trained therapists. Its effectiveness has been well-demonstrated when supported by therapist guidance and promising results have been reported in numerous Western regions and cultural contexts, particularly in Nordic countries (Andersson et al., 2012; Mahoney et al., 2014; Wootton et al., 2019; Lundström et al., 2022). Additionally, the short-term effectiveness of ICBT has been demonstrated in randomized controlled trials (RCTs) within Asian cultural contexts such as Japan and China (Matsumoto et al., 2022; Wu et al., 2023). Recently, an ICBT program for OCD and Body Dysmorphic Disorder was introduced in the Swedish public health system. Lundström et al. (2023) recently reported that this program demonstrated positive outcomes, with a 49 % participant positive response rate, and 21 % achieving remission post-intervention. While this study was a prospective single-arm trial without a control group, it involved a large sample size of 434 participants. A recent network meta-analysis has indicated that guided ICBT was less effective than face-to-face CBT, but superior to psychological/placebo interventions or waiting lists (Zhang et al., 2023).

1.4. Long-term effectiveness of guided ICBT

Previous studies have demonstrated the effectiveness of guided ICBT for the treatment of OCD. However, the evidence supporting these findings is primarily based on short-term OCD outcomes assessed immediately following treatment or at 3 to 6-month follow-up points (Wootton et al., 2013; Herbst et al., 2014; Mahoney et al., 2014; Kyrios et al., 2018; Matsumoto et al., 2022; Wu et al., 2023). In other words, current research on guided ICBT has primarily focused on its short-term effectiveness; only two studies have reported a 12-month long-term follow-up (Wootton et al., 2015; Lundström et al., 2022), while only one reported a 24-month follow-up (Andersson et al., 2014). As OCD follows a chronic course, making judgments about guided ICBT effectiveness based solely on short-term outcomes is insufficient.

1.5. Objective

Previous research lacks sufficient insights into the long-term outcomes of OCD for 24 months post-ICBT intervention, and the factors predicting favorable long-term prognosis remain unclear. Moreover, most studies have been conducted in Western cultural contexts, with very limited research in Asian cultural settings. Furthermore, studies investigating the impact of ICBT on the quality of life (QoL) of patients with OCD are scarce. Considering medical costs, improvement in QoL is a crucial indicator for introducing novel interventions (Office for Health Improvement and Disparities, 2020). Hence, we formulated three hypotheses and analyzed 2-year longitudinal follow-up data from patients with OCD who underwent guided ICBT, as follows:

- Guided ICBT continues to reduce OCD severity over the course of 24 months.
- Remission status at post-treatment predicts favorable long-term prognosis.
- Guided ICBT for OCD is cost-effective in the long term, considering increased QOL and costs.

2. Methods

2.1. Study design

This study investigated the long-term outcomes of patients with OCD who underwent guided ICBT through an RCT and a rescue trial. Specific eligibility criteria, exclusion criteria, treatment strategies, and short-term outcomes have been previously detailed (Matsumoto et al., 2022). The original study was approved by the Chiba University Hospital Ethics Committee (G2019017) and registered in the Japanese Clinical Trial Registry (UMIN00039375). This follow-up study was approved by the Ethics Committee of Chiba University Graduate School of Medicine (ID: 3922).

2.2. Outcomes measure

2.2.1. Primary measure for OCD severity

The primary outcome of this study was the Y-BOCS total score, which measures OCD severity (Goodman et al., 1989; Nakajima et al., 1995). Y-BOCS measurements at baseline and post-treatment were performed by a trained clinical psychologist (SH). During the follow-up period, participants were mailed the Y-BOCS self-report version and encouraged to complete and return the scale (Baer, 1991; Hamagaki et al., 1999). The Y-BOCS consists of 10 items, each of which scored on a Likert scale from 0 to 4 (range 0–40), and the Y-BOCS total score of 13/14 was used as the cutoff for OCD (Farris et al., 2013).

2.2.2. Secondary measure for QoL

We calculated quality-adjusted life years (QALY) using the EuroQol 5-Dimension 5-Level (EQ-5D-5L) to determine the cost-effectiveness of novel treatments as a healthcare technology (van Hout et al., 2012; Ikeda et al., 2015). The EQ-5D-5L questions assess various dimensions of QoL. Health status was evaluated across five dimensions, namely mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension comprised five levels, namely no problems, slight problems, moderate problems, severe problems, and extreme problems. QALY scores range from 0.0000 (worst health) to 1.0000 (full health). The developed Japanese version of EQ-5D-5L is highly reliable.

