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Cost-effectiveness analysis of telephone cognitive-behaviour therapy for adolescents with obsessive-compulsive disorder

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Abstract

Background: Telephone cognitive-behaviour therapy (TCBT) may be a cost-effective method for improving access to evidence-based treatment for obsessive-compulsive disorder (OCD) in young people.

Aims: Economic evaluation of TCBT compared to face-to-face CBT for OCD in young people.

Method: Randomised non-inferiority trial comparing TCBT to face-to-face CBT for 72 young people (aged 11 to 18) with a diagnosis of OCD. Cost-effectiveness at 12-month follow-up was explored in terms of the primary clinical outcome (CY-BOCS) and quality-adjusted life-years (QALYs).

Results: Total health and social care costs were higher for face-to-face CBT (mean total cost £2965, SD £1548) than TCBT (mean total cost £2475, SD £1024) but this difference was non-significant (p=0.118). There were no significant between-group differences in QALYs or the CY-BOCS and there was strong evidence to support the clinical non-inferiority of TCBT. Cost-effectiveness analysis suggests a 74% probability that face-to-face CBT is cost-effective compared to TCBT in terms of QALYs, but the result was less clear in terms of CY-BOCS, with TCBT being the preferred option at low levels of willingness to pay and the probability of either intervention being cost-effective at higher levels of willingness to pay being around 50%.

Conclusions: Although cost-effectiveness of TCBT was sensitive to the outcome measure used, TCBT should be considered a clinically non-inferior alternative when access to standard clinic-based CBT is limited, or when patient preference is expressed.

Declaration of interest

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Introduction

Obsessive-compulsive disorder (OCD) is a serious and disabling disorder which often begins in childhood.[1,2] OCD causes significant disruption to the child's academic, family and social life, and impairs the child's cognitive and psychosocial development.[2-4] Because OCD is often a chronic condition, it imposes substantial long-term economic and social burdens at both the individual and national levels.[5,6] The direct ($2.1 billion) and indirect costs ($6.2 billion) of OCD was estimated to be $8.4 billion a year in 1990 USD prices, accounting for 5.7% of the costs of all mental illnesses.[5] In the UK, the total costs of anxiety disorders (service costs and lost earnings), including OCD, was projected to be £14.2 billion (at 2007 prices) in 2026.[6] Despite the well-documented effectiveness of cognitive-behaviour therapy (CBT) in treating this patient group,[7] under-diagnosis and under-treatment are common, partly due to inequalities in access to treatment.[8-11] Following the call from the National Service Framework for Mental Health to improve accessibility of effective treatments for common mental health problems,[12] alternative treatment modalities using current technologies such as telephone and computer are increasingly being researched and developed.[10,13] Evidence in adult OCD suggests that telephone CBT (TCBT) shows promising advantages over face-to-face CBT in terms of reduced service and patient costs, and improved accessibility and convenience.[14-16] This study reports the results of an economic evaluation of TCBT in a group of young people with OCD carried out alongside a randomised controlled trial.[17]

Method

Hypothesis

The economic aim of the trial was to compare the cost-effectiveness of TCBT with face-to-face CBT in treating young people with OCD. We hypothesised that TCBT would be cost-effective at a service level compared to face-to-face CBT.

Trial design

Participants were recruited by referral from primary care general practitioners, and from mental health professionals within secondary and tertiary care settings within the National Health Service (NHS) to a specialist OCD clinic between 2008 and 2011. Information about the study was conveyed by word of mouth, letter to referring agencies, advertisements published on webpages of national OCD charities within the UK, and by a research support organisation within the NHS (the Mental Health Research Network).

Inclusion criteria were: (a) primary OCD according to DSM-IV criteria,[18] (b) a Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS)[19] score of 16 or greater, indicating moderate to severe impairment, (c) aged 11 to 18 years; (d) medication free or on a stable dose of medication for a period of 12 weeks or greater, (e) no suicidal intent, drug or alcohol abuse, or psychotic symptoms, (f) no learning disability or pervasive developmental disability, (g) need and want CBT, and agreeable to randomisation, and (h) agreeable to parental involvement in treatment. Exclusion criteria were: (a) current diagnosis of psychosis, current alcohol or substance abuse/dependence, (b) English too poor to engage in treatment, (c) severe disabling neurological disorder, (d) diagnosed global learning disability or pervasive developmental delay, and (e) characteristics interfering with completion of treatment within trial (e.g. a life-threatening or unstable medical illness).

After initial clinical assessments, eligible participants attended a second clinic appointment approximately 8 weeks later. Participants who remained symptomatic were randomised to CBT or TCBT in a 1:1 ratio using a computer-generated randomisation sequence prepared before the study commenced. There were no restrictions or matching. A repeated measures design was used and assessments were conducted immediately before treatment (i.e., baseline), immediately after treatment (i.e., post-treatment), and at follow-up points scheduled at 3-months, 6-months, and 12-months post-treatment.

Ethics statement

The study protocol was approved by the Joint South London and Maudsley / Institute of Psychiatry Research Ethics Committee (08/H0807/12).

