Eur J Health Econ (2011) 12:489–497
DOI 10.1007/s10198-010-0266-y

ORIGINAL PAPER

Cost-effectiveness of cognitive-behavioral group therapy for dysfunctional fear of progression in cancer patients

C. Sabariego · M. Brach · P. Herschbach · P. Berg · G. Stucki

Received: 19 October 2009 / Accepted: 28 June 2010 / Published online: 6 August 2010
© Springer-Verlag 2010

Abstract Anxiety and fear are often associated with chronic conditions such as cancer. This paper targets the cost-effectiveness analysis of a cognitive-behavioral group therapy (CBT) in comparison to a client-centered, supportive-experiential group therapy (SET) in cancer patients with dysfunctional fear of progression. An incremental cost-effectiveness analysis was performed using data from a randomized controlled trial among cancer patients receiving inpatient rehabilitation. The means, 95% confidence intervals [95% CI], incremental cost-effectiveness graphic and acceptability curve were obtained from 1,000 bootstrap replications. A total of 174 patients were included in the economic evaluation. The estimated means [95% CI] of direct costs and reduction of fear of progression were €9,045.03 [6,359.07; 12,091.87] and 1.41 [0.93; 1.92] for patients in the SET and €6,682.78 [4,998.09; 8,440.95] and 1.44 [1.02; 1.09] for patients in the CBT. The incremental cost-effectiveness ratio [95% CI] amounts to minus €78,741.66 [−154,987.20; 110,486.32] for an additional unit of effect. Given the acceptability curve, there is a 92.4% chance that the CBT, compared with the SET, is cost-effective without the need of additional costs to payers. Our main result is the superior cost-effectiveness of the cognitive-behavioral intervention program in comparison to the non-directive encounter group for our sample of cancer patients with high levels of anxiety.

Keywords Cost-effectiveness · Cancer · Cognitive-behavioral therapy · Economic evaluation · Resource use

JEL code I19

C. Sabariego · M. Brach
Institute for Health and Rehabilitation Sciences, Ludwig-Maximilians-University, Marchioninistraße 17, 81377 Munich, Germany

M. Brach · G. Stucki
Swiss Paraplegic Research, Postfach CH-6207, Nottwil, Switzerland

P. Herschbach · P. Berg
Department and Outpatient Clinic of Psychosomatic Medicine and Psychotherapy, Division of Psychosocial Oncology, Technische Universität München, Ismaninger Str. 22, 81675 Munich, Germany

G. Stucki (✉)
Department of Health Sciences and Health Policy, University of Lucerne, Pilatusstrasse 20, 6000 Luzern, Switzerland
e-mail: gerold.stucki@paranet.ch

Introduction

Anxiety and fear are often associated with conditions such as cancer. In addition to the burden to patients and their families, fear and anxiety associated with medical conditions have important socio-economic consequences, such as high health care use costs [1–3]. Therefore, interventions, which can reduce fear and anxiety of patients suffering from chronic conditions, would not only benefit patients directly, but could also contribute to the reduction of the economic burden to society.

An important aspect of fear, especially in chronic progressive diseases such as cancer, is the fear of progression or, more specifically, fear on the part of patients that their disease will progress and lead to either death or disability [4]. Fear of progression may be ameliorated with cognitive-behavioral therapies (CBT). However, it is still unclear whether or not and to what extent CBT can reduce fear and

anxiety, in general, and fear of progression, in particular [5–8]. Nevertheless, a recent study by Herschbach found a statistically significant long-term reduction of fear of progression in cancer patients after CBT as well as after a client-centered, supportive-experiential group therapy (SET) [9, 10].

While the demonstration of reduced fear of progression is an important patient-relevant outcome, it would be as important from a societal perspective to demonstrate whether CBT and SET can result in the reduction of direct and indirect medical costs. More specifically, whether CBT can be more cost-effective than SET needs to be studied. Cost reduction was addressed and demonstrated in studies among cancer patients [11, 12]. However, assessment of outcomes in psychosocial interventions applied to cancer populations has been heavily weighted in domains such as quality of life and psychological distress, whereas economic evaluations are altogether lacking [8].

The objective of our study was therefore to perform an incremental cost-effectiveness analysis of a randomized controlled trial published by Herschbach et al. [10] comparing a cognitive-behavioral group therapy (CBT) focusing on fear of progression to client-centered, supportive-experiential group therapy (SET).

Materials and methods

Study design

We performed an economic evaluation alongside a randomized controlled trial. Participants were recruited between November 2002 and December 2003 in two rehabilitation clinics in the region of Bavaria, Germany. Inclusion criteria were: breast, colon or cervical carcinoma (at all illness phases), minimum age of 18 years, inpatient rehabilitation and increased fear of progression measured with the standardized Fear of Progression Questionnaire [13]. Patients were excluded if they had cognitive impairment, were bedridden or had poor command of the German language. All patients had medical care insurance. A total of 174 cancer patients were randomized into two intervention groups (CBT or SET). Patients were assessed at baseline, post-intervention and at the 3- and 12-month follow-up after discharge.