2.2.3. Cost of guided ICBT

The total costs were determined based on the actual cost of guided ICBT, including a website and a chat tool on the treatment. The total cost of ICBT was calculated using Japanese healthcare costs, including JPY 3500 per session for 12 sessions per patient, along with ICBT program costs, which comprised an e-learning platform that costs JPY 5500 per month for 3 months and a chat tool that costs JPY 6600 per month for 3 months. The cost of JPY 3500 per session refers to the amount charged per session when CBT is conducted by a non-physician healthcare provider (Ministry of Health, Labor and Welfare, 2020). The e-learning platform utilized was LearningBOX (learningBOX Inc., Tatuno, Japan) and the chat tool was ShareMedical (ShareMedical Inc., Tokyo, Japan).

2.3. Intervention

The participants underwent an ICBT intervention guided by a therapist, which consisted of 12 sessions. The participants followed one session of the ICBT program per week. The treatment module was developed based on evidence-based CBT manuals, the gold standard for OCD treatment, and included psychoeducation, Theories A and B,

behavioral experiments, exposure and response prevention (ERP), various types of exposure, mindfulness, relaxation, and relapse prevention. The therapist initiated the sessions and provided the participants with notifications to inform them that a new session had started. After each ICBT session, participants were given a brief debriefing to practice CBT skills in their daily lives. For questions about the treatment course, the participants were allowed to contact the therapist via a chat tool or telephone. No face-to-face sessions were conducted during the treatment period.

2.4. Statistical analyses

2.4.1. Overview of statistical analytics strategy

Data are presented as mean values, standard deviations, frequencies, and percentages. Missing-value imputation was performed using the free software package "mice" in R version 4.3.1 (R Foundation, Vienna, Austria) to handle missing values (R Core Team, 2011; van Buuren and Groothuis-Oudshoorn, 2011).

As a primary analysis, we performed repeated measures analysis of variance (ANOVA) for a one-way design. As a sensitivity analysis, several procedures were performed to examine the impact of additional face-to-face CBT on patients. Two separate statistical analyses were conducted in the sensitivity analysis. In addition, to the primary analysis, we conducted a regression analysis to determine whether the remission status immediately post-treatment can predict favorable long-term outcomes. Between post-treatment and follow-up points, to determine whether there was an increase in the proportion of remitters, McNemar tests were performed. Furthermore, a cost-effect analysis was conducted to evaluate the provision of additional guided ICBT for outpatients with OCD undergoing standard treatment. Statistical analyses were performed using SPSS version 28 (IBM Corp., Armonk, New York, United States) or free soft R version 4.3.1 (R Foundation, Vienna, Austria). The Bonferroni correction was used to adjust for multiple comparisons, with the significance level set at $p < 0.05$.

2.4.2. Primary analysis

Repeated measures ANOVA was performed to test for any significant differences in the Y-BOCS total scores among the four assessment time points. After conducting repeated measures one-way ANOVA, multiple comparison tests were performed to determine whether there was a significant decrease in the Y-BOCS total score between any assessment time points compared with baseline. Consistent with the previous RCT and a single arm trial, statistical analyses were conducted on clinical outcomes related to depression and generalized anxiety, following the same approach as the primary analysis (please refer to the supplementary materials for details).

2.4.3. Additional analyses

Paired binary data for remitters, defined as individuals with the Y-BOCS total score < 14 at assessment points, were analyzed using McNemar tests in R to investigate the increase in the proportion of OCD remitters during the 24-month follow-up period from post-intervention. Additionally, we conducted a regression analysis to determine whether the remission status immediately post-treatment can predict favorable long-term outcomes.

2.4.4. Sensitivity analysis

We collected information on participants who received additional face-to-face CBT during the follow-up period. To investigate the potential additional treatment effects on those who underwent face-to-face CBT, unpaired *t*-tests were conducted for the Y-BOCS total scores at three follow-up time points between participants with and without face-to-face CBT. Additionally, participants who received additional face-to-face CBT were excluded, and a repeated measures ANOVA was performed for those who received guided ICBT only.

2.4.5. Cost-effectiveness analysis

For the cost-effectiveness analysis, the incremental cost-effectiveness ratio (ICER) was outputted. The ICER is an indicator developed for healthcare cost-effectiveness, which is defined as the difference in intervention costs divided by the difference in intervention effects. The incremental ICER was calculated as follows:

$$ICER = \frac{\Delta Cost}{\Delta Effect}$$

In this cost-effectiveness analysis, we utilized QALYs based on EQ-5D-5L's QoL values for the effectiveness measure. The incremental effect was calculated as the difference between the area under the curve of QALYs based on EQ-5D-5L QoL values at each assessment time point and the area under the curve of QALYs assuming no change in QoL over the 24 months (benchmark). The incremental cost was determined based on the total cost of guided ICBT. Evaluating the monetary value associated with gaining one QALY will allow for the assessment of the societal acceptance of interventions. For instance, the willingness-to-pay (WTP) per 1.000 QALYs among the Japanese population is estimated at JPY 5 million (Shiroiwa et al., 2016). In other words, if the cost of an intervention falls below JPY 5 million for an increase of 1.000 QALYs (full health), the novel intervention is considered cost-effective.