Consent statement

Written informed consent was obtained from all parents and participants over 16 years, and informed assent from participants under 16 years after a detailed description of the study had been given.

Clinical trials registration number

The trial was registered on the International Standard Randomized Controlled Trial Number Register (ISRCTN27070832).

Interventions

Treatment consisted of 14 sessions of CBT, lasting approximately 60 minutes, delivered by six experienced clinical psychologists following a detailed treatment manual. Treatment was

identical within conditions except that participants randomised to TCBT received all treatment sessions via telephone. Sessions 1-2 consisted of psycho-education, sessions 3-12 consisted of graduated exposure with response prevention (E/RP) and incorporated various cognitive strategies as appropriate, sessions 13-14 consisted of relapse prevention and ongoing symptom management (if required). The treatment protocol incorporated 10 minutes of parental discussion at the end of each treatment session. Homework E/RP tasks were assigned between sessions and participants were encouraged to complete daily E/RP. The treatment protocol has been validated in previous trials.[20,21] All 14 sessions were required to be completed within 17 weeks, allowing illness, missed appointments, or holidays to be accommodated. Treating therapists received supervision by senior clinical psychologists who were specialists in CBT for OCD and all sessions (wherever possible) were audio recorded. A random sample of n=225 (25%) recorded sessions were audited and independently rated for integrity to protocol. The rate of adherence to the manual was 93% and there were no differences in adherence ratings between conditions.[17]

Outcomes

Research assessments were completed in face-to-face interviews at baseline, post-treatment, 3-months, 6-months and 12-months post-treatment. The primary outcome measure for the economic evaluation was the Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS),[19] which was administered by an independent clinician blinded to treatment condition. CY-BOCS is a detailed semi-structured clinician administered interview, incorporating a 10-item inventory of paediatric OCD symptoms severity, and is comprised of an obsession severity score and compulsion severity score. Using a 5-point scale for each item (score 0 to 4), the total scores range from 0 to 40, where higher scores indicate worse outcomes. The CY-BOCS has demonstrated robust psychometric properties, with good

internal consistency, convergent and divergent validity reported[19] and has been shown to respond to change.

Secondary analysis explored cost-effectiveness in terms of quality-adjusted life years (QALYs), using the self-report EQ-5D-3L (5 dimensions, 3 levels) measure of health-related quality of life.[22] The EQ-5D is a generic questionnaire that assesses health-related quality of life on five dimensions including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension has three levels, leading to a total of 243 possible health states, each of which is associated with a score used to calculate QALYs. The questionnaire also contains a visual analogue scale (VAS) which enables participants to rate their current health state between zero (worst imaginable health state) and 100 (best imaginable health state).

Being a generic health state measure, the EQ-5D allows policy makers to make comparisons, and most importantly, resource allocation decisions, across competing interventions within the same patient group or more broadly across different disease areas and populations. The EQ-5D is used extensively in economic evaluations of mental health disorders, despite a lack of evidence to support the relevance and validity of the measure in all mental health populations, particularly young populations. Psychometric assessment of the EQ-5D in young people with persistent major depression provides evidence of weak to moderate validity and responsiveness.[23] However, further research is needed to test the generalisability of these results to other child and adolescent mental health populations.[23] For this reason, the EQ-5D is used to supplement results from the primary cost-effectiveness analysis in this study.

Costs

Economic data were collected in interview at baseline, post-treatment and 3-month, 6-month and 12-month follow-ups. The economic evaluation took a health and social care perspective but additionally included carer costs which were expected to be influenced by treatment delivery method (telephone or face-to-face). Service use information was recorded using the Child and Adolescent Service Use Schedule (CA-SUS), which included hospital and community health and social services, and concomitant psychotropic medications. Travel costs and productivity losses of the primary carer were recorded using the Carer Service Use Schedule (CARER-SUS). Both schedules have been designed based on previous economic evaluations in child and adolescent mental health populations.[24,25] All unit costs are reported in Pound Sterling and were for the financial year 2010-2011, which was the most recent year over which the trial data were collected. No discounting was necessary due to the short duration of the trial.

A nationally applicable unit cost for CBT for young people of £115 per hour of face-to-face contact was applied to all CBT sessions young people attended in the trial.[26] Sessions that young people did not attend (DNAs) were assumed to have a zero cost on the basis that the clinician would be able to make use of the time available to do something else. This unit cost was based on estimates from a randomised controlled trial of interventions for adolescents with major depression[25] and includes the cost of supervision and relevant overheads (management, administrative, capital, estates etc.). Expert opinion was sought which confirmed that this unit cost was reasonable, given similarities in the grade and seniority of the therapists involved and the length of the sessions. In addition, data collected by therapists at each session, which included session length, confirmed that the average length of time spent delivering TCBT sessions was equal to that of face-to-face sessions (mean 62 minutes

in both groups) hence the same cost was applied to both treatment conditions. Costs of psychotropic medication were taken from the British National Formulary,[27] and costs of hospital contacts, including in-patient and out-patient appointments, and accident and emergency attendance, were obtained from the National Schedule of Reference Costs.[28] Contacts with community health and social services were taken from national publications.[26] Unit costs were multiplied by the corresponding service use data to generate total service costs per patient.