Interventions

All patients underwent the same 3-week inpatient rehabilitation program. In addition to the standard rehabilitation program, patients in both CBT and SET groups received four sessions of group psychotherapy, each lasting 90 min. While the CBT was a directive and specific intervention aimed at confronting patients with their fears and making them learn to cope with them, the SET was a non-directive and unspecific intervention focusing on emotional expression, mutual support and reassurance, and social comparison [14].

Health-care utilization and costs

The economic evaluation was performed from the societal perspective. As this study was conducted over a 1-year period, costs and effects were left undiscounted. Incremental intervention costs were calculated based on the duration of the four sessions of group psychotherapy, group size and salaries of the psychologists. Following the Guidelines of the Working Group Methods in Health Economic Evaluation (AG MEA), a 20% charge was added to the calculated costs because of the time spent learning the manuals, preparing the sessions and conducting supervisions.

Patients of SET and CBT completed a retrospective health-care resource use assessment questionnaire at baseline and 12 months after rehabilitation. The questionnaire was developed following the guidelines proposed by the Working Group Methods in Health Economic Evaluation (AG MEA) [15]. We combined resource use volumes with unit costs to obtain a net cost per patient. If resource use was obtained for recall periods shorter than 12 months, resource use data were extrapolated to obtain annual figures. Direct medical costs included visits to practitioners, non-physician service utilization, inpatient and outpatient hospital treatments, day care, medication, devices and aids. Direct non-medical costs included loss of leisure time of patients due to participation in self-help groups and of parents or friends due to voluntary caregiving. Indirect costs were assessed using the human capital approach and calculated based on sick leave days. All costs were calculated in euros.

Unit costs

All costs were calculated for the year 2004. Medication was valuated on the basis of prices of the online German drugs index book [16]. Devices and aids were valuated with prices charged by the health-care funds of the regional association of the AOK Bavaria [17]. Costs for the day-care treatment were valuated in a conservative way with prices charged in 2004 at the University of Munich Hospital. All other index costs were proposed by the Working Group Methods in Health Economic Evaluation (AG MEA) [18]. These index costs were extrapolated for 2004 using a factor of 0.025 for the first year and 0.020 for the following years based on recommendations of the AG MEA. An overview of used costs is summarized in Table 1.

Effectiveness data

We report means and standard deviations of the fear of progression score and of the mental scale of the SF12 estimated in the original RCT.

Cost-effectiveness analysis

We performed an incremental cost-effectiveness analysis (CEA) comparing both intervention groups (CBT and SET) and calculated the incremental cost-effectiveness ratio (ICER). Costs used in the CEA were the mean direct costs (medical and non-medical) within the first year after discharge. Effectiveness was measured with the standardized Fear of Progression Questionnaire [4]. The mean fear of progression at the 12-month follow-up minus the mean fear of progression at baseline was used as an effectiveness measure. As a reduction in the fear of progression is aimed, effectiveness is expected to have negative figures. However, negative effectiveness measures in CEA are interpreted as being less effective. Owing to this fact, we multiplied the effectiveness by negative 1 to get positive figures in the event of more effects. To increase the comparability of this study to literature, we also performed the incremental CEA considering as an effect the mental score (MCS) of the 12-item Health Survey (SF-12) questionnaire at the 12-month follow-up [19]. The SF-12 includes 12 items that are summarized in two weighted summary scales: mental health (MCS) and physical health (PCS); lower scores indicate more severe disability. The items related to mental health (MCS) cover limitations to usual activities and emotional state. The mental score of the

Table 1 Prices applied in the economic evaluation

Cost categories	Price (€)	Cost categories	Price (€)
Physician visits[a]		Day-care treatment	
General practitioner	16.03	Internal medicine	252.00
Neurologist	23.02	Surgical	484.00
Internist	34.62	Gynecology	175.00
Oncologist	21.89	Neurology	269.00
		Radiology	235.00
		Physical medicine	270.00
		Oncology	575.00
		Pain unit	285.00
Inpatient treatment[c]		Outpatient treatment (hospital)	
Internal medicine	310.62	Gastroenterology	23.02
Surgical	349.55	Gynecology	26.88
Gynecology	377.33	Surgical	22.94
Gastroenterology	358.45	Urology	28.88
Urology	374.03	Dermatology	15.63
Dermatology	332.87	Internal medicine	34.62
Neurology	357.34	Orthopedic	23.43
Orthopedic	275.02	Cardiology	61.79
Cardiology	348.44	Radiology	83.54
Radiology	416.30	Pneumology	37.82
Rehabilitation oncology	105.00	Rheumatology	30.18
Rehabilitation orthopedics	102.00	Psychology	47.51
Mean value	390.00	Mean value	23.02
Psychotherapy[d]	47.51	Self-help groups (patient hour price)	17.80
Physiotherapy	21.89	Time of relatives (hour price)	17.80
Massage	9.70	Sick leave days[e]	89.00
Ergotherapy	29.00	Psychologist minutes[b]	0.4910

[a] Price per visit

[b] Salary of rehabilitation clinic staff

[c] Price per day

[d] Price per session

[e] Price of a calendar day

SF12 was chosen for comparison because of its close association with the Fear of Progression Questionnaire [4].