3. Results

3.1. Participants characteristics

The flow chart of the present study is shown in Fig. 1. The mean age of the 25 participants (14 males and 11 females) was 29.8 (SD = 12.7, range 15–60) years. Table 1 shows the participant demographics. Five adolescents (2 male and 3 female participants) and 20 adults (12 male and 8 female participants) were included in the present study (Supplementary Materials Table S1). All outcome data were available for 14 participants, whereas 11 had missing values at least one. The group with complete data ($n = 14$) had a higher mean age than the group with missing values ($n = 11$). The participants' characteristics categorized by the presence of missing values were shown the Supplementary Materials (Table S2).

3.2. Long-term outcome

Fig. 2 illustrates the trends in the Y-BOCS total scores in participants who underwent guided ICBT for 24 months. Table 2 shows results of multiple comparisons tests. The results of repeated measure ANOVA showed significant changes in means of the Y-BOCS total scores among the endpoints ($F(4,96) = 22.02$, $p < 0.001$), while multiple comparisons tests showed a significant difference between baseline and the other endpoints ($p < 0.001$). After the intervention, means (SE) of the Y-BOCS total scores showed significant decrease, dropping to 8.48 (1.10) (95 % CI: 5.09–11.87) at post-intervention, 11.20 (1.68) (95 % CI: 6.02–16.38) at 6 months, 14.36 (1.89) (95 % CI: 8.51 to 21.65) at 12 months, and 14.48 (2.32) (95 % CI: 7.31 to 21.65) at 24 months. The results of the analysis for all outcomes at baseline, post-intervention, and three follow-up time points including depression and anxiety are listed in Supplementary Materials Tables S3–S5.

3.3. Results of additional analyses

The remission rates were 44 % immediately after guided ICBT, 72 % at the 6-month follow-up, 80 % at the 12-month follow-up, and 76 % at the 24-month follow-up. Comparative analyses conducted across all follow-up time points revealed a significant increase in the proportion of individuals in remission ($\chi^2(1) = 7.11$–11.08, $p < 0.01$). Furthermore, regression analysis showed that remission status immediately after ICBT was a significant predictor of remission at both the 12-month ($z = 2.20$, $p = 0.03$) and 24-month ($z = 2.20$, $p = 0.03$) follow-ups.