Productivity losses of the primary carers were valued using the human capital approach.[29] This involves multiplying the individual's salary by hours of absence from work due to their child's illness. Travel costs of public transport, such as train and bus, were self-reported in the CARER-SUS. To estimate travel cost by private car, mileage between the clinic and home address was multiplied by the national average standing (basic costs of keeping the car for use on the road, including annual car tax, insurance, cost of capital used for the car and depreciation) and running (costs that depend directly on using the car, including fuel costs, parking and tolls, tyres, servicing and repair costs) cost per mile.[30]

Statistical method

The trial was designed to test non-inferiority in effects of the two competing interventions, so one may consider it legitimate to conduct a cost-minimisation analysis (CMA), which is an analysis method involving comparison of costs alone, given equal outcomes. However, CMA has been criticised for leading to biased results, causing overestimation or underestimation of the probability that treatment is cost-effective.[31] For this reason, cost-effectiveness analysis (CEA) is recommended, regardless of non-inferiority, for exploration of uncertainty surrounding the cost and effectiveness data and to help interpret the economic results.[31,32]

Analyses were carried out on an intention-to-treat basis, with the primary objective of comparing the costs and cost-effectiveness of TCBT and face-to-face CBT at the final 12-month follow-up point. In order to best utilise all available data, multiple regression was used to impute missing total cost, QALY and CY-BOCS data in the main cost-effectiveness analyses using the impute command in STATA. Factors included in the multiple regression were treatment arm and the following baseline characteristics: gender, age, CY-BOCS scores and EQ-5D scores. All analyses were adjusted for baseline characteristics including gender, age, CY-BOCS scores and EQ-5D scores using multiple regression techniques. Results from the smaller sample with full economic data were reported in sensitivity analyses to explore the robustness and validity of the imputed data.

Results from cost-effectiveness analyses were expressed in terms of incremental cost-effectiveness ratios (ICERs), defined as the difference in mean costs divided by the difference in mean effects, calculated using the net benefit approach.[33] Non-parametric bootstrapping (random and repeat re-sampling from the costs and outcome data) was used to generate a large number of sets of expected incremental costs and effects for both treatment groups (1000 replications).[29] The proportion of these that were greater than zero gives the probability that TCBT is the optimal choice, i.e. cost-effective compared to face-to-face CBT, subject to a range of thresholds which represent decision makers' willingness-to-pay for a unit improvement in outcome.

These probabilities were used to generate cost-effectiveness acceptability curves (CEAC), which are the recommended alternative to confidence intervals around ICERs to overcome problems associated with ratio estimators in standard statistical methods.[34,35] CEACs account

for the uncertainty surrounding the estimates of expected costs and outcomes, and act as a useful tool to inform decision makers on the probability that an intervention will be cost-effective at different thresholds.[35] Cost-effectiveness planes were used to illustrate the distribution of bootstrapped mean differences in costs and outcomes.

Sensitivity analyses were carried out to investigate the robustness of the economic evaluation, and to account for uncertainty that exists around some of the input parameters and assumptions. Firstly, as noted above, a complete case sensitivity analysis was undertaken to explore the validity of the imputation method used for dealing with missing data. Secondly, we considered the ongoing debate about the inclusion of various non-healthcare related costs[36] and repeated the economic analyses by employing the NHS and personal social services perspective preferred by NICE in guideline development, which involved the removal of all costs borne by the carers. Finally, we considered the hypothesis that face-to-face CBT overhead costs may be higher than TCBT overhead costs as a result of the need for potentially more expensive clinical space, compared to office space, administrative costs related to the booking of clinical space, and time spent preparing the clinic space. Whilst the main analysis was conservative, assuming equal overheads for TCBT and face-to-face CBT, the sensitivity analysis reduced the cost of TCBT by 10%.

Results

Participants

72 participants were recruited into the trial, 36 randomised to TCBT and 36 to face-to-face CBT. Baseline demographic and clinical characteristics of the two treatment groups are shown in the online supplement. The current paper focuses on the economic results; further detail on participant characteristics and clinical results are reported elsewhere.[17]

At final 12-month follow-up, full clinical data was available for 27 (75%) participants in the CBT group and 25 (69%) participants in the TCBT group and full economic data was available for 21 (58%) in the CBT group and 22 (61%) in the TCBT group. Comparison of baseline characteristics between those with available and those with missing data revealed a significant difference in baseline CY-BOCS scores (p=0.033), with those missing having poorer baseline scores, but no differences in any other variables.

Outcomes

For the primary clinical outcome, CY-BOCS, at all assessment points through to six-month follow-up, the difference between conditions was non-significant and the 95% confidence interval lies below the 5-point difference margin, indicating that TCBT was not inferior to face to face CBT. For the 12-month follow-up point, the difference remained non-significant but non-inferiority of TCBT could not conclusively be demonstrated as the 95% confidence interval included the margin of difference.[17] All secondary measures included in the clinical trial confirmed non-inferiority at all assessment points.[17]

Table 1 reports the results for the EQ-5D. Both groups show improvements in health-related quality of life over time but there were no significant differences between the groups.

