Journal of Affective Disorders ∎ (∎∎∎∎) ∎∎∎–∎∎∎

Contents lists available at SciVerse ScienceDirect

Journal of Affective Disorders

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

Research report

Economic evaluation of audio based resilience training for depression in primary care

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ARTICLE INFO

Article history:
Received 27 June 2012
Received in revised form
29 January 2013
Accepted 30 January 2013

Keywords:
Depression
Primary care
Cost-effectiveness
Computerised cognitive behavioural therapy
Self-hypnosis

ABSTRACT

Background: Although there is some evidence on the effectiveness and cost-effectiveness of computerised cognitive behavioural therapy (CCBT) for treating anxiety and depression in primary care, alternative low-cost psychosocial interventions have not been investigated.
Methods: The cost-effectiveness of an audio based resilience training (Positive Mental Training, PosMT) was examined using a decision model. Patient level cost and effectiveness data from a trial comparing a CCBT treatment and usual care and effectiveness data from a study on PosMT were used to inform this.
Results: Net benefits of CCBT and PosMT were approximately equal in individuals with 'moderate' depression at baseline and markedly in favour of PosMT for the 'severe' depression subgroup. With only four observations in the 'mild' depression category for PosMT, the existing evidence base remains unaltered.
Limitations: Efficacy data for the PosMT arm was derived from a study using a partially randomised preference design and the model structure contains simplifications due to lack of data availability.
Conclusion: PosMT may represent good value for money in treatment of depression for certain groups of patients. More research in this area may be warranted.

1. Introduction

The prevalence, burden and financial impact of depression are well documented (Sobocki et al., 2006; Wittchen and Jacobi, 2005). However, its management in primary care, the principal locus of treatment in the UK, has been described as suboptimal (Barley et al., 2011). Non-economic barriers to superior depression care exist (Barley et al., 2011). Moreover, the lack of resources for delivering effective psychological treatment options such as cognitive behavioural therapy (CBT) is a key problem. This has increased the interest in low-cost, low intensity psychosocial interventions including computerised versions of cognitive behavioural therapy (CCBT). The existence of (albeit limited) evidence supporting its clinical and cost-effectiveness (Foroushani et al., 2011; Gerhards et al., 2010; Kaltenthaler et al., 2006) has led to recommendations of CCBT as a treatment option for mild to moderate depression by the National Institute for Health and Clinical Excellence (NICE, 2010).

Alternative therapies remain relatively underexplored from a health economic perspective (Solomon et al., 2013; Spinks and Hollingsworth, 2009). Although these may be purchased out of pocket, from a public healthcare perspective failure of rigorous evaluation may mean that cost-effective treatment options are not utilised. This paper aims to assess the cost-effectiveness of an alternative psychosocial therapy for depression in primary care, i.e. an audio based resilience training, in comparison with treatment as usual (TAU) and one of the most commonly used CCBT programmes in the UK.

2. Methods

2.1. Interventions

A self-help audio-based psychosocial therapy, Positive Mental Training (PosMT) as detailed by Dobbin et al. (2009) was assessed. At first contact, participants were shown a 10 min introductory video, followed by an 18 min audio recording. This was the first of a modular 12 week CD based series during which individuals were advised to listen to one 18 minute track at home every day for a week (12 tracks in total). Tracks covered relaxation, positive suggestion, visualisation and mindfulness techniques which promote distance from negative thoughts similar to CBT, fostering well being and emotional resilience. Standard GP and nurse supervision and monitoring were maintained during this period but antidepressants were not allowed in this study arm.

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0165-0327/$ - see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.jad.2013.01.044

PosMT was compared to Beating the Blues (BtB), a CCBT programme. This involved an introductory video (15 min) along with 8 weekly CBT sessions delivered by an interactive computer program as well as 'homework' projects both of which were responsive to the person's needs. Progress reports were made available at the end of each session and, at the general practitioner's discretion, the patients in this treatment arm were also allowed to receive pharmacotherapy, physical investigations, general support or advice but no face-to-face psychological interventions (Proudfoot et al., 2004). The above services were also part of TAU in the NHS which in addition included referrals to a practice nurse, counsellor or other mental health professionals as appropriate who were also allowed to provide psychological interventions.

