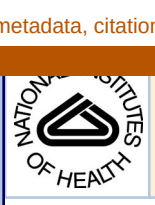

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Cost-Effectiveness of a Community-Integrated Home Based Depression Intervention in Older African Americans

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Abstract

Objectives—To test the cost-effectiveness of a home-based depression program, Beat the Blues (BTB).

Design—We conducted a cost-effectiveness analysis as part of a previously reported randomized controlled trial that tested BTB versus a wait-list control group.

Setting—Community-dwelling older African American adults.

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Conflict of Interest:

Pizzi, Frick, Suh, and Prioli have no conflicts of interest to disclose. Mr. Jutkowitz is supported by a grant from the Agency for Health Research & Quality National Research Service Award Traineeship and the Hearst Foundation. Dr. Gitlin is an employee of Johns Hopkins University and receives honoraria for various speaking engagements. Dr. Gitlin also consults with a few agencies concerning best practices with Phillips Life Line Falls Advisory Board and receives royalties for two books. The findings reported in this manuscript were funded by NIMH.

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Participants—African Americans who were ≥55 years of age, English speaking, cognitively intact (MMSE ≥24), and had depressive symptoms (PHQ-9 score ≥5) (N=129).

Intervention—Participants randomly assigned to BTB received up to 10 home visits over a period of 4 months by licensed social workers who provided care management, referral/linkage, stress reduction, depression education, and behavioral activation to help participants achieve self-identified goals.

Measurements—Incremental cost effectiveness ratios (ICERs) of BTB versus wait-list controls during the 4-month study period. The primary ICER was defined as cost/quality-adjusted life year using the EQ-5D and secondarily using the HUI-3. Additional ICERs were calculated using clinical measures (cost per depression improvement, cost per depression remission). Costs included BTB intervention, depression-related healthcare visits and medications, caregiver time, and social services.

Results—BTB cost per participant per month was $146. Base case ICERs were $64,896 per QALY (EQ-5D) and $36,875 per QALY (HUI-3). Incremental cost per depression improvement was $2,906 and per remission was $3,507. Univariate and probabilistic sensitivity analyses yielded cost/QALY range of $20,500-$76,500.

Conclusion—Based on the range of cost effectiveness values resulting from this study, BTB is a cost-effective treatment for managing depressive symptoms in older African Americans that compares favorably with the cost effectiveness of previously tested approaches.

Keywords

depression; cost; cost-effectiveness; health utility; African American

INTRODUCTION

Depression causes significant morbidity in older adults.[1,2] Although antidepressants and traditional psychotherapy remain mainstays of therapy, cost-effective non pharmacologic treatments are needed, particularly for older adult and minority populations.[3–6] Previous studies have examined the cost-effectiveness of depression treatments involving both pharmacologic agents and non-pharmacological programs or models of care; however, these studies vary widely with regard to the populations studied and the interventions and economic methods employed. Results indicate a wide range of incremental cost-effectiveness ratios (ICERs) from $2,500-$460,000/ quality-adjusted life year (QALY).[7–14] Furthermore, none of these studies has evaluated the cost-effectiveness of home and community-based non pharmacologic interventions and with an older African American population. This is important because prior studies of older African Americans have demonstrated that depressive symptoms are under detected and under treated, and that this group may have reduced access to treatments.[1,15–18] As the healthcare system moves toward evidence-based decision-making, research on the cost-effectiveness of new models of mental health care that are accessible to community-dwelling minority populations and that provide nonpharmacological treatment options has been identified as a public health priority.[19,20] This paper reports the cost-effectiveness (CE) of one such program—Beat the Blues (BTB), which was designed for and previously tested in randomized control trial of

African Americans. This is the first study to our knowledge that examines the CE of a novel nonpharmacological approach to addressing depressive symptoms in this population. Furthermore, our study has important methodological value in that we report detailed CE findings using a robust array of outcome measures, including QALYs as well as the remission and reduction of depressive symptoms.