Table 1 here

Resource Use

Mean number of service contacts for participants with full economic data over the treatment and 12-month follow-up period are shown in the online supplement. There were few

differences in service utilisation between the two groups, although participants in the face-to-face CBT group had slightly more outpatient appointments and more contacts with community health and social services than those in the TCBT group, particularly GP and clinical psychologist contacts. Despite the different modes of delivery, intervention attendance was similar in each group (12.3 sessions in the face-to-face CBT group versus 12.8 sessions in the TCBT group out of a possible 14 sessions).

Total costs

Total costs per participant over the treatment and 12-month follow-up period are reported in Table 1. Intervention costs were similar in the two groups, as a result of the similar number of sessions attended (mean cost in CBT group £1476, SD 289; mean cost in TCBT group £1415, SD 307). On average, total cost per participant in the face-to-face CBT group was £2965 (SD 1548), which was £490 more costly than the TCBT group (£2475, SD 1024). This difference was not statistically significant (p=0.118). For both groups, the CBT interventions accounted for the greatest proportion of the total costs (53%), followed by carer costs (20%) and hospital services (16%).

Carer costs were relatively low and differed little between groups. Only a small proportion of parents reported taking any time off work (n=13 at the post-treatment follow-up point) and travel costs reported in the face-to-face CBT group were small.

Cost-effectiveness analysis

Figure 1 shows a scatterplot of the bootstrapped replications for incremental cost and incremental CY-BOCS score for TCBT on the cost-effectiveness plane. Because lower CY-BOCS scores are associated with improved outcomes, the standard cost-effectiveness plane is

reversed (outcomes deteriorate when moving from left to right on the *x*-axis). Compared to TCBT, face-to-face CBT has higher bootstrapped mean cost per participant (£697) and slightly better bootstrapped mean effects on the CY-BOCS (-0.07367), giving rise to an ICER of £9461 per unit reduction (improvement) in CY-BOCS. In other words, a one-point improvement in CY-BOCS can be realized if decision makers are willing to pay an additional £9461 for face-to-face CBT.

It should be noted that, whilst the cost-effectiveness results presented are based on a unit improvement in CY-BOCS, a clinically meaningful reduction in symptoms has been suggested to be at least a 35% reduction in CY-BOCS score.[37] Taking the minimum for inclusion in this study of a CY-BOCS score of 16, a 35% reduction would be 6 points. Thus, whilst the incremental cost per unit improvement in CY-BOCS is £9,461, willingness to pay for a clinically meaningful improvement would need to be a minimum of £56,766 for face-to-face CBT to be considered cost-effective compared to TCBT using the CY-BOCS. This minimum would increase with increasing severity of impairment at baseline. For example, taking the average baseline score for trial participants of approximately 25, a 35% reduction would be equivalent to approximately 9 points on the CY-BOCS and thus willingness to pay for a clinically meaningful improvement would need to be at least £85,149 per participant for face-to-face CBT to be considered cost-effective compared to TCBT.

The results for QALYs are shown in Figure 2, where, in this case, lower scores are associated with poorer outcomes so the standard cost-effectiveness plane applies (outcomes improve when moving from left to right on the x-axis). Face-to-face CBT was again associated with higher bootstrapped mean cost per participant (£697) and improved bootstrapped mean effects in QALY (0.0794) compared to TCBT, giving rise to an ICER of £8778 per unit

increase in QALY. Thus for both measures of outcome, TCBT is associated with lower costs but also slightly poorer outcomes.

Figures 1 and 2 here

The cost-effectiveness acceptability curves (CEAC) shown in Figure 3 illustrate that at the standard NICE willingness-to-pay threshold of £20,000 per QALY (NICE, 2008), the probability of TCBT being the dominant option is 26% and thus the probability of face-to-face CBT being cost-effective compared to TCBT is 74%. There is no clear consensus threshold for a unit improvement in CY-BOCS. Figure 3 suggests that at low levels of willingness to pay (£4000 and below), there is a higher probability of TCBT being the cost-effective option. However, as willingness to pay rises above this amount, the probability of either intervention being cost-effective is around 50%.

Figure 3 here

Sensitivity analyses

Sensitivity analyses, reported in the online supplement, did not alter the overall findings of the cost-effectiveness analyses. The complete case and the narrower NHS/social services perspective reduced the mean cost per participant in each group, but the difference between groups remained very similar (£490 primary analysis; £542 complete case analysis; £421 narrow perspective) and these differences remained non-significant. Differences in costs became statistically significant between the two groups when the cost of TCBT was reduced by 10% to £104 per session (mean difference £631, p=0.044). However, this did not alter the cost-effectiveness results.

Discussion

The results of this economic evaluation, and the associated clinical trial,[17] suggest there is strong evidence to support the clinical non-inferiority of TCBT compared to face-to-face CBT for young people with OCD, and no evidence to suggest any statistically significant differences in total cost per participant between the two groups, albeit with lower observed costs in the TCBT group.