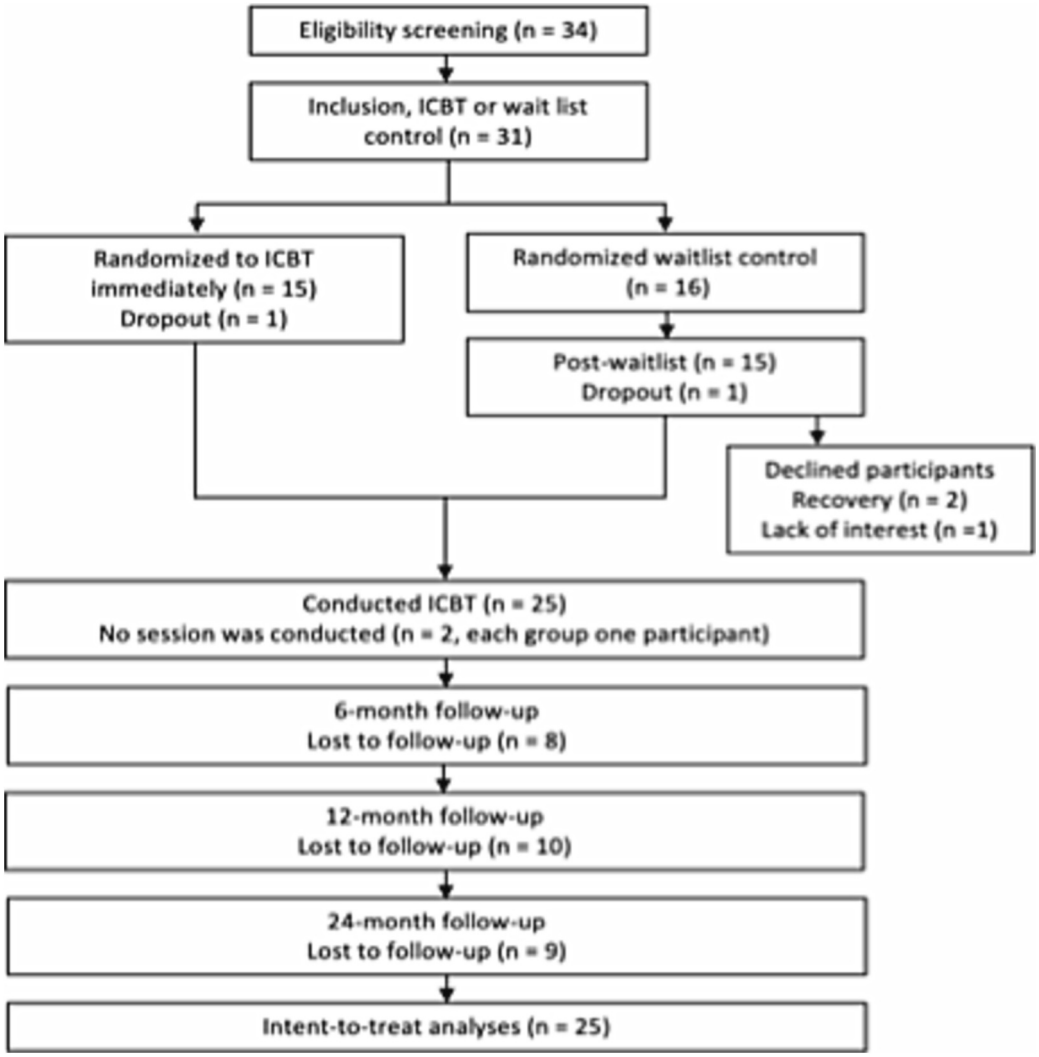

Fig. 1. Study flow chart.

3.4. Results of sensitivity analyses

During the 24-month follow-up period, eight patients (32 %) underwent additional face-to-face CBT. Among the 14 individuals with residual OCD symptoms immediately post-treatment, 7 received additional face-to-face CBT, while 1 participant, who had achieved remission from OCD, sought face-to-face CBT to address comorbid social anxiety disorder. Un-paired *t*-tests revealed no significant differences in the mean severity of OCD at the three follow-up time points between the groups. However, the participants who received additional face-to-face CBT exhibited a more severe level of obsessive-compulsive symptoms at the end of the ICBT program (Supplementary Materials Table S6).'

Among the 17 participants without additional face-to-face CBT, one-way repeated measures ANOVA demonstrated a significant reduction in the mean Y-BOCS total score ($F(4,64) = 14.59$, $p < 0.001$). The results of the multiple comparisons test showed significant change at all endpoints from baseline ($p < 0.001$) (Supplementary Materials Table S7).

3.5. Cost-effectiveness of guided ICBT for OCD

Repeated measure ANOVA results showed non-significant changes in the means of QALYs calculated by the EQ-5D-5L regarding the endpoints ($F(4,96) = 2.83$, $p < 0.053$). However, multiple comparison tests showed significant differences between baseline and 6 months and 24 months follow-up ($p = 0.008$–0.01). After the intervention, the means (SE) of QALYs showed significant increases, up to 0.09594 (0.03) (95 % CI: 0.01592–0.17596) at 6 months and 0.12330 (0.04) (95 % CI: 0.02452–0.22209) at 24 months (Table 2).

Fig. 3 shows increased QALYs over 2 years following guided ICBT compared with the benchmark. Based on the baseline assumption, the QALY for two years was 1.35808. Consequently, the incremental QALY over the two years was 0.09905. The corresponding incremental cost incurred was JPY 99,000; therefore, the resulting ICER was JPY 999,495, which is less than the JPY 5 million threshold for the willingness to pay per 1.0 QALY (Shiroiwa et al., 2016), indicating that the new intervention is cost-effective in the long term.

4. Discussion

4.1. Principal findings

This study investigated the 24-month long-term outcomes of guided ICBT for OCD. The severity of OCD significantly decreased from post-intervention to the 24-month follow-up compared with baseline. The remitter rates significantly increased following guided ICBT, and remission status immediately after guided ICBT was a predictor of improved long-term outcomes. This study provided evidence for the prolonged treatment effect of guided ICBT for outpatients with OCD, expanding previous findings.

Table 1
Participant demographics.