METHODS

The BTB trial was conducted in collaboration between academic research centers and a senior center in Philadelphia. Participants were recruited from print media, presentations to community groups, senior center membership, and a home support program for temporarily medically compromised older adults. Participants underwent two sequential depression screenings by a trained screener over 2 weeks using the Patient Health Questionnaire-9 (PHQ-9), a validated 9-item self-report measure widely used in clinical and research contexts.[21,22,23] Candidates who scored ≥5 on both PHQ-9 administrations and who were African American, ≥55 years of age, English speaking, and cognitively intact (Mini Mental State Examination> 24) were eligible to participate. Study participants were randomized to receive the BTB intervention or to a wait list that received the intervention in its entirety after the 4-month follow-up (control group). All participants were assessed at baseline, 4, and 8 months by interviewers blinded to group assignment.

Beat the Blues Intervention

We selected treatment components of BTB that reflected best evidence and preferred coping mechanisms of the targeted population. Previous research and our focus group work conducted to inform intervention development suggested that older African Americans prefer nonpharmacological strategies as first-line treatment and also tend to use active coping mechanisms such as engaging in activities to handle daily life stressors.[24,25,26] Further, previous research suggests that depressive symptoms in this group may reflect a confluence of external contextual factors such as poor self-management of chronic disease or financial strain that warrant consideration and modification as part of a depression treatment program.

In up to 10 sessions over 4 months, BTB interventionists (trained, licensed social workers) provided depression education and care management, made referrals and linkages, taught stress reduction techniques, and used behavioral activation to help participants achieve self-identified goals.[25] BTB does not employ medications, but participants may have sought and been on medication care from a medical doctor before, during, or after study participation.

Main efficacy findings from the trial have been previously reported and indicated that BTB reduced depressive symptoms, anxiety, and functional difficulties; improved quality of life (QoL), behavioral activation, and well-being; and enhanced depression knowledge. Additionally, at 4 months, 44% of BTB participants were in remission compared with 27% of wait-listed controls.[27]

The cost effectiveness analysis was added to the main trial after recruitment was underway, and included a subset of 129 participants. Costs were reported at baseline and 4 months

($US 2010) and included three main categories: (1) BTB intervention (screening, intervention delivery, and supervision); (2) healthcare service use (inpatient, outpatient, and medication costs); (3) formal care giving and social service use. Work productivity losses were also captured but were excluded post hoc since few participants were working (n = 12). A detailed explanation of cost measures is provided in the supplemental appendix.

The primary effectiveness measure used in the cost effectiveness analysis was QALYs, which are recommended as the preferred outcome measure in societal CE studies.[28] QALYs were measured at baseline and 4 months using the Euro-QoL 5D (EQ-5D), which includes 5 domains (mobility, self-care, daily activities, pain/discomfort, depression/anxiety) scored along 3 levels (no problems, some problems, extreme problems). The study was powered to detect a EQ-5D score difference of .098 between BTB and wait list control with power 0.8, which is within reasonable expectations based on prior research. A scoring algorithm based on US preference weights was used to convert EQ-5D health states to utilities.[30] We chose EQ-5D because of the availability of US scoring and the instrument's simplicity. Owing to its limited number of domains and few levels within each domain, we decided to also capture QALYs using the Health Utilities Index, v.3 (HUI-3). HUI-3 consists of 40 items that capture 8 attributes of health-related QoL: vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain.[31] The scoring algorithm was obtained from Health Utilities Inc. and is based on Canadian health preference weights. Utility scores from both instruments range from 0–1, with a higher score indicating better quality-adjusted life. To convert utilities into QALYs, we calculated the area under the curve of observed utility for the 4-month period. This reflects the change in utility experienced by each group.

We also calculated CE using clinical measures, specifically, cost per depression remission and cost per reduction in depressive symptoms. Reduction of symptom severity and remission and reduction were also the primary outcomes of the main trial as measured by the PHQ-9. Using a recall period of 2 weeks for the presence of 9 symptoms, the PHQ-9 yielded two scores: symptom severity score from 0–27, and a diagnostic category (minimal to no symptoms [PHQ score 0–4], mild depression [score 5–9], moderate depression [score 10–14], moderately severe depression [score 15–19], and severe depression [score 20–27]) mapping onto the DSM-IV.[32] Consistent with the main trial and PHQ-9 scoring guidelines, we defined remission as a score <5 at 4 months.