Statistical analysis

We used non-parametric bootstrap techniques with 1,000 replications to estimate mean values and 95% confidence intervals. To compare the means of the groups, we calculated the achieved significance level (ASL) using bootstrap-t methods. The achieved significance level corresponds to the p value of a t test and will be called p_{boot} here [20]. A probability p value of <0.004 with Bonferroni correction was considered significant. The uncertainty surrounding the estimates of cost-effectiveness was illustrated by a cost-effectiveness acceptability curve. Mean costs and mean effects distributions obtained from 1,000 bootstrap replications were used to plot the incremental cost-effectiveness plane and the acceptability curve. As the distribution of bootstrap estimates of costs and effects was symmetric, we used the percentile method to estimate confidence intervals [21].

Uncertainty in the cost and effectiveness estimates can be allowed for by sensitivity analysis, statistical inference or a combination of the two approaches [22]. We addressed the uncertainty-presenting confidence intervals obtained from bootstrap samples and calculated acceptability curves for the incremental cost-effectiveness ratios [23]. Statistical calculations were performed using SPSS version 14.0.

Results

Study population

Health-care resource data were collected for the 174 patients randomized either in the CBT ($N = 91$) or in the SET ($N = 83$) group. Baseline characteristics of the study population are reported in Table 2. The main diagnoses of the study population in the CBT and SET groups, respectively, were: 61.8 and 59% breast cancer, 6.7 and 8.4% colorectal cancer, 9.0 and 8.4% bladder/prostate cancer, 12.4 and 8.4% gynecological cancer and 10.1 and 15.7% other cancers. Complete indirect cost data of patients employed at baseline were available at the 12-month follow-up for 73 patients (44 CBT; 29 SET). No missing data were imputed.

Dropouts

By the 12-month follow-up, 37 patients (18 CBT; 19 SET) had dropped out. Dropouts were very similar to participants with regard to age, sex, employment and oncological treatment in the past year. However, whereas at baseline only 56.8% of dropouts were asymptomatic and 29.7% had relapse or metastasis, 72.3% of the participants were asymptomatic and only 14.6% had relapse or metastasis. Ten dropouts died within the follow-up.

Table 2 Baseline characteristics of patients

	CBT ($N = 91$)	SET ($N = 83$)
Age (mean years ± SD)	53.7 (9.6)	53.8 (10.6)
Male (%)	14.3	14.5
Employed patients (%)	52.8	42.2
Education (%)		
Elementary school	34.4	39.8
Secondary school	30.0	30.1
University entrance diploma	31.1	27.7
Other	4.4	2.4
Living with a partner/relative (%)	75.6	74.1

The baseline direct medical costs and indirect costs of the dropouts were compared with those of the participants. In comparison to participants [€14,321.19 (95% CI 12,217.62; 16,424.76)], dropouts incurred significantly fewer direct medical costs at baseline [€8,875.66 (95% CI 6,171.16; 11,580.15)]. Dropouts incurred considerably fewer costs in day-care treatment, inpatient treatment, non-medical services, medication and ambulant physician treatment than participants (data not shown). Although the proportion of employed patients was very similar in both groups, dropouts on average incurred fewer indirect costs [6,366.92€ (95% CI 2,501.48; 10,232.36)] than participants [12,793.75€ (95% CI 10393.56; 15193.93)]. As participants had significantly more inpatient days than dropouts, they also had more sick leave days.

Health-care utilization and costs

Both CBT and SET were performed as an additional therapy module to a standard 3-week inpatient rehabilitation program. The incremental cost of adding either CBT or SET to the costs of a standard 3-week inpatient rehabilitation program was about €47 per patient or €282 per group.

Resource use is presented in Table 3. Patients of the CBT at the 12-month follow-up had fewer general practitioner visits, fewer inpatient days, less outpatient treatment in hospital, fewer sick leave days and required less caregiving from friends/relatives than patients of the SET. Consequently, these patients at the 12-month follow-up on average had fewer direct medical, direct non-medical and indirect costs, but these differences where not significant ($p_{boot} = 0.451$, $p_{boot} = 0.552$ and $p_{boot} = 0.396$, respectively; Table 4). However, the main finding considering direct medical and indirect costs is a statistically significant reduction in average costs after rehabilitation in both groups. Patients incurred at baseline many more inpatient

Table 3 Utilization of health-care resources and sick leave days during the 12-month follow-up