Variable	Participant (n = 25)
Sex	
Male, n (%)	14 (56.0 %)
Female, n (%)	11 (44.0 %)
Age (years), Mean (SD)	
Mean (SD)	29.8 (12.7)
Range	16–60
Total Y-BOCS score at baseline	
Mean (SD)	22.8 (4.8)
Range	15–33
Pharmacotherapy, n (5)	16 (64.0 %)
Antidepressants, n (%)	14 (56.0 %)
Anxiolytics, n (%)	3 (12.0 %)
Antipsychotics, n (%)	6 (24.0 %)
Comorbidities	13 (52.0 %)
MDD, n (%)	6 (24.0 %)
Panic Disorder, n (%)	5 (20.0 %)
Agoraphobia, n (%)	4 (16.0 %)
SAD, n (%)	5 (20.0 %)
GAD, n (%)	1 (4.0 %)
ADHD, n (%)	1(4.0 %)
ASD, n (%)	4 (16.0 %)
Response (change in total Y-BOCS score < 35 %), n (%)	16 (64.0 %)
Remission (total Y-BOCS score < 14), n (%)	11 (44.0 %)
Need for face-to-face CBT, n (%)	8 (32.0 %)

Note: ADHD, attention-defect hyperactivity disorder; ASD, autism spectrum disorder; CBT, cognitive behavioral therapy; GAD, generalized anxiety disorder; MDD, major depressive disorder; n, number; SAD, social anxiety disorder; SD, standard deviation; Y-BOCS, Yale-Brown obsessive-compulsive scale.

4.2. Long-term effectiveness

We observed a significant reduction in OCD severity compared with baseline, not only immediately post-intervention but also at the 6-, 12-, and 24-month follow-up periods. Most previous guided ICBT studies have focused on short-term effectiveness (Andersson et al., 2012; Mahoney et al., 2014; Wootton et al., 2013; Wootton et al., 2019; Wu et al., 2023), while our findings suggest long-term effectiveness, which has never been reported. The proportion of remitters increased from 44 % post-treatment to 80 % at the 12-month follow-up and 76 % at the 24-month follow-up, suggesting that guided ICBT has a delayed treatment effect on OCD. The delayed treatment effect has been reported as a phenomenon in guided ICBT for pediatric OCD (Lenhard et al., 2020). Previous studies examining long-term outcomes through ≥12-month follow-ups have not observed such delayed treatment effects in face-to-face ERP (Højgaard et al., 2017; Melin et al., 2020; Matsumoto et al., 2020). Rather, ERP studies on OCD suggest a decrease in treatment effect 12 months post-treatment (Foa et al., 1984; Matsumoto et al., 2020).

The current 24-month follow-up study included 5 adolescents aged 15–17 years and 20 adults aged 18–60 years at baseline: the age of

Table 2
Results of multiple comparison tests.

Measures	Time-point	Mean difference	SE	*P*-value	95 % confidence intervals (Lower bound, Upper bound)
Y-BOCS					
	Post	−8.48	1.01	<0.001	5.09, 11.88
	6 months	−11.20	1.68	<0.001	6.02, 16.38
	12 months	−14.36	1.89	<0.001	8.51, 20.21
	24 months	−14.48	2.32	<0.001	7.31, 21.65
EQ-5D-5L					
	Post	0.07488	0.03	0.21	−0.16869, 0.01893
	6-month	0.09594	0.03	0.01	0.01592, 0.17596
	12-month	0.07623	0.05	1.00	−0.22460, 0.07214
	24-month	0.12330	0.04	0.008	0.02452, 0.22209

Note: EQ-5D-5L: EuroQol 5 dimension-5 levels 5 lists; Y-BOCS, Yale-Brown Obsessive-Compulsive Scale; SE, standard error.