In terms of cost-effectiveness, whilst our secondary cost-effectiveness analysis based on QALYs favoured face-to-face CBT, our primary cost-effectiveness analysis based on the CY-BOCS was less clear. This analysis suggests that TCBT may be the preferred option at low levels of willingness to pay for additional improvements in CY-BOCS scores, whilst at higher levels of willingness to pay, the probability of either intervention being cost-effective is around 50%.

Taking into consideration evidence to suggest that TCBT is clinically non-inferior to CBT, evidence from our primary cost-effectiveness analysis to suggest TCBT has a 50% or higher probability of being cost-effective compared to face-to-face CBT, and potential cost-savings for TCBT, which were statistically significant in sensitivity analysis hypothesising a 10% reduction in the cost of TCBT given the potential for lower overhead costs, TCBT presents as an effective alternative for young OCD sufferers who are unable or unwilling to access face-to-face CBT.

There are a number of limitations of the work presented. First, there is currently no evidence of the validity or responsiveness of the EQ-5D in young people with OCD, and some evidence to suggest that the youth version of the EQ-5D (EQ-5D-Y) is not correlated with

clinical outcomes in such populations,[38] so the sensitivity of the EQ-5D to clinically important changes is in doubt. Lack of sensitivity of broadly focused outcome measures compared to disease-specific measures has been demonstrated in a previous paediatric OCD population,[39] so this is a real possibility in the current sample. However, both measures of effect showed consistent improvements over the post-treatment and follow-up periods and there were no significant between-group differences. This suggests that the EQ-5D may be a relatively robust and sensitive measure of effect in this patient group, though more research is required to substantiate this.

Sample sizes, estimated for the purpose of the primary clinical question,[17] were small, and thus the economic evaluation may have been underpowered. We attempted to minimise the further impact of data loss through imputation of missing data and, although the imputation method was robust in sensitivity analysis, results of the study still require careful interpretation due to the small sample sizes and large amount of missing economic data at the 12-month follow-up. Significant differences in the baseline CY-BOCS scores ($p=0.033$) were found between those with missing data and those with full economic data, with those missing having marginally higher symptom scores at baseline, although this was less than 2 points on the CY-BOCS scale which is unlikely to be clinically meaningful. No significant differences were detected in any other baseline characteristics.

Data collected at each therapy session confirmed that there were no differences in terms of length of sessions, grade of therapists and thus costs, between TCBT and face-to-face CBT, and that CBT sessions in young people with OCD are comparable to those with major depression, which is what the unit cost applied was based on. However, a more detailed micro-costing (bottom-up) in future research may still be valuable as it would provide more

accurate estimates of treatment costs. In an attempt to compensate for the lack of a micro-costing approach, and the hypothesis that overhead costs associated with TCBT may be lower than those for face-to-face CBT, the cost of TCBT was reduced by 10% in sensitivity analysis, and the cost results, although not the cost-effectiveness results, were found to be sensitive to this parameter.

In terms of generalisability, all treatments within the trial were delivered by NHS therapists to NHS patients aged 11 to 18 with a clinical diagnosis of OCD. However, this was a single site study based in a specialist clinic in London, so generalisability across the UK or other countries is not proven.

Finally, the trial enabled comparisons to be made in terms of improving access to treatment by attempting to remove geographical, social or financial barriers, between the two delivery modes for CBT in young people with OCD. It was not, however, designed to quantify the effect of TCBT on commonly long NHS waiting lists that result from therapist shortage.[10] Since with greater access comes greater demands, improvement in access via waiting list reduction could only be achieved in this patient group if TCBT is proven to save therapists' time, and if the treatment could be delivered by more therapists through increased training and effective dissemination of clinical and training materials.[9] Thus, the implications for the NHS in terms of availability of resources to provide such service and the impact of such provision on the NHS waiting list remain unclear. The full economic impact of TCBT in reducing waiting time or delayed access is unknown and further research is needed. Similarly, the analysis does not take into consideration resource implications in terms of therapist location, with face-to-face CBT requiring therapy rooms which are often in great demand, compared to TCBT which can take place at a desk.

436

437 **Policy implications**

438 There is no evidence to suggest that TCBT is cost-effective compared to face-to-face, clinic-
439 based CBT in this study, particularly in terms of QALYs, and therefore TCBT may not be the
440 preferred strategy of policy makers by default. However, taking into consideration the non-
441 inferiority of effects, the potential for cost savings and the potential to overcome barriers to
442 treatment, it should be recognised that TCBT has a place in supporting the government's
443 initiative to increase accessibility of effective treatments for OCD[12] and should be offered
444 where access to specialist clinic-based CBT is limited or where patient or family preference
445 for telephone therapy is high.

446

447 It is also important to consider the generalisability of the results and the context within which
448 the study was undertaken. The study is not able to come to conclusions about the cost-
449 effectiveness of TCBT for young people who were excluded from the study including those
450 with mild impairment, with current alcohol or substance abuse or dependence, with psychosis
451 or psychotic symptoms, or with chaotic medication use. In addition, the study is not able to
452 come to any conclusion about the cost-effectiveness of TCBT in more rural settings, where
453 specialist clinic-based services are likely to be particularly inaccessible.