Indication	At baseline		12-month follow-up	
	SET ($N = 83$)	CBT ($N = 91$)	SET ($N = 83$)	CBT ($N = 91$)
Physician visits (per month)				
General practitioner	1.17 (1.51)	1.29 (1.93)	0.98 (1.35)	0.63 (1.09)
Neurologist	0.07 (0.26)	0.06 (0.23)	0.09 (0.34)	0.05 (0.22)
Internist	0.24 (0.77)	0.44 (1.34)	0.17 (0.48)	0.32 (0.83)
Oncologist	0.69 (1.53)	0.32 (0.73)	0.31 (0.87)	0.36 (0.79)
Orthopedist	0.31 (2.21)	0.14 (0.53)	0.28 (1.10)	0.23 (0.79)
Hospital inpatient treatment (days per year)	16.21 (17.24)	13.56 (13.96)	8.87 (15.90)	3.57 (8.56)
Outpatient treatment in hospital (per month)	0.85 (1.86)	1.04 (2.21)	2.1 (12.56)	0.58 (1.59)
Day-care treatment (treatment days per year)	8.14 (14.40)	9.47 (16.16)	2.17 (5.15)	3.43 (10.34)
Psychotherapy (visits per quarter)	1.18 (3.17)	0.84 (2.33)	1.57 (4.03)	2.19 (4.64)
Physiotherapy (visits per quarter)	2.46 (5.39)	1.58 (4.95)	2.93 (7.20)	2.43 (6.19)
Massage (units per quarter)	1.84 (4.99)	0.64 (2.17)	2.68 (6.20)	1.49 (4.17)
Ergotherapy (visits per quarter)	0.07 (0.65)	0	0.07 (0.62)	0
Self-help groups (visits per month)	0.18 (0.50)	0.12 (0.39)	0.31 (0.77)	0.19 (0.55)
Relatives' help (hours per month)	19.93 (45.43)	14.99 (35.19)	9.07 (38.17)	5.52 (10.56)
Aids and devices (absolute units per year)	19	10	12	15
Medication (costs per month)	248.63 (682.19)	229.45 (690.89)	109.69 (164.71)	105.71 (170.68)
Sick leave days (calendar days per year)[a]	110.50 (119.08)	111.46 (107.78)	72.82 (117.02)	50.86 (84.59)

Values (except for aids and devices) are means (standard deviations)

[a] Only of paid, employed patients at beginning of the study

Table 4 Mean (95% confidence interval) costs (in the last 12 months) at baseline and at the 12-month follow-up

	Baseline	12-month follow-up	p value
Direct medical costs			
SET ($N = 83$)	13,213.16 [11,055.47; 16,012.25]	6,737.21 [5,085.96; 8,553.15]	$p_{boot} = 0.000$
CBT ($N = 91$)	13,116.39 [10,666.51; 15,707.37]	5,350.93 [4,117.45; 6,661.93]	$p_{boot} = 0.000$
Direct non-medical costs			
SET ($N = 83$)	4,239.27 [2,353.15; 6,458.65]	2,039.14 [647.46; 4,197.53]	$p_{boot} = 0.070$
CBT ($N = 91$)	3,204.44 [1,785.18; 5,177.69]	1,213.87 [739.86; 1,734.75]	$p_{boot} = 0.069$
Indirect costs			
SET ($N = 44$)	12,810.81 [9,362.09; 16,283.96]	6,500.68 [2,946.32; 10,691.75]	$p_{boot} = 0.045$
CBT ($N = 55$)	11,161.38 [8,535.00;13,809.28]	4,507.01 [2,482.35; 6,852.89]	$p_{boot} = 0.001$

Means and confidence intervals calculated with 1,000 bootstrap replications. Costs are presented in euros

days and day-care days, consumed more medication and needed more caregiving than in the 12-month follow-up. Nevertheless, it is important to mention that the rehabilitation program followed a curative, invasive and generally expensive oncological treatment: Before baseline, many patients received either chemotherapy (63.2%) or irradiation therapy (56.9%), and 93.7% were operated on. In the 12-month follow-up, only 13.9% received chemotherapy, 8.8% irradiation therapy and 17.5% were operated on.

Effectiveness data

The fear of progression mean (SD) score was at baseline 11.49 (2.45) in the CBT and 11.02 (2.41) in the SET group. At the 12 month follow-up, the fear of progression mean score was 10.07 (2.48) in the CBT and 9.73 (2.23) in the SET group. Regarding the mental score of SF12, the mean scores at baseline were 38.7 (8.9) and 37.3 (8.4), and at the 12 month follow-up 43.3 (11.4) and 42.6 (9.4) in the CBT and SET groups, respectively.