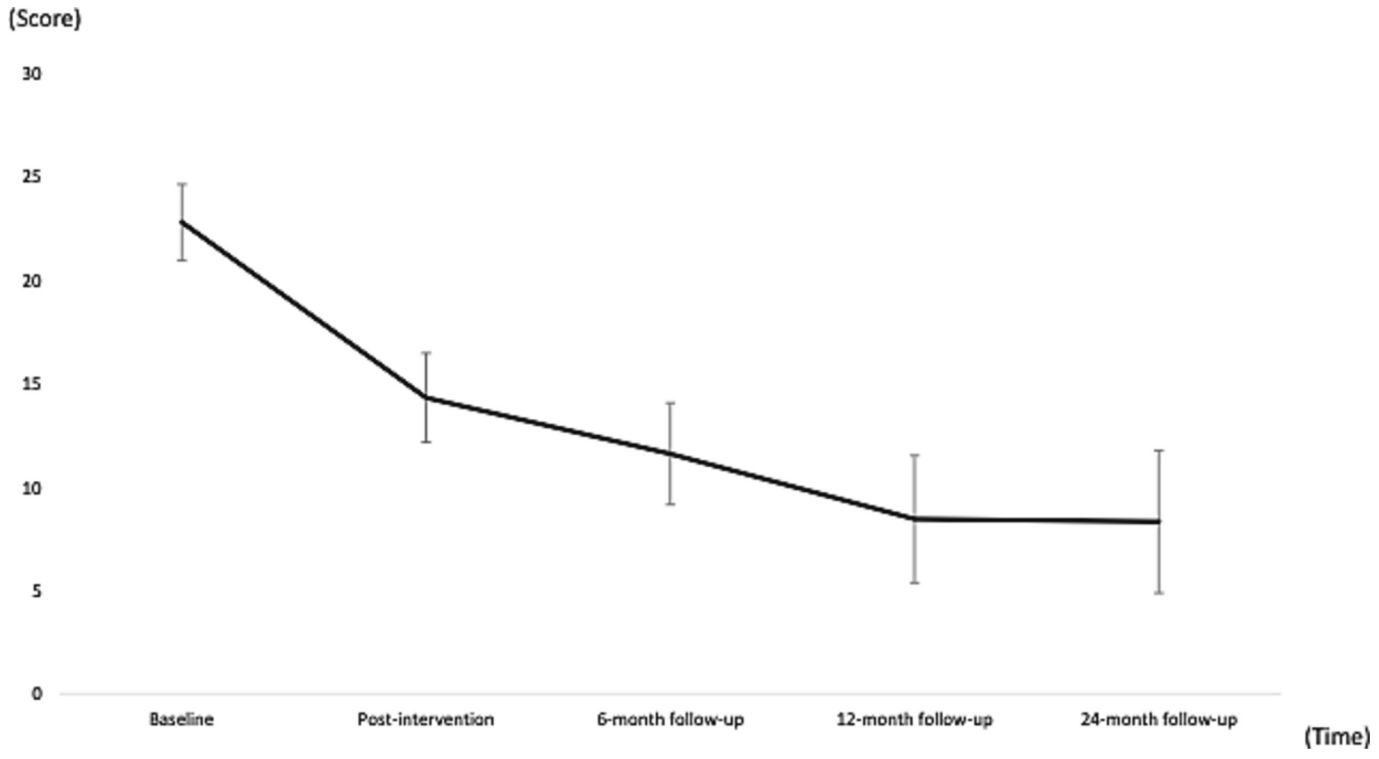

Fig. 2. Primary outcome result.