2.2. Decision-analytic model

In absence of head-to-head trials of these interventions, it was necessary to use a decision analytic model to synthesise current evidence on the potential cost-effectiveness of PosMT. This framework compares the expected or average impact of interventions. To do so, pay-offs, such as healthcare costs and health-related quality of life are assigned to all possible treatment outcomes. Subsequently, the probability of these pathways (and hence expected costs and outcomes) by treatment option is determined based on current evidence (Petrou and Gray, 2011). A decision tree was used to model pathways for treatment of depression in primary care.

The structure of an existing model (Kaltenthaler et al., 2006) was adapted as illustrated in Fig. 1 and, where appropriate, the same parameter assumptions were adopted. In each treatment arm, patients were assumed to be distributed among four health states following treatment. These were defined according to commonly used severity thresholds on the Beck Depression Inventory (BDI). Scores ≤ 9 represented minimal depression symptoms, 10–18 mild symptoms, 19–29 moderate symptoms and 30–63 severe symptoms.

The post-treatment distribution of patients among these depression states for each treatment arm was derived from the samples of two studies. These were the available cases from a randomised trial by McCrone et al. (2004) examining TAU ($n=75$) and BtB ($n=89$) and a study of PosMT (Dobbin et al., 2009) using a partially randomised preference design ($n=43$). Both investigations were carried out in a primary-care setting. The studies adopted different follow-up periods and so for consistency we derived transition probabilities from baseline depression levels to 3 month follow-up states in this model. Patients were assumed to stay in these health states for 5 months. The analysis focused on two subgroups, i.e. those presenting moderate or severe depression at baseline because of the small participant numbers with mild depression in the PosMT study ($n=4$).

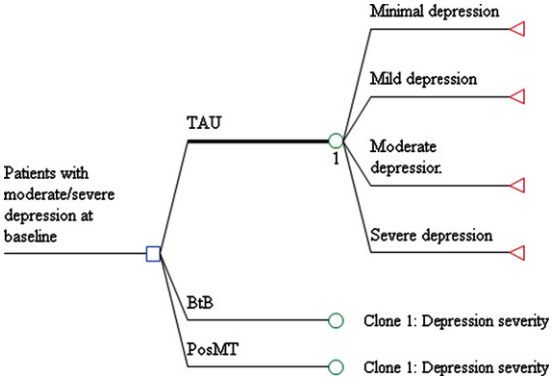

Fig. 1. Decision tree structure.

2.3. Model parameters

The benefits of the interventions were measured using quality-adjusted life years (QALYs). These are preference-based metrics combining quality of life and length of time spent in the respective depression states. To derive the quality weights, in base case analysis of the model, health-related quality of life data based on the EQ-5D for the moderate and severe depression states were obtained from Kaltenthaler et al. (2006) (p. 40).

Service use costs were assessed from the perspective of the healthcare sector and included costs of the interventions and service use associated with the respective health states. These were derived for TAU and BtB from existing patient level data using updated unit costs (Curtis, 2010; Department of Health, 2010; McCrone et al., 2004). Service use costs in the 6 months following treatment according to the BDI category at 3 months follow-up were adjusted for baseline costs, baseline severity and treatment arm using a generalised linear model (van Asselt et al., 2009). This models the error structure in cost data more closely than ordinary least squares regression (Moran et al., 2007). Service use costs for the PosMT branch were assumed to be the same as in TAU.

It was necessary to make a number of assumptions to determine the cost of the interventions. Assuming an average practice size of 6000 patients, the current NHS price for use of BtB amounts to a £720 annual licence fee plus a setup cost of £1500 payable in year one only. The use of the software over 3 years was assumed with an average throughput of 37.5 patients per year with costs annuitised over this period using an interest rate of 3.5%. Based on the assumption of a computer costing £700 with half the time available for other purposes and capital overhead costs as noted in Curtis (2010), the cost of hardware and overheads for the BtB treatment arm were annuitised in the same way. The cost of one hour of practice nurse contact was added for supporting a course of BtB (Kaltenthaler et al., 2006).