Cost-effectiveness analysis

Both direct costs and reduction of fear of progression data were available for 61 patients of the SET and 65 patients of CBT. The estimated means [95% CI] of direct costs and reduction of fear of progression were €9,045.03 [6,359.07; 12,091.87] and 1.41 [0.93; 1.92] in the SET, and €6,682.78

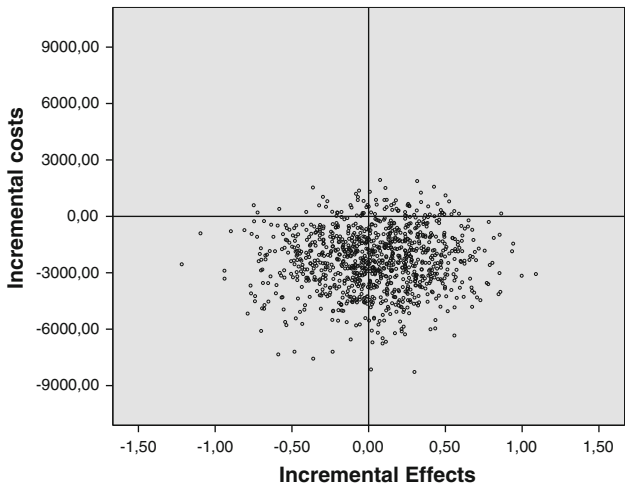

Fig. 1 Incremental cost-effectiveness plane. Costs are direct costs (medical and non-medical) within the first year after discharge. Effects are the reduction of fear of progression within the first year after discharge. Cost and effect pairs were estimated with 1,000 bootstrap replications

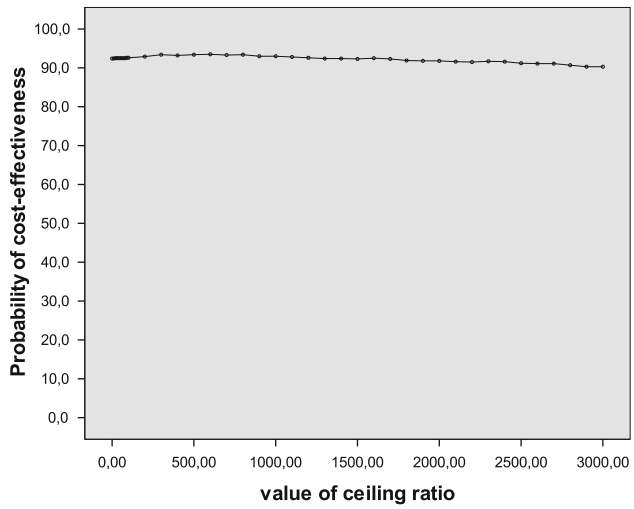

Fig. 2 Acceptability curve regarding the probability of superior cost-effectiveness of CBT in comparison to SET. *Curve* estimated with 1,000 bootstrap replications

[4,998.09; 8,440.95] and 1.44 [1.02; 1.09] in the CBT. Figure 1 shows the cost-effectiveness plane. The majority of the cost-effect pairs after bootstrap analysis were located in the southern quadrants of the cost-effectiveness plane, suggesting fewer costs but very similar effects. The differences [95% CI] in effects and direct costs amounted to 0.03 [−0.68; 0.67] and to minus €2,362.25 [−5,753.91; 622.36], respectively. Due to these figures, CBT can be considered a dominant strategy, with the resulting ICER [95% CI] amounting to minus €78,741.66 [−154,987.20; 110,486.32] for an additional unit of effect. Given the acceptability curve, there is a 92.4% chance that CBT, compared with SET, is cost-effective without a need for additional costs to payers, i.e., there is a probability of 92.4% that the ICER is negative, meaning that CBT is less costly, albeit similarly effective (Fig. 2).

Both direct costs and quality of life data were available for 63 patients of the SET and 67 patients of the CBT. The estimated means [95% CI] of all direct costs and the mental scale of the SF-12 were €8,873.88 [6,259.44; 11,727.79] and 43.48 [41.09; 45.81] in the SET group, as well as €6,157.79 [4,782.19; 7,634.02] and 43.64 [40.97; 46.24] in the CBT, resulting in a negative ICER [95% CI] amounting to minus €16,975.56 [−20,307.00; 19,198.20] for an additional unit of effect. The majority of the cost-effect pairs after bootstrap analysis were located in the southern quadrants of the cost-effectiveness plane (plane not shown), suggesting fewer costs and very similar effects. Given the acceptability curve (figure not shown), there is a 96.5% chance that CBT, compared with SET, is cost-effective without the need for additional costs to payers. In the development phase of the Fear of Progression Questionnaire, a close association between the fear of progression score and the mental score of the SF-12 was identified. This could be one explanation for the similarity of the results described above with results of the CEA using fear of progression as the effect outcome [4]. Indirect costs were not included in the cost-effectiveness analysis because only 52.8% of CBT and 42.2% of SET participants were still in the work force and indirect costs were calculated based on sick leave periods (Figs. 3, 4).