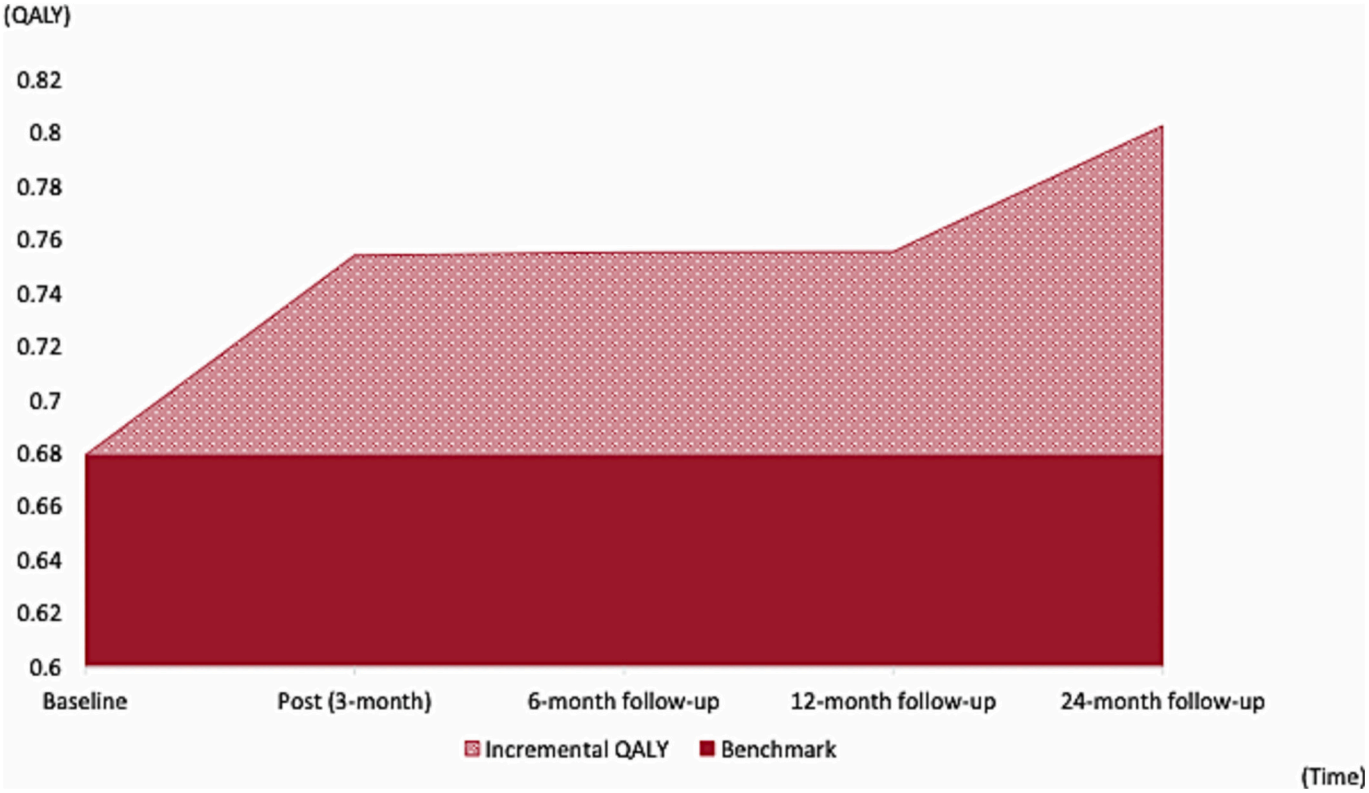

Fig. 3. Incremental QALYs.

adulthood is set at 18 years in Japan. All participants received guided ICBT; during the intervention, they had psychiatric outpatient visits, with the majority undergoing pharmacotherapy (64.0 %). Since 60 % (n = 3) of the adolescents and 65 % (n = 13) of the adults were on pharmacotherapy, the outcomes of the present study likely could have reflected the combined effects of CBT and medication (Mao et al., 2022). A network meta-analysis of 54 RCTs suggested that the combination of psychotherapeutic and psychopharmacological interventions was more effective in treating severe OCD (Skapinakis et al., 2016). Considering long-term observations, future research should consider the combination of pharmacotherapy and ICBT.

In the present study, 8 participants opted for additional face-to-face CBT immediately after completing guided ICBT. Their decision was likely influenced by the relatively limited response to OCD during guided ICBT (Supplementary Materials Table S6). The 8 participants who underwent face-to-face CBT showed no significant differences in the severity of obsessive-compulsive symptoms compared with a group of 17 participants who did not receive additional treatment at 6, 12, and 24 months. Therefore, the additional face-to-face CBT might have been therapeutically effective in treatment-resistant participants. Three (60 %) of the five adolescents received voluntarily additional face-to-face CBT. In contrast, 5 (25 %) of 20 adults received voluntarily for additional CBT. Improving adherence to treatment is crucial in ICBT compared to face-to-face CBT (Kambeitz-Ilankovic et al., 2022). Factors such as literacy skills, concentration, and individual capabilities are considered to be lower in adolescents compared to adults, potentially influencing treatment adherence in ICBT (Johansson et al., 2015). Further research should investigate these factors to assess their impact on ICBT response.

In the ICBT of the present study provided, cognitive interventions, such as psychoeducation, regarding OCD-specific psychopathology, Theory A vs. B, and behavioral experiments were incorporated in the first half of the treatment modules, alongside ERP. Interestingly, the only other ICBT study on OCD in adults with a 24-month follow-up also showed that the severity of Y-BOCS and OCI symptoms did not significantly decrease after treatment, although recovery rates continued to increase (Andersson et al., 2014). In this study, alongside ERP, metacognitive cognitive restructuring was also provided. Integrating cognitive therapeutic techniques with ERP in a complex CBT approach may enhance the effectiveness of OCD treatment (Aardema et al., 2022). A recent systematic review and meta-analysis suggested that CBT with diverse components can be highly efficacious in the treatment of OCD (Ferrando and Selai, 2021). Incorporating these findings into the context of ICBT, where reading text posted on the website forms a central part of therapy, can be feasible and beneficial. The features of repeated access in ICBT may contribute to the improvement in long-term outcomes. Given the effectiveness of repetitive trials in maintaining knowledge and skills (Sennhenn-Kirchner et al., 2018; Spreckelsen and Juenger, 2017), the inclusion of behavioral experiments in guided ICBT, verifying obsessional catastrophic consequences such as death, curses, harm, and accidents, may lead to favorable long-term prognoses. Future research should examine how the stages of change in the health behaviors of patients undergoing ICBT evolve at various follow-up points and how these changes affect treatment.