With PosMT, patients were loaned copies of the training DVD and CDs. In the base case, the full set cost to healthcare staff for low volume orders (1–50 units) was utilised assuming that each set would be passed on three times before getting lost, resulting in a cost of the intervention of £9 per user. To implement BtB and PosMT in a primary care practice, a half-day and two-half day training sessions were required respectively according to the manufacturers. The opportunity cost of a GP and a clinical support worker was accounted for, and a half-day training session was assumed to last 4 h. A cost of £85 per person per half-day session was incurred for PosMT. No information on training fees was available in the case of BtB, therefore, the same figure was applied. All training costs were also annuitised over 3 years. It was assumed that individuals already had access to a CD/DVD player. Twenty-five minutes of practice nurse time was assumed to be necessary to screen individuals suitable for both interventions. Other care and monitoring costs by GPs and practice nurses were assumed to be equal across the three treatment options and so not included. Current unit costs for staff time were derived from Curtis (2010). No discounting was undertaken because of the short time horizon of the decision model.

2.4. Sensitivity analyses

To assess the sensitivity of the results to the intervention costs, deterministic sensitivity analyses were conducted. Specifically, the implications of a high and low treatment cost scenario were considered. Since the licence and training costs per practice are

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fixed, the base case throughput of 37.5 patient was varied to 25 and 50 in the respective scenarios following the approach of Kaltenthaler et al. (2006). The clinical support costs were changed to reflect 1 h of community clinical support worker contact, and 1 h from a primary care counsellor. Furthermore, the screening time was varied between 20 and 30 min and the costs for the PosMT material were changed to £7.5 per person for mp3 downloads in the low cost scenario and £52.5 per person in the high cost scenario, which represents the private out of pocket cost of the full set of material (Positive Rewards, 2011). As a sensitivity analysis for the outcome measure, SF-36 data by Dobbin et al. (2009) were converted into an SF-6D utility scores (Kharroubi et al., 2007) to estimate mean scores by depression severity after adjusting for baseline values using an ordinary least square regression to account for time-invariant errors.

The impact of parameter uncertainty, i.e. the uncertainty and imprecision surrounding estimated model inputs, was assessed using probabilistic sensitivity analysis. Rather than using an average value as input in the model this approach assigns a distribution around the base case value of inputs and executes the analysis several thousand times based on simulated random draws from these distributions (Petrou and Gray, 2011). The parameters defining these distributions were calculated based on sample means and errors taking into account correlation of regression parameters where applicable. The types of distributions were assigned to each input parameter as appropriate (Briggs et al., 2003, 2006; Kaltenthaler et al., 2006). For EQ-5D scores, a sample size of 15 was assumed in each depression subgroup to calculate standard errors since only standard deviations errors are reported in Kaltenthaler et al. (2006). Based on the simulation results, the decision uncertainty was represented using cost-effectiveness acceptability curves. These can be interpreted as the probability that an intervention is the most cost-effective at different values of willingness to pay for a QALY (Fenwick et al., 2004).

3. Results

The model inputs are detailed in Tables 1–3. Table 1 provides a breakdown of the outcomes, i.e. cost and benefits by health state. The point estimates for follow-up service costs persons suffering from mild depression were lower than those for minimal depression and a six fold increase in costs was observed between the moderate and severe group. Given the assumptions made, in the base case the cost of the PosMT intervention was determined to be approximately a third of that for BtB (£40 vs. £120) (Table 2). The data in Table 3 indicate that treatment with PosMT was superior to treatment with BtB and TAU in both subgroups. Unlike the other two treatments, for the PosMT arm, minimal depression was the most likely outcome at follow-up, with a probability of 48% and 43% for patients with moderate and severe depression at baseline respectively. The effectiveness of PosMT compared to BtB was particularly large in the patients with severe depression at baseline. In fact, in the PosMT arm severe depression at baseline predicted better post-treatment quality of life compared to patients within moderate initial levels of depression. As previously noted, since there were only four participants in the baseline mild depression subgroup of the PosMT study to inform the comparison, from decision maker's perspective, similar the existing cost-effectiveness analysis (Kaltenthaler et al., 2006) the optimal choice of treatment in this category necessarily remains BtB (details not shown). Differences in recruitment strategies between the two studies may account for the larger number of participants with mild depression in the BtB study.