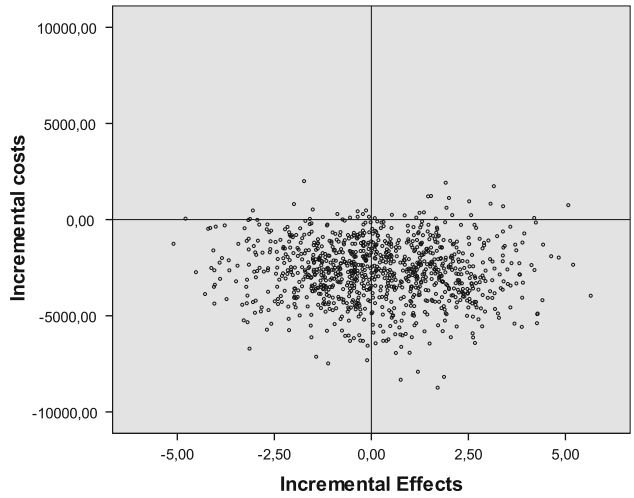

Fig. 3 Incremental cost-effectiveness plane. Costs are direct costs (medical and non-medical) within the first year after discharge. The effect outcome is the score of the mental scale of the SF12 within the first year after discharge. Cost and effect pairs were estimated with 1,000 bootstrap replications

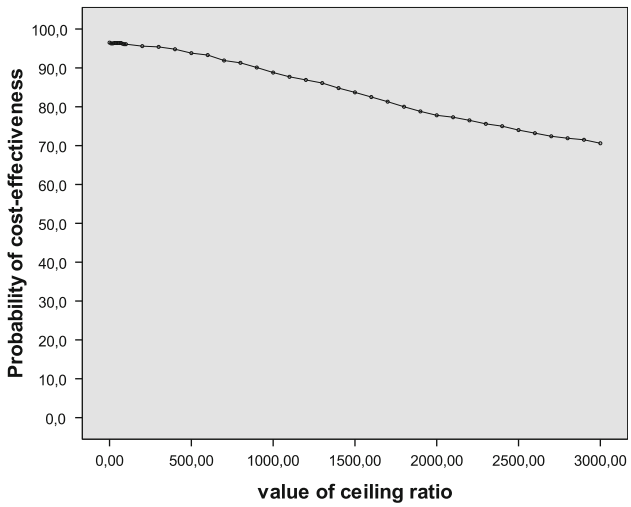

Fig. 4 Acceptability curve regarding the probability of superior cost-effectiveness of CBT in comparison to SET using the mental scale of the SF-12 as the effect outcome. *Curve* estimated with 1,000 bootstrap replications

Discussion

A recent, randomized controlled trial aiming to treat cancer patients with elevated levels of anxiety demonstrated a long-term reduction of fear of progression after CBT and SET [9, 10]. From the societal perspective, whether the improved clinical outcomes also translate into economic benefits is of interest. Our objective was therefore to perform an incremental cost-effectiveness analysis of the results of this randomized controlled trial published by Herschbach. The incremental cost of adding either CBT or SET to a standard 3-week inpatient rehabilitation program was estimated to be about €282 per group. Considering direct costs incurred in the first 6 months after discharge from rehabilitation, we could show a superior cost-effectiveness of CBT in comparison to SET without the need of additional costs on the part of payers.

As literature shows that behavioral treatments are in general an effective intervention for reducing unnecessary medical usage and costs [24], we expected our patients to report fewer costs in the follow-up. Indeed, patients incurred at the 12-month follow-up approximately half the average of baseline costs. However, both the CBT and the SET were performed as an additional therapy module to a standard 3-week inpatient rehabilitation program and followed a curative, invasive and generally expensive oncological treatment. We are therefore not able to determine to what extent the reduction correlates with the effect of the psychological interventions.

Patients of the CBT in follow-up statistics had fewer, nonsignificant direct and indirect costs than patients of the SET, mainly because of fewer inpatient and sick leave days. Our findings are similar to those of a pilot study targeting the impact of expressive disclosure in a prostate cancer population, which showed a statistically nonsignificant trend toward a lower frequency of health contacts and lower utilization of medicines in the intervention group [11]. However, this study observed a very small sample and the intervention is hardly comparable to ours. An RCT evaluating a group psychosocial intervention among breast cancer patients determined a statistically nonsignificant between-group reduction on direct medical costs [12]. To date, we have found no papers addressing productivity loss among cancer populations receiving psychotherapeutical interventions.

When interpreting our results considering the comparison of costs between groups, it is important to recognize that we preferred to compare two interventions instead of comparing CBT with no intervention at all. One consequence of this approach was that it was much more difficult to demonstrate superiority in cost-effectiveness. We also have to keep in mind that we had many dropouts in the follow-up and these had significantly fewer costs at baseline than participants. A possible explanation for this is that dropouts at baseline had more relapses and metastases than the remaining patients. Due to their illness severity, these patients were probably receiving palliative instead of expensive, curative oncological treatments. Owing to the differences described above, we made the assumption that our costs of follow-up were probably slightly overestimated due to the absence of the dropouts.

Although there was neither a statistically significant difference in effects nor a statistically significant difference in costs between our groups, there was a difference in the cost-effectiveness of the interventions. Indeed, the recent development of cost-effectiveness acceptability curves reminds us that the absence of a statistical difference in either costs or effects does not necessarily mean that two treatments cannot be distinguished [25]. Moreover, because of the usual low power of economic evaluations performed alongside randomized clinical trials, the focus of cost-effectiveness studies should be on estimating cost-effectiveness, even when either cost or effect differences lack conventional statistical significance [26].