CE was evaluated from a societal perspective and based on recommendations of the U.S. Public Health Service Panel on Cost-Effectiveness[29] using the ICER shown below:

$$\mathrm{ICER}=\frac{\text{Total Cost Difference}_{\mathrm{BTB}}-\text{Total Cost Difference}_{\text{wait-list control}}}{\text{Effectiveness Difference}_{\mathrm{BTB}}-\text{Effectiveness Difference}_{\text{wait-list control}}}$$

In this equation, the total cost and effectiveness differences of BTB and for wait list control were calculated as the costs (for the numerator; effectiveness for the denominator) for each of these two groups at 4 months minus baseline, thus representing a difference-in-difference approach. The denominator represented the change in outcome (baseline to 4 months) and was tested using the four effectiveness measures previously described: EQ-5D QALYs, HUI-3 QALYs, % experiencing clinical remission of depressive symptoms (PHQ-9 <5), and

% experiencing reduction of depressive symptoms (improvement in depression as indicated by movement ≥1 PHQ-9 severity category).

Consistent with best practices in economic evaluation sensitivity analyses were performed on our main CE ICER (EQ-5D cost/QALY). [29] A probabilistic sensitivity analysis (PSA; Sensitivity Analysis 1) was conducted using distributions around the cost and effectiveness measures to make a probabilistic statement regarding the ICER. This type of analysis is critical for trial-based cost effectiveness analyses, since sample sizes are typically too small to provide certainty in the base case ICER. The PSA was a simulation performed using Tree Age Pro 2009 (Tree Age Software, Inc., Williamstown MA) that consisted of 1,000 random iterations with the goal of determining the likelihood that BTB was cost-effective compared to wait-list control.

A second sensitivity analysis (Sensitivity Analysis 2) was performed to understand how the ICER would change if specific components of BTB intervention costs were modified. This consisted of a series of univariate sensitivity analyses where each component cost of BTB was varied by ± one standard deviation of its mean, to reveal which aspects of the program (i.e., interventionist travel, program delivery, and training) could be streamlined to maximize CE.

RESULTS

Participant Characteristics

Over a 2-year period, 703 older adults were screened for the trial of whom 241 (34.3%) were eligible and 208 (86.3%) were willing to participate. Of these, 129 (62.0%) were included in the CE study because funding for the cost study was obtained after the main trial had begun. The CE sample was statistically similar to the pre-CE sample (n=79) across baseline characteristics except percent of participants reporting pain medication (pre-CE sample had higher % reporting pain medication likely due to a change in the way pain medications were recorded for the CE sample). At 4 months, the cost study included 57 participants in the BTB and 56 in the wait-list control (Figure 1).

Characteristics of the cost study sample (n=129) were as follows: the mean age was 68.7 years; 79.1% were female, 45.7% completed at least a high school education; the mean baseline PHQ-9 score was 12.6. There were no statistically significant differences at baseline between those randomized to BTB (n=68) versus the wait-list control (n=61) except that fewer BTB participants lived alone than did those in the wait-list control ($P = 0.002$) (Table 1).

Cost of BTB and Service Use

The total cost of implementing BTB was $146/person/month or $585/person over the 4-months**,** and the total cost difference at 4 months (BTB-wait list control) was $491. This additional cost in the BTB treatment group was largely driven by the costs of the intervention. Differences in service use costs were not statistically significant. The cost of depression-related doctor calls and visits (mean/person, during the 4 months) for the BTB treatment group was $3.96 compared with $2.68 per wait-list control. Medication costs for

the BTB treatment group were $159.32 (mean/person, during the 4 months) versus $196.97 for wait-list control. For caregiver services, BTB treatment group costs were $95.54 (mean/person during the 4 months) versus $38.12 per wait-list control. Spending on social services for BTB participants was also slightly more than for those in the wait-list control (means/person during the 4 months were $96.86 vs. $89.98, respectively). Costs of complementary/alternative medicine use were similar for the BTB treatment group and wait-list control.

Effectiveness

At baseline, the BTB group's EQ-5D utility (0.566) was slightly lower than wait-list controls (0.582; not statistically significant). By 4 months, the BTB group experienced a mean EQ-5D utility of 0.665 (0.099 increase) with the wait-list control utility 0.635 (0.053 increase). For HUI-3, at baseline the BTB group's utility (0.335) was lower than that of the wait-list control (0.432; not statistically significant). By 4 months, the BTB group's utility was 0.479 (0.144 increase), whereas the utility for wait-list controls was 0.496. Thus, the magnitude of utility increase for HUI-3 was greater than EQ-5D for both study groups.