Table 1
Transition probabilities by treatment arm in % (observed counts).

Depression severity at 3-month follow-up	Moderate baseline depression			Severe baseline depression		
	TAU	BtB	PosMT	TAU	BtB	PosMT
Minimal	17 (5)	32 (11)	48 (10)	29 (6)	21 (7)	43 (9)
Mild	44 (15)	47 (17)	26 (5)	13 (2)	21 (7)	39 (8)
Moderate	28 (9)	18 (6)	22 (4)	25 (5)	18 (6)	13 (2)
Severe	11 (3)	3 (0)	4 (0)	33 (7)	21 (7)	9 (1)
Total	100 (32)	100 (34)	100 (19)	100 (20)	100 (27)	100 (20)

TAU: Treatment as usual; BtB: Beating the Blues and PosMT: Positive Mental Training. Transition probabilities were calculated by updating minimally informative priors with the observed multinomial distributions (see Briggs et al., 2003).

Table 2
Mean (standard error) service use costs and utility inputs by depression severity.

Parameter	Minimal depression	Mild depression	Moderate depression	Severe depression
Utility weights				
EQ-5D[a]	0.88 (0.06)	0.78 (0.05)	0.58 (0.08)	0.38 (0.08)
SF-6D	0.70 (0.08)	0.63 (0.07)	0.56 (0.08)	0.48 (0.09)
Service use costs over 8 months in pounds	105.89 (168.66)	41.32 (133.67)	220.29 (168.42)	1378.24 (5)

[a] Standard error figures assume a sample size of 15 in each subgroup.

Table 3
Intervention costs (per person in 2009 £).

	Beating the Blue (*BtB*)			*Positive Mental Training* (*PosMT*)		
	Base Case	Low cost scenario	High cost scenario	Base case	Low cost scenario	High cost scenario
Training fees	3.91	2.93	5.86	7.82	5.86	11.73
Hardware and capital overheads	31.01	20.97	41.95	0.00	0.00	0.00
Screening	12.50	10.00	15.00	12.50	10.00	15.00
Clinical support	36.00	23.00	44.00	0.00	0.00	0.00
Training opportunity costs	4.45	3.34	6.68	8.90	6.68	13.35
Licence fee/cost of materials	33.39	25.04	50.09	9.00	7.50	52.50
Total cost per person	121.26	85.29	163.57	38.22	30.04	92.58
Assumed throughput	37.5	50	25	37.5	50	25

Please cite this article as: Koeser, L., et al., Economic evaluation of audio based resilience training for depression in primary care. Journal of Affective Disorders (2013), http://dx.doi.org/10.1016/j.jad.2013.01.044

For individuals presenting moderate depression at baseline both TAU and BtB were dominated, i.e. had higher costs and lower benefits than PosMT (Table 4). However, the differences between PosMT and BtB were relatively low in patients with moderate depression at baseline. Therefore, as reflected in Fig. 2, PosMT and BtB had a similar probability of being the most cost-effective (0.5 vs. 0.4). Again, PosMT was found to be the dominant option in the case of patients with severe depression. Given the high service use costs in this subgroup, superior treatment effect both has a large impact in terms of quality of life and cost reduction. Thus, the probability of being the most cost-effective option remained above 80% at all levels of willingness to pay (Fig. 3).

Table 4
Cost-effectiveness by BDI category at baseline (base case analysis).

Treatment	Expected cost (£)	Expected effectiveness (EQ-5D QALYs)	Expected effectiveness (SF-6D QALYs)
Moderate (*BDI* 19–29)			
TAU	249.44	0.08	0.03
BtB	232.58	0.12	0.04
PosMT	205.37	0.12	0.05
Severe (*BDI* 30–63)			
TAU	548.74	0.16	0.05
BtB	544.93	0.18	0.06
PosMT	238.63	0.25	0.08