454

455 Further research priorities in this field include (1) comparison of the cost-effectiveness of
456 TCBT with other less resource-intensive modes of delivering evidence-based treatments,
457 such as computerised or internet-based CBT for OCD[13,37] or therapist supported self-help
458 programmes,[10] (2) investigation of the cost-effectiveness and feasibility of TCBT delivered
459 by other health professionals within the community setting, such as CBT-trained nurses
460 (mental health nurse or practice-based nurse), or generic CAMHS therapists, and (3)

replication of the study with a larger sample of participants recruited from multiple sites, including both rural and urban sites.

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CT, DM-C, KL, IH and SB designed the study, GK, KL and HT collected the data, HT, SB and JS carried out the analysis, HT, SB and JS drafted the manuscript. All authors commented on and approved the manuscript. All authors had full access to the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Data availability

All authors had full access to the data. Data available from corresponding author upon request.

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619 Table 1: Outcomes and costs by treatment groups

	CBT (n=36)	TCBT (n=36)		
	Mean (s.d.)	Mean (s.d.)	Mean difference (95% CI)	p-value
EQ-5D VAS				
Baseline	7.52 (1.45)	7.85 (1.63)	-0.33 (-1.06 to 0.39)	0.366
Post-treatment	8.75 (1.30)	8.48 (1.51)	0.27 (-0.39 to 0.94)	0.412
Final follow-up	8.91 (0.71)	9.10 (0.75)	-0.19 (-0.53 to 0.15)	0.277
EQ-5D Utilities				
Baseline	0.76 (0.15)	0.80 (0.27)	-0.04 (-0.15 to 0.06)	0.396
Post-treatment	0.89 (0.14)	0.89 (0.22)	-0.00 (-0.08 to 0.09)	0.952
Final follow-up	0.93 (0.08)	0.91 (0.08)	0.01 (-0.02 to 0.05)	0.379
QALYs				
Final follow-up	1.19 (0.21)	1.14 (0.29)	0.05 (-0.07 to 0.17)	0.379
Costs between baseline and 12-month post-treatment follow-up (£)				
Intervention	1476 (289)	1415 (307)	61 (-79 to 201)	0.391
Hospital services	550 (1040)	313 (532)	237 (-152 to 625)	0.229
Community services	330 (406)	233 (233)	98 (-61 to 250)	0.230
Medication	40 (110)	14 (5)	19 (-12 to 63)	0.176
Carer cost	569 (658)	500 (692)	69 (-249 to 386)	0.666
Total cost	2965 (1548)	2475 (1024)	490 (-127 to 1107)	0.118

620 VAS=visual analogue scale; QALY=quality adjusted life years

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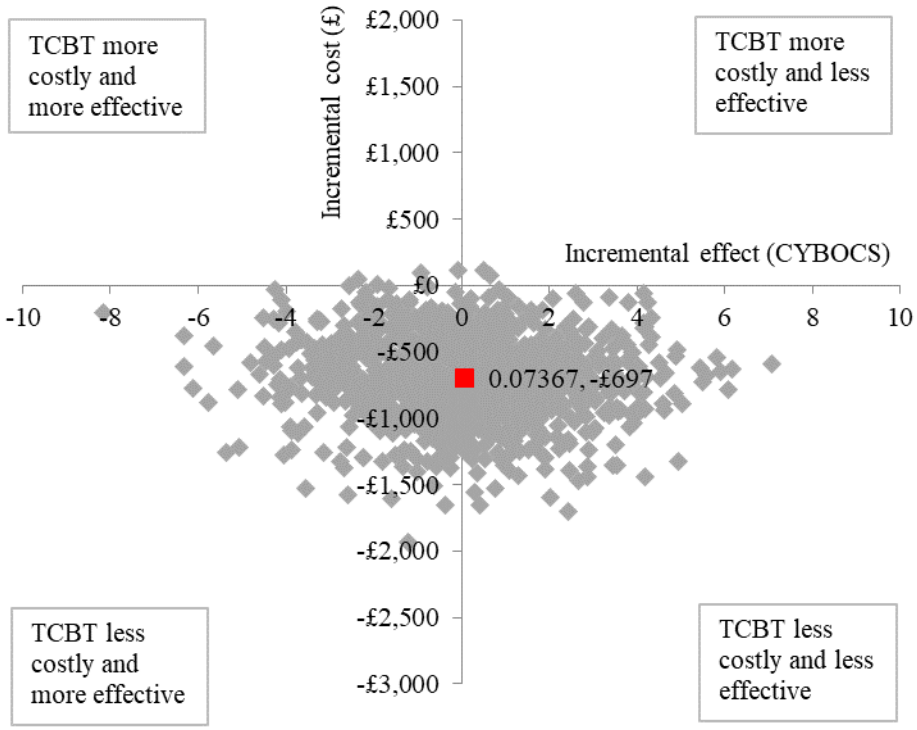
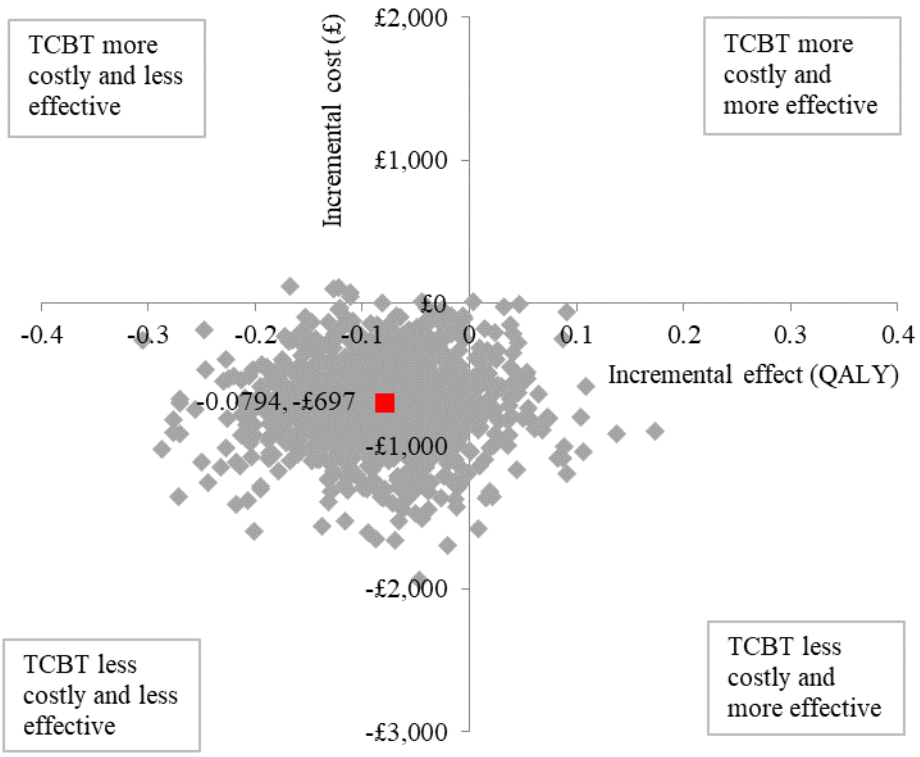
Figure 1: Bootstrapped mean differences in costs and effects in term of CY-BOCS for TCBT compared to face-to-face CBT