In terms of clinical effectiveness, 71.9% of BTB CE participants experienced a reduction in depressive symptoms to a lower PHQ-9 severity, compared with 60.7% in the wait-list control. Additionally, 38.6% of BTB participants experienced clinical remission of depression at 4 months, compared with 28.6% in the wait-list control.

Cost-Effectiveness

The ICER of BTB compared with wait-list controls was $64,896 and $36,875 for EQ-5D and HUI-3 derived QALYs, respectively. The ICER for clinical depression measures was $3,507 per participant experiencing a reduction in depressive symptoms to a lower severity category, and $2,906/participant experiencing remission of depressive symptoms (Table 2).

Sensitivity analyses conducted using the ICER resulting from our main health utility measure, cost/EQ-5D derived QALY (Sensitivity Analysis 1, shown in Figure 2), revealed a majority (91%) of the simulated ICERs in the upper right quadrant of the CE plane, indicating that, in most cases, BTB treatment costs more than wait-list control but is more effective.

For Sensitivity Analysis 2, when the cost of each component of BTB was modified within one standard deviation of its mean to determine which exerted the greatest impact on the ICER, we found that travel and BTB delivery were most significant (Figure 3). Specifically, when interventionist travel costs (mileage + labor) varied from $37 to $385, the ICER ranged from $42,000/QALY- $88,000/QALY. When the cost of BTB program delivery (e.g., home sessions) varied from $64-$330, the ICER ranged from $47,000/QALY-$82,000/QALY. Materials and interventionist follow-up contacts also affected the ICER, but to a lesser extent.

DISCUSSION

This is the first CE analysis of a home-based nonpharmacological depression program designed for older African Americans, a growing population for which disparities in access

to and receipt of mental health treatments persist. The ICERs from two measures were $36,875/QALY (HUI-3) and $64,896/QALY (EQ-5D). Based on these ICERs, BTB's incremental cost effectiveness falls within the societal CE funding thresholds generally reported in the literature (US $50,000-$100,000/QALY) [32] and is in the range of ICERs previously reported for pharmacological and nonpharmacological depression interventions.[7,8,9–12] Thus, BTB's CE may support its adoption for older African Americans with depressive symptoms, but ultimately the decision to adopt it will depend upon what cost/QALY decision-makers are willing to pay.

It should be noted that more participants reported taking antidepressant(s) at baseline in BTB versus the wait list control group. Hence it is reasonable to question whether the QALY improvements in BTB were influenced by more participants taking anti depressants. We explored this issue and found that at 4 months the number reporting antidepressants decreased in BTB and increased in wait list control. This shift makes it difficult to determine the exact influence of antidepressants on our findings, but we suspect it is not a major factor. Also, this positive outcome of a decline in medication use in the treatment group compared to an increase in medication use in the control group suggests that further research on the impact of BTB be explored.

Given the popularity of medications, it is worth considering how BTB's CE compares specifically to antidepressants. Kendrick et al (2009) reported CE based on a trial of selective serotonin reuptake inhibitors plus supportive care, versus supportive care alone, for mild to moderate depression and reported ICERs of $32,496–$48,744/QALY.[9,33] A Canadian study by Van Baardewijk (2005) examined incremental CE of duloxetine versus extended-release venlafaxine using a decision analytic model. The ICER of both duloxetine and extended-release venlafaxine was estimated at $20,290/QALY.[13,33] Domino and colleagues (2008) evaluated the CE of fluoxetine alone versus in combination with a cognitive behavioral therapy approach, which ranged from $24,000–$123,000/QALY (comparison was placebo).[14]

Our study also reported CE from a clinical perspective using remission and reduction of depressive symptoms; we found ICERs to range from $2,000–$5,000. Few studies have reported ICERs this way. Hemels and colleagues found the cost per successfully treated severely depressed patient (based on achievement of remission) to be $3,537 for escitalopram versus $4,673 for citalopram.[34] BTB's CE compares favorably to these values.