Our estimated cost-effectiveness ratios are negative and the magnitude of such ratios is not informative. Moreover, the judgment as to whether an intervention is considered cost-effective depends on the willingness of payers to reimburse additional costs for additional clinical benefits. For both reasons, we estimated an incremental cost-effectiveness acceptability curve (CEAC), which represents the probability that CBT is cost-effective, compared with SET for a range of maximum monetary values (ceiling ratios λ) that a decision maker might be willing to pay for an additional unit of effect [27, 28]. In our study, the calculated

probability of 92.4% of higher cost-effectiveness without the need of additional costs clearly states the superiority of CBT in comparison with SET. An even higher probability is achieved (96.5%) considering quality of life as the effect.

The comparison of these results to the literature is limited, because the outcome assessment in psychosocial interventions applied to cancer populations have been heavily weighted in domains such as quality of life and psychological distress [8]. Nevertheless, in a meta-analysis targeting the cost-effectiveness of psychological interventions for generalized anxiety disorders, CBT was the most effective and cost-effective intervention [29]. Our results support these findings.

Our study has some limitations. First, our economical evaluation was performed alongside the main trial and was probably underpowered, which led to wide confidence limits. Second, we used a self-report questionnaire to collect information about health-care resources, and this kind of data source is susceptible to recall bias. Third, we extrapolated a part of the direct cost components to obtain 1 year figures conservatively assuming that resource use increases constantly. Fourth, we recognize that fear of progression, the effect used in the CEA, is an unusual outcome and eventually difficult to interpret. However, it is an important outcome because of its clinical relevance to patients and clinicians. In order to increase the comparability of our work with literature, we decided to estimate an additional ICER using a well-recognized and easier to interpret measure: the mental scale of SF-12. Another possibility would have been to estimate QALYs using the SF-12. However, the accuracy of utilities estimated from the SF-12 was recently considered unsatisfactory, especially for older and less healthy groups, and inaccurate values can easily bias the conclusion of a CUA [30]. Additionally, necessary parameters of a representative sample of the German population are not available so far. Due to the fact that the results of a CUA would have been questionable, we decided to go for a CEA using the SF-12 to increase the comparability of our study with other studies.

Our main result is the superior cost-effectiveness of CBT in comparison to SET for our sample of cancer patients with high levels of anxiety. However, the magnitude of the economic benefits when comparing CBT with no intervention requires further investigation. Further economic evaluations should also focus more closely on the impact of psychological interventions on productivity loss.

Acknowledgments This study was supported by the German Federal Ministry of Education and Research (BMBF) and the German Pension Insurance Administration (VdR). We thank the clinics and our colleagues for their contribution to this study: H. Faller, E. Trempa, A. Reusch, W. Igel, A. Maucher, K. Behets, J. Stepien, J. Lerch, B. Hoßner, B. Heldmann, J. Markel, C. Berthold, B. Süß, R. Schröck, L. Schmid, K. Zellmann, G. Rauthe and W. Miehle.

Conflict of interest All authors have nothing to disclose.