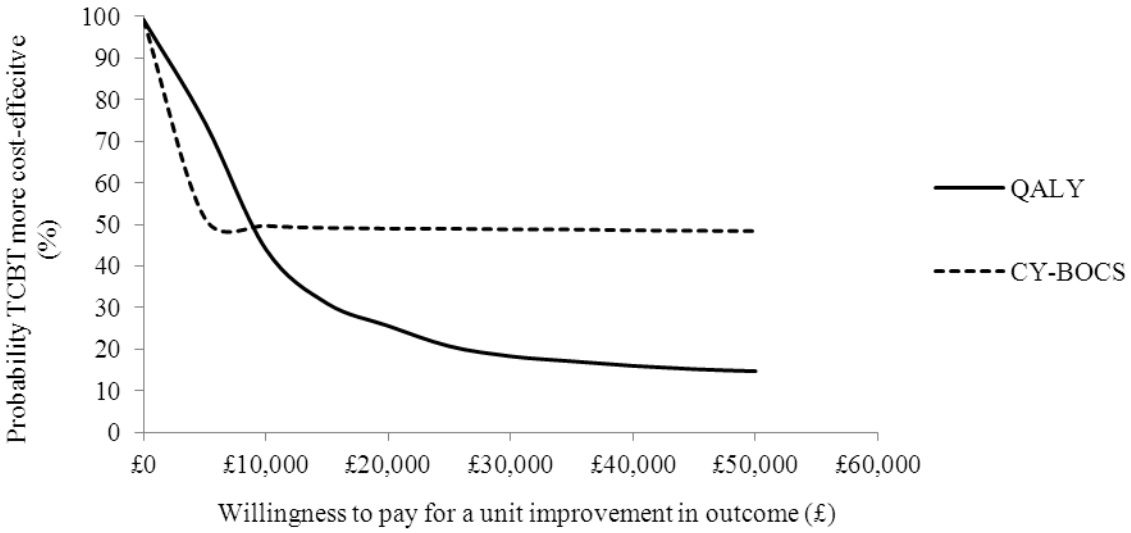
Note: Standard cost-effectiveness plane is reversed as higher CY-BOCS scores reflect poorer outcomes

Figure 2: Bootstrapped mean differences in costs and effects in term of QALYs for TCBT compared to face-to-face CBT