4.3. *Cost-effectiveness of guided ICBT for OCD*

Cost-effectiveness analyses revealed that guided ICBT for OCD was cost-effective in the Japanese healthcare system. The results of the present study supported the findings of the only previous health economic evaluation study on guided ICBT for OCD conducted in Japan by Matsumoto et al. (2022). In an earlier study, the QALY gain post-treatment compared with usual care was 0.02. However, this gain significantly increased in our study to 0.09905 over 24 months. Moreover, the cost-effectiveness analysis revealed that the additional cost required to achieve a unit increase in QALY was JPY 999,495, which is lower than the cost (JPY 4,950,000) estimated from the previous short-term outcome. This new estimate falls below the Japanese willingness-

to-pay threshold of JPY 5 million (Shiroiwa et al., 2016). These findings suggest that guided ICBT is more cost-effective for OCD in the long term than in the short term in Japan. To the best of our knowledge, this study is the first to provide evidence based on long-term observational data in guided ICBT for OCD in Japan. The previous studies on guided ICBT in adults with OCD has suggested short-term cost-effectiveness based on follow-up data from treatment initiation to 6 months (Andersson et al., 2015; Matsumoto et al., 2022; Wu et al., 2023). To our knowledge, the present study provides the first evidence of sustained cost-effectiveness for 24 months based on actual measured QALYs, thus expanding insights into the cost-effectiveness of guided ICBT in patients with OCD. Given the cost-effectiveness of guided ICBT and its relatively low cost, even marginal QALY gains seem to fall below willingness-to-pay thresholds, whether in the short or the long term. On the other hand, a cost-benefit analysis from the perspective of social costs has not been performed in this study due to the unavailability of data on direct and indirect costs. In Australia, Sweden, and China, the analysis from a societal perspective suggested that guided ICBT options could deliver substantial benefits to society (Andersson et al., 2015; Osborne et al., 2019; Wu et al., 2023). Since economic evaluations could significantly influence the structure of the healthcare system within regions or countries, future studies of guided ICBT for OCD in Japan should conduct cost-benefit analysis from the perspective of social costs.

4.4. Naturalistic observation method in the present study

The present study was designed using a naturalistic observation method. The strengths of the naturalistic approach lie in its high ecological validity, allowing researchers to record behaviors that would naturally occur in the environment without external interference. However, there is a limitation: researchers could not control variables, making replication of the study impossible for reliability confirmation (Tutor2u, 2021). In this study, naturalistic observation suggested that individuals receiving guided ICBT for OCD showed sustained improvement in OCD symptoms over two years. However, limitations related to data attrition and the inherent characteristics of this method might have affected its reliability. Outside Japan and Sweden, there is a lack of studies with a 24-month follow-up after intervention (Andersson et al., 2014). Therefore, future research should focus on cross-cultural longitudinal studies with large samples to verify the reliability of these findings.

4.5. Limitations

The first limitation of this study is the lack of data on naturalistic designs. To address this limitation, we performed data imputation to create a pooled dataset. Second, data on several long-term outcomes were collected via mail using self-completed forms, which might have introduced bias. Third, there was no control condition in the present study. Ideally, a randomized long-term cohort study comparing treatment as usual with guided ICBT should be conducted. Fourth, the cost-effectiveness judgment was based solely on willingness to pay and did not rely on observed data of direct and indirect costs of the treatment. Costs can be calculated using the Trimbos/iMTA questionnaire for costs associated with psychiatric illness (TIC—P) (Roijen et al., 2002). At the initiation of the previous RCT, the Japanese version of the TIC-P was not available, preventing the collection of cost data of each participant. For future research, cost-effectiveness analysis should incorporate a broader range of treatment costs using the Japanese version of TIC—P. Finally, owing to the small sample size in this study, a larger cohort study remains warranted to confirm our findings.

5. Conclusions

Our study results confirmed the three hypotheses of this research, namely guided ICBT for OCD continues to improve OCD severity in the long term, individuals achieving remission immediately post-intervention maintain favorable long-term outcomes, and guided ICBT remains cost-effective for the long term.

CRediT authorship contribution statement

KM contributed to the conception and design of this study, as well as data acquisition, analysis, and interpretation of the results. SH contributed to the conception of this study, data acquisition, analyses, and interpretation of the results. ES contributed to the conception and design of this study. All authors contributed to the drafting and critical revision of the manuscript, approved the final manuscript, and took responsibility for all aspects to ensure that questions regarding the accuracy or completeness of any part of the work have been investigated.

Declaration of competing interest

The authors declare no competing interest.

Acknowledgments

We extend our gratitude to the participants who participated in this observational study. We also thank Editage for English language editing.

Funding

This study was funded by the Japan Society for the Promotion of Science KAKENHI Grant-in-Aid for Scientific Research (Grant Number 18K03130 and 22H00985), Takeda Science Foundation 2020 Medical Research Grant. The publication of the results from this study was also supported by the Young Researchers Support Program and the Research Associate Professor System at Kagoshima University.

Clinical trial registration

Japanese Clinical Trial Registry (UMIN000039375).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.invent.2024.100725.

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