The expected benefits of the interventions decreased when the SF-6D was used as an outcome measure as a result of the smaller differences in utility scores between the four health states (Table 2). Both in the moderate and severe depression subgroups this had a favourable impact on the cost-effectiveness acceptability curves of PosMT (Fig. 4 and Fig. 5). The economic value of each intervention can also be expressed in expected net monetary benefits. In this framework the expected benefits of an intervention in terms of improvements in quality of life are translated into monetary terms assuming a maximum threshold that one is willing to pay for these improvements (Briggs et al., 2006). This simplifies the comparison between interventions because benefits and costs are measured on a common (monetary) scale. In the base case, for the moderate depression subgroup, using a threshold ratio of £20,000 per QALY, for TAU, BtB and PosMT net benefits were 1510, 2430 and 2488 respectively using the EQ-5D and 287, 656 and 768 using the SF-6D. In the severe group these figures were 2575, 3016 and 4739 using the EQ-5D and 555, 672 and 1480 using the SF-6D. This implies that regardless of the outcome measure, differences between BtB and PosMT in expected net benefit are relatively small in the moderate depression group. Therefore, using the EQ-5D, the calculation of the intervention with the highest expected net benefit was sensitive to the cost scenario under consideration. However, the estimated differences in treatment effect are sufficiently high in the patient group with severe depression at baseline for cost assumptions to have little impact.

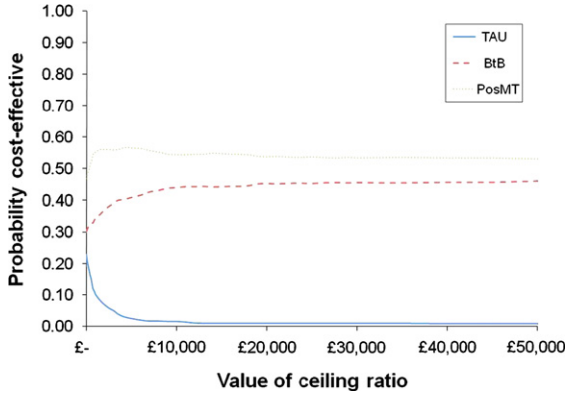

Fig. 2. Cost-effectiveness acceptability curves for moderate depression and EQ-5D as outcome measure (base case analysis).

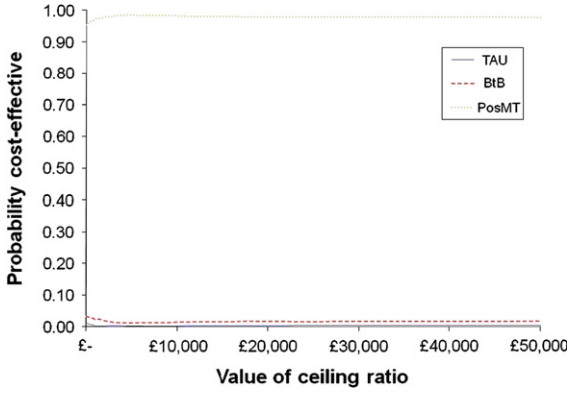

Fig. 3. Cost-effectiveness acceptability curves for severe depression and EQ-5D as outcome measure (base case analysis).

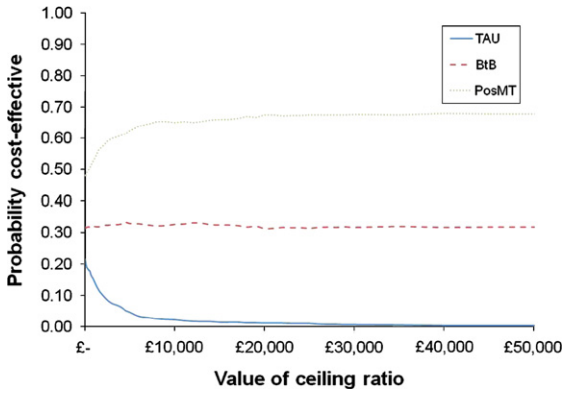

Fig. 4. Cost-effectiveness acceptability curves for moderate depression and SF-6D as outcome measure.