634 Figure 3: Cost-effectiveness acceptability curves showing the probability that TCBT is cost-

635 effective compared to face-to-face CBT



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638 **CHEERS checklist**

Section/item	Item No	Recommendation	Reported on page No/ line No
Title and abstract			
Title	1	Identify the study as an economic evaluation or use more specific terms such as "cost-effectiveness analysis", and describe the interventions compared.	page 1, line 1 to 2
Abstract	2	Provide a structured summary of objectives, perspective, setting, methods (including study design and inputs), results (including base case and uncertainty analyses), and conclusions.	page 2, line 12 to 38
Introduction			
Background and objectives	3	Provide an explicit statement of the broader context for the study.	page 4, line 41 to 63
		Present the study question and its relevance for health policy or practice decisions.	page 4, line 61 to 63
Methods			
Target population and subgroups	4	Describe characteristics of the base case population and subgroups analysed, including why they were chosen.	page 5, line 79 to 89; online supplement page 1, table 1
Setting and location	5	State relevant aspects of the system(s) in which the decision(s) need(s) to be made.	page 5, line 72 to 74
Study perspective	6	Describe the perspective of the study and relate this to the costs being evaluated.	page 9, line 166 to 168; page 9, line 178 to page 10, line 204
Comparators	7	Describe the interventions or strategies being compared and state why they were chosen.	page 6, line 112 to 128
Time horizon	8	State the time horizon(s) over which costs and consequences are being evaluated and say why appropriate.	page 7, line 131 to 132
Discount rate	9	Report the choice of discount rate(s) used for	page 9, line 175 to 176

Section/item	Item No	Recommendation	Reported on page No/ line No
		costs and outcomes and say why appropriate.	
Choice of health outcomes	10	Describe what outcomes were used as the measure(s) of benefit in the evaluation and their relevance for the type of analysis performed.	page 7, line 130 to page 8, line 162
Measurement of effectiveness	11a	*Single study-based estimates:* Describe fully the design features of the single effectiveness study and why the single study was a sufficient source of clinical effectiveness data.	page 4, line 61 to 63; page 6, line 91 to 97
	11b	*Synthesis-based estimates*: Describe fully the methods used for identification of included studies and synthesis of clinical effectiveness data.	N/A
Measurement and valuation of preference based outcomes	12	If applicable, describe the population and methods used to elicit preferences for outcomes.	N/A
Estimating resources and costs	13a	*Single study-based economic evaluation:*Describe approaches used to estimate resource use associated with the alternative interventions. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	page 9, line 164 to 176; page 9, line 178 to page 10, line 204
	13b	*Model-based economic evaluation:* Describe approaches and data sources used to estimate resource use associated with model health states. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	N/A
Currency, price date, and conversion	14	Report the dates of the estimated resource quantities and unit costs. Describe methods for adjusting estimated unit costs to the year of reported costs if necessary. Describe methods for converting costs into a common currency base and the exchange rate.	page 9, line 173 to 175
Choice of model	15	Describe and give reasons for the specific type of decision-analytical model used. Providing a figure to show model structure is strongly	N/A

Section/item	Item No	Recommendation	Reported on page No/ line No
		recommended.	
Assumptions	16	Describe all structural or other assumptions underpinning the decision-analytical model.	N/A
Analytical methods	17	Describe all analytical methods supporting the evaluation. This could include methods for dealing with skewed, missing, or censored data; extrapolation methods; methods for pooling data; approaches to validate or make adjustments (such as half cycle corrections) to a model; and methods for handling population heterogeneity and uncertainty.	page 10, line 206 to page 12, line 256
Results			
Study parameters	18	Report the values, ranges, references, and, if used, probability distributions for all parameters. Report reasons or sources for distributions used to represent uncertainty where appropriate. Providing a table to show the input values is strongly recommended.	Online supplement, table 2
Incremental costs and outcomes	19	For each intervention, report mean values for the main categories of estimated costs and outcomes of interest, as well as mean differences between the comparator groups. If applicable, report incremental cost-effectiveness ratios.	Page 29, table 1; Page 13, line 272 to 282; Page 14, line 296 to 308
Characterising uncertainty	20a	*Single study-based economic evaluation:*Describe the effects of sampling uncertainty for the estimated incremental cost and incremental effectiveness parameters, together with the impact of methodological assumptions (such as discount rate, study perspective).	Page 16, line 355 to 363; Online supplement, table 3; page 30, figure 1; page 31, figure 2; page 32, figure 3
	20b	*Model-based economic evaluation:* Describe the effects on the results of uncertainty for all input parameters, and uncertainty related to the structure of the model and assumptions.	N/A
Characterising	21	If applicable, report differences in costs, outcomes, or cost-effectiveness that can be	N/A

Section/item	Item No	Recommendation	Reported on page No/ line No
heterogeneity		explained by variations between subgroups of patients with different baseline characteristics or other observed variability in effects that are not reducible by more information.	
Discussion			
Study findings, limitations, generalisability, and current knowledge	22	Summarise key study findings and describe how they support the conclusions reached. Discuss limitations and the generalisability of the findings and how the findings fit with current knowledge.	page 17, line 365 to page 19, line 438; page 20 line 440 to page 21 line 465;
Other			
Source of funding	23	Describe how the study was funded and the role of the funder in the identification, design, conduct, and reporting of the analysis. Describe other non-monetary sources of support.	Page 22, lines 472 to 476
Conflicts of interest	24	Describe any potential for conflict of interest of study contributors in accordance with journal policy. In the absence of a journal policy, we recommend authors comply with International Committee of Medical Journal Editors recommendations.	Page 2, lines 33 to page 3, line 38

For consistency, the CHEERS statement checklist format is based on the format of the CONSORT statement checklist