Our analysis is comprehensive, but we acknowledge that US healthcare stakeholders—particularly health plans—have a budgetary impetus to make decisions based on cost rather than CE. Though BTB would appear expensive due to travel to participants' homes and time requirements, it costs only $146/participant/month for 4 months. This is comparable to the average wholesale prices of certain brand name antidepressants.[35] Despite BTB's competitive costs, it is worth exploring whether the program can be delivered via fewer visits without compromising its effectiveness. In addition, there may be opportunities to centralize services, deliver aspects of the program remotely, or create economies of scale in training and supervision.

Considering our findings, it could be argued that health plans that reimburse for antidepressants and traditional psychotherapy should expand their benefits to include tested nonpharmacological programs such as BTB. Such programs are an important treatment option for older adults, especially those who cannot tolerate antidepressant side effects or are at risk for polypharmacy due to multiple concomitant medications.

This study has significant methodological importance. First, we reported CE using a variety of measures to fully inform healthcare decision-makers. Since the results of applied health economic analyses can differ widely based on what interventions are tested, what costs are included, and what outcomes are applied, analyzing an array of measures is critical to advancing the field. We demonstrated that choice in utility instrument can significantly affect CE calculations. The magnitude of utility improvements from theEQ-5D was less than HUI-3, only 0.0076 or 2.77 quality–adjusted life days (versus 0.0133 or 4.85 quality-adjusted life days for HUI-3). This difference, although small, maybe clinically significant to patients. However, to a healthcare decision maker who is primarily interested in CE, the EQ-5D derived ICER is nearly $30,000 more than HUI-3 and calls into question which measure should be chosen for making programmatic decisions. One explanation for the utility differences may be that HUI-3 is more sensitive to change than EQ-5D in the BTB population; HUI-3 contains many more items relevant to the intervention and its domains are specifically relevant to older adults (e.g., cognition, ambulation, and sensory domains encompassing vision and hearing). In future studies, it may be useful to employ a new version of EQ-5D that contains 5 response levels (EQ-5D-5L), potentially offering greater precision.[32]

Limitations

There are several limitations to this analysis. First, findings may not be generalizable to other populations (e.g., Caucasians or other minorities), and the four month time horizon prohibits a determination of BTB's long-term CE. However, it should be noted that the main trial found that treatment benefits endured from 4 to 8 months for the BTB group without further intervention. Second, the wait-list control experienced improvements in depressive symptoms and improvements in quality-adjusted life, perhaps as a consequence of taking part in the trial. Therefore, our findings may not represent the cost effectiveness of BTB vs. true usual care.

Further, the sample size for this study was smaller than that of the BTB main trial, but it met our recruitment goals for the CE study. Further, we modeled the impact of uncertainty by performing comprehensive sensitivity analyses, consistent with best practices in economic evaluation.[28] Since a goal of CE studies is to inform decision makers by providing a range of results, sensitivity analyses are critical. It should also be pointed out that the sample size for the EQ-5D was slightly greater than it was for the HUI-3; a post-hoc review of the data collection forms suggests that interviewers in some cases had difficulty administering the HUI-3, resulting in 21/226 (9.3%) of HUI-3 batteries being unscorable (10/113 baseline and 11/113 at 4 months). Future research involving HUI-3 would benefit from more focused interviewer training to ensure smooth administration. Finally, certain categories of service use costs (healthcare, care giving, and social services) were captured using a 30-day recall,

which was shorter than the 4-month period between assessments. For these categories, we conservatively assumed that utilization during the past 30 days represented all utilization during the 4 months; but it is possible that some participants sought more frequent care.