References

1. Hoffman, D.L., Dukes, E.M., Wittchen, H.U.: Human and economic burden of generalized anxiety disorder. Depress Anxiety, 1091–4269 (2006)
2. Andlin-Sobocki, P., Wittchen, H.U.: Cost of anxiety disorders in Europe. Eur. J. Neurol. **12**(Suppl 1), 39–44 (2005)
3. Wittchen, H.U.: Generalized anxiety disorder: prevalence, burden, and cost to society. Depress Anxiety **16**, 162–171 (2002)
4. Herschbach, P., Berg, P., Dankert, A., Duran, G., Engst-Hastreiter, U., Waadt, S., Keller, M., Ukat, R., Henrich, G.: Fear of progression in chronic diseases: psychometric properties of the fear of progression questionnaire. J. Psychsom. Res. **58**, 505–511 (2005)
5. Sheard, T., Maguire, P.: The effect of psychological interventions on anxiety and depression in cancer patients: results of two meta-analyses. Br. J. Cancer **80**, 1770–1780 (1999)
6. Meyer, T.J., Mark, M.M.: Effects of psychosocial interventions with adult cancer patients: a meta-analysis of randomized experiments. Health Psychol. **14**, 101–108 (1995)
7. Newell, S.A., Sanson-Fisher, R.W., Savolainen, N.J.: Systematic review of psychological therapies for cancer patients: overview and recommendations for future research. J. Natl Cancer Inst. **94**, 558–584 (2002)
8. Owen, J.E., Klapow, J.C., Hicken, B., Tucker, D.C.: Psychosocial interventions for cancer: review and analysis using a three-tiered outcomes model. Psychooncology **10**, 218–230 (2001)
9. Herschbach, P., Berg, P., Waadt, S., Duran, G., Engst-Hastreiter, U., Henrich, G., Book, K., Dinkel, A.: Group psychotherapy of dysfunctional fear of progression in patients with chronic arthritis or cancer. Psychother. Psychosom. **79**, 31–38 (2010)
10. Herschbach, P., Book, K., Dinkel, A., Berg, P., Waadt, S., Duran, G., Engst-Hastreiter, U., Henrich, G.: Evaluation of two group therapies to reduce fear of progression in cancer patients. Support. Care Cancer **18**, 471–479 (2010)
11. Rosenberg, H.J., Rosenberg, S.D., Ernstoff, M.S., Wolford, G.L., Amdur, R.J., Elshamy, M.R., Bauer-Wu, S.M., Ahles, T.A., Pennebaker, J.W.: Expressive disclosure and health outcomes in a prostate cancer population. Int. J. Psychiatry Med. **32**, 37–53 (2002)
12. Simpson, J.S., Carlson, L.E., Trew, M.E.: Effect of group therapy for breast cancer on healthcare utilization. Cancer Pract. **9**, 19–26 (2001)
13. Mehnert, A., Herschbach, P., Berg, P., Henrich, G., Koch, U.: Fear of progression in breast cancer patients—validation of the short form of the Fear of Progression Questionnaire (FoP-Q-SF). Z. Psychosom. Med. Psychother. **52**, 274–288 (2006)
14. Herschbach, P., Duran, G., Engst-Rastreiter, U., Waadt, S., Berg, P.: Gruppentherapetische Behandlung von Progredienzangst bei Krebspatienten. Verhaltenstherapie Verhaltensmedizin **27**, 298–309 (2006)
15. Hessel, F., Wittman, M., Petro, W., Wasem, J.: Methoden zur Kostenerfassungim Rahmen der ökonomischen Evaluation einer Rehabilitations-maßnahme bei chronischen Atemwegserkrankungen. Pneumologie **54**, 289–295 (2002)
16. Rote-Liste: Rote Liste Service GmbH. In: ECV Verlag, Frankfurt (2004)
17. AOK: Vergütungsliste für Orthopädische Hilfsmittel der Primärkassen in Bayern (2004)
18. Krauth, C., Hessel, F., Hansmeier, T., Wasem, J., Seitz, R., Schweikert, B.: Empirical standard costs for health economic

evaluation in Germany—a proposal by the working group methods in health economic evaluation. Gesundheitswesen **67**, 736–746 (2005)
19. Gandek, B., Ware, J.E., Aaronson, N.K., Apolone, G., Bjorner, J.B., Brazier, J.E., Bullinger, M., Kaasa, S., Leplege, A., Prieto, L., Sullivan, M.: Cross-validation of item selection and scoring for the SF-12 health survey in nine countries: results from the IQOLA project. International quality of life assessment. J. Clin. Epidemiol. **51**, 1171–1178 (1998)
20. Barber, J.A., Thompson, S.G.: Analysis of cost data in randomized trials: an application of the non-parametric bootstrap. Stat. Med. **19**, 3219–3236 (2000)
21. Carpenter, J., Bithell, J.: Bootstrap confidence intervals: when, which, what? A practical guide for medical statisticians. Stat. Med. **19**, 1141–1164 (2000)
22. Drummond, M.F., O'Brien, B., Stoddart, G.L., Torrance, G.W.: Methods for the Economic Evaluation of Health Care Programmes, 2nd edn. Oxford Medical Publications, New York (1997)
23. Briggs, A.H.: Statistical approaches to handling uncertainty in health economic evaluation. Eur. J. Gastroenterol. Hepatol. **16**, 551–561 (2004)
24. Chiles, J.A., Lambert, M.J., Michael, J., Hatch Arlin, L.: The impact of psychological interventions on medical cost offset: a meta-analytic review. Clin. Psychol. Sci. Prax. **6**, 204–220 (1999)
25. Knapp, M., Thorgrimsen, L., Patel, A., Spector, A., Hallam, A., Woods, B., Orrell, M.: Cognitive stimulation therapy for people with dementia: cost-effectiveness analysis. Br. J. Psychiatry **188**, 574–580 (2006)
26. Briggs, A.: Economic evaluation and clinical trials: size matters. BMJ **321**, 1362–1363 (2000)
27. Briggs, A., Fenn, P.: Confidence intervals or surfaces? Uncertainty on the cost-effectiveness plane. Health Econ. **7**, 723–740 (1998)
28. Fenwick, E., O'Brien, B.J., Briggs, A.: Cost-effectiveness acceptability curves—facts, fallacies and frequently asked questions. Health Econ. **13**, 405–415 (2004)
29. Heuzenroeder, L., Donnelly, M., Haby, M.M., Mihalopoulos, C., Rossell, R., Carter, R., Andrews, G., Vos, T.: Cost-effectiveness of psychological and pharmacological interventions for generalized anxiety disorder and panic disorder. Aust. N. Z. J. Psychiatry **38**, 602–612 (2004)
30. Chuang, L.H., Kind, P.: Converting the SF-12 into the EQ-5D: an empirical comparison of methodologies. Pharmacoeconomics **27**, 491–505 (2009)