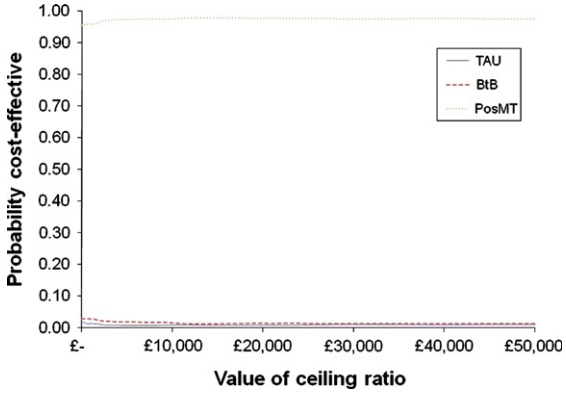

Fig. 5. Cost-effectiveness acceptability curves for severe depression and SF-6D as outcome measure.

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4. Discussion and limitations

For individuals affected by moderate and (in particular) severe depression the results of this evaluation suggest that PosMT may represent good value for money from a healthcare perspective. However, gaps remain in the evidence base surrounding the efficacy of this intervention for treating mild and minimal depression. Biases may be present because the treatment efficacy for PosMT was based on a randomised preference trial (Gemmell and Dunn, 2011; House of Lords' Science and Technology Committee, 2000). In fact, this trial may also be considered to be a before and after study because 95% of participants in this trial had a preferred treatment to which they were allocated (Dobbin et al., 2009). With regards to the comparators used in the model, an independent randomised study of CCBT in depression exists. It confirms that it is likely to be cost-effective relative to usual care (Gerhards et al., 2010). However, this study measured quality of life directly using both EQ-5D and SF-6D rather using predicted values based on BDI scores. In contrast to this model, it suggested that there were no significant differences in QALYs between CCBT and treatment as usual (0.71 QALYs for CCBT and 0.72 QALYs for TAU using EQ-5D and 0.67 QALYs for both groups using SF-6D) but lower healthcare costs were found in the CCBT group (€1428 vs. €1912).

The decision model contains simplifications and limitations due to lack of data availability and, therefore, it is important to not overstate the evidence in favour of PosMT (Haji Ali Afzali et al., 2012). Only three potential treatment options were compared with each other, ignoring for instance, therapeutic approaches combining CBT and PosMT, comparable resilience training programs, as well as different methods of delivering CBT (Hollinghurst et al., 2010) or free online CBT programmes (Mackinnon et al., 2008). Although the most recent unit cost information was used to inform the model, to some extent, both for BtB and PosMt current practice differs from that investigated in the studies on which it is based. For example, GP training, which was not explicitly part of the original PosMT study (Dobbin et al., 2009), may make screening unnecessary. Furthermore, the more recent online version of BtB may influence both cost and outcomes of this intervention.

The time-horizon and complexity of the model was considerably reduced in comparison to Kaltenthaler et al. (2006), since there did not appear to be any information on relapse rates, quality of life beyond three months and probability of suicide for the PosMT arm. It remained necessary to make assumptions on the longevity of the quality of life gain and service use. Furthermore, the model does not account for issues surrounding the uptake of the interventions, study dropout and treatment adherence or the effect of the interventions on lost productivity (Andersson and Cuijpers, 2008; Kaltenthaler et al., 2006). Another limitation of the analysis was the small samples that the *post hoc* subgroup analyses were based on in all treatment arms. Finally, given that BtB has only been recommended as a treatment option for mild to moderate depression (NICE, 2010), one needs to be cautious about using it as a comparator for the severe depression subgroup. However, PosMT may offer useful therapeutic opportunities in this group given the estimated level of treatment effect. Further research would be valuable to extend understanding here.

Role of funding source

This study was funded by the Foundation for Positive Mental Health, a charity registered in Scotland No SC041132 which distributes *Positive Mental Training*. It provided access to data on interventions evaluated. AD and SR work for the Foundation and contributed to the paper.

Conflict of interest

Alistair Dobbin and Sheila Ross are involved in the development and commercial exploitation of *Positive Mental Training*, the audio based resilience training used in this study. Paul McCrone has conducted an economic evaluation of *Beating the Blues*, a study partially funded by the Ultrasis, the distributors of the software.

Acknowledgements

None.

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Please cite this article as: Koeser, L., et al., Economic evaluation of audio based resilience training for depression in primary care. Journal of Affective Disorders (2013), http://dx.doi.org/10.1016/j.jad.2013.01.044