CONCLUSION

BTB is a novel nonpharmacological program involving a partnership with a senior center for its delivery. Based on commonly stated willingness to pay thresholds, BTB may be a cost-effective treatment option for managing depressive symptoms in older African Americans. Findings suggest that the program may have an acceptable CE, though more robust examination of the program in a larger and longer study would be worthwhile. We also identified potential opportunities to reduce BTB costs. Although BTB was tested with an older African American urban community, we believe that its focus on addressing social ecological factors that impinge upon mood may be a highly relevant treatment approach for other minority populations and individuals with low socio-economic status. As the population ages and healthcare budgets experience continued strains, economic analyses such as these and for diverse older adult populations are critically needed to understand the value of nonpharmacological modalities to healthcare decision-makers.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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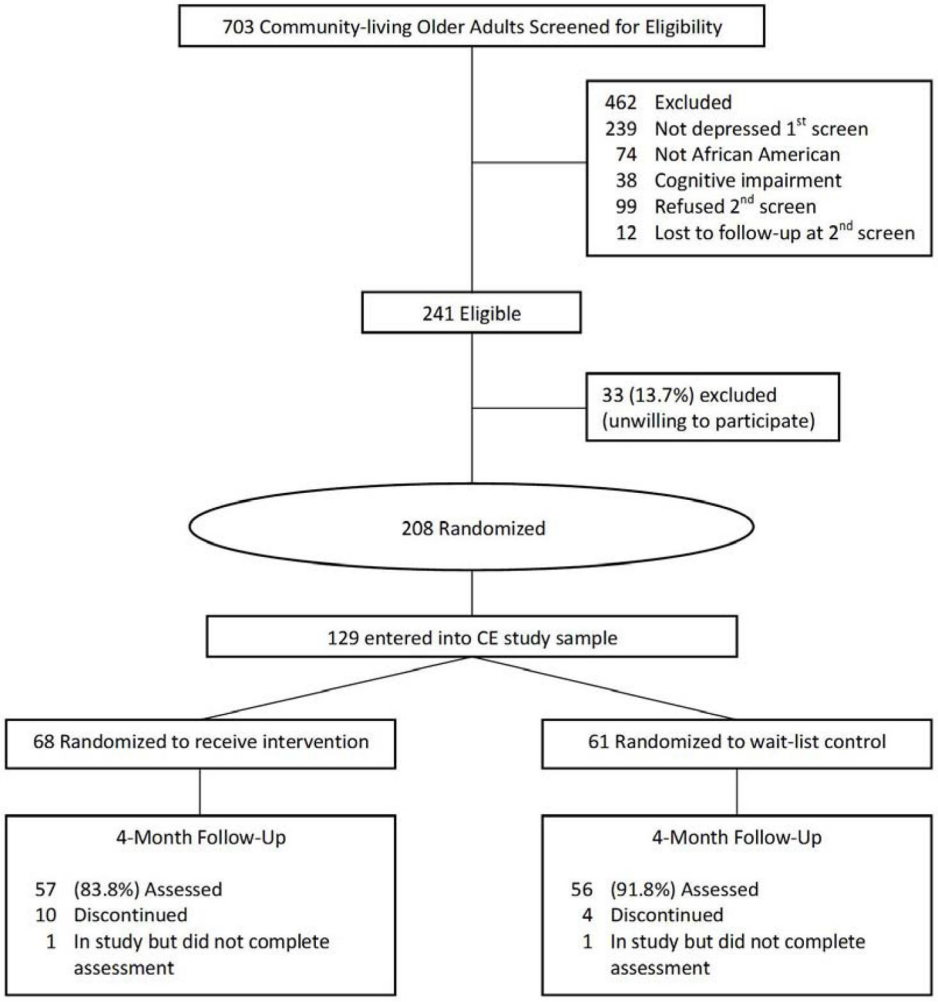

Figure 1.
Flow Chart of Beat the Blues Trial CE Sample. No legends

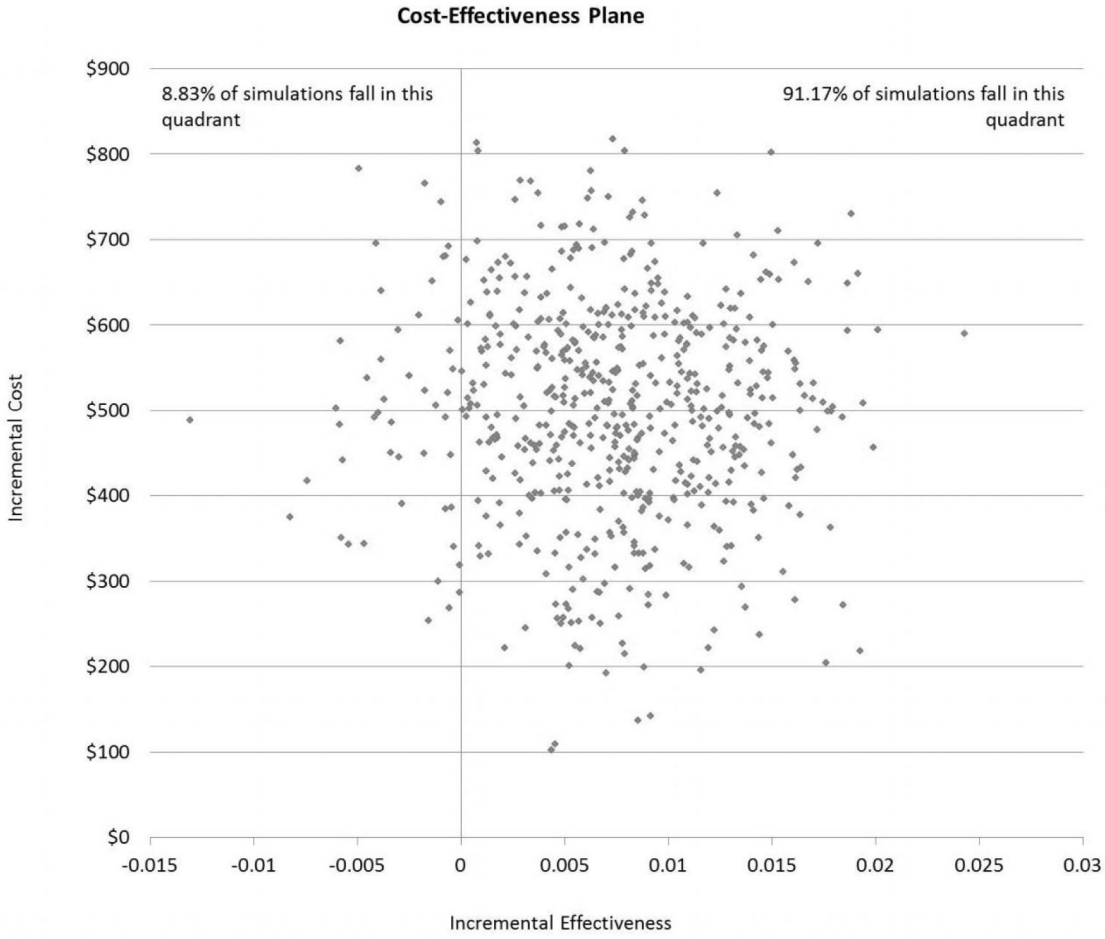

Figure 2.

Sensitivity Analysis 1: CE Plane and Acceptability Curve for BTB Cost per Quality-Adjusted Life Year, performed on main EQ-5D-derived ICER. [a]This figure shows the costs associated with BTB for each quality-adjusted life year gained compared to the wait-list control. [b]Costs were assigned a gamma distribution; utilities were based on EQ-5D findings and tested with a 1-gamma distribution.

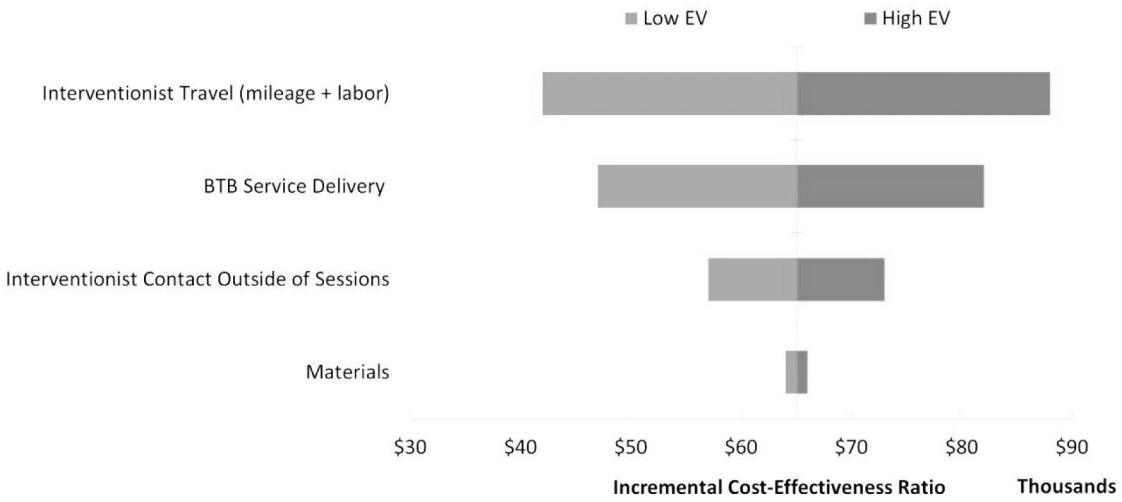

Figure 3.

Sensitivity Analysis 2: Tornado Diagram Showing Impact of Changing BTB Intervention Cost Domains. [a]Diagram shows a one-way sensitivity analysis for the components of the BTB intervention that when varied between ± one standard deviation has the greatest impact on the main EQ-5D-derived ICER. Dollar amounts indicate the expected ICER given the low and high estimates for the four most sensitive cost domains. EV: expected value

Table 1

Baseline Characteristics of BTB CE Sample (N=129)

Characteristic	Pooled Sample (n=129)	BTB Intervention Group (n=68)	Wait-List Control Group (n=61)	p-value
Age (mean years ±SD)	68.7 (±8.4)[a]	68.0 (±8.4)[b]	69.5, (±8.4)	0.310
Female (n, %)	102 (79.1)	56 (82.4)	46 (75.4)	0.333
Education (n, %)				0.295
< High School	22 (17.1)	9 (13.2)	13 (21.3)	
High School	37 (28.7)	18 (26.5)	19 (31.1)	
> High School	70 (54.3)	41 (60.3)	29 (47.5)	
Level of Financial Difficulty (n, %)				0.196
Not difficult at all	27 (20.9)	10 (14.7)	17 (27.9)	
Not very difficult	18 (14.0)	10 (14.7)	8 (13.1)	
Somewhat difficult	50 (38.8)	26 (38.2)	24 (39.3)	
Very difficult	34 (26.4)	22 (32.4)	12 (19.7)	
Married/Living as Married (n, %)	12 (9.3)	10 (14.7)	2 (3.3)	0.237
Living Alone (n, %)	77 (59.7)	32 (47.1)	45 (73.8)	0.002
Medications (n, %)				
Antidepressant	25 (19.4)	15 (22.1)	10 (16.4)	0.416
Anxiolytic	22 (17.1)	13 (19.1)	9 (14.8)	0.511
Pain	38 (29.5)	19 (27.9)	19 (31.1)	0.690
PHQ-9 Depression Severity Score (mean ±SD)	12.6 (±5.1)	13.22 (±5.3)	11.92 (±4.7)	0.146
IADL Difficulty (mean ±SD)[c,d]	2.02 (±0.7)[a]	2.07 (±0.7)[b]	1.97 (±0.7)	0.455
ADL Difficulty (mean ±SD)[c,d]	1.57 (±0.6)[a]	1.55 (±0.7)[b]	1.58 (±0.6)	0.813
Comorbidities (n, %)				
Arthritis	98 (76.0)	52 (76.5)	46 (75.4)	0.889
High blood pressure	107 (82.9)	59 (86.8)	48 (78.7)	0.227
High cholesterol	79 (61.2)	46 (67.6)	33 (54.1)	0.117

[a] n=128

[b] n=67.

[c] IADL = Instrumental Activities of Daily Living; ADL = Activities of Daily Living.

[d] Scored on a scale from 1–5, where 1 = no difficulty and 5 = prohibitive difficulty.

Table 2

Incremental CE Ratios (ICERs)

	Incremental Cost Difference	Incremental Effectiveness Difference	ICER
Quality-Adjusted Life Years			
EQ-5D, BTB vs. wait-list control	$491.05	0.0076[a]	$64,896.00
HUI-3, BTB vs. wait-list control	$491.05	0.0133[a]	$36,874.57
Clinical Measures			
Percent of participants who experienced a reduction in depressive symptom category on the PHQ-9, BTB vs. wait-list control	$491.05	11.2%	$4,384.38
Percent of participants who experienced clinical remission of symptoms (PHQ-9 <5) , BTB vs. wait-list control	$491.05	10.0%	$4,910.50

[a] Incremental Effectiveness is presented relative to wait list control indicating that BTB produced greater effects.