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Chapter 8

Cost-utility of an Internet-based intervention with or without therapist support in comparison with a waiting list for individuals with eating disorder symptoms

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Abstract

Objective: To investigate the cost-utility of the internet-based intervention 'Featback' provided with different levels of therapist support, in comparison to a waiting list. **Method:** This economic evaluation was conducted from a societal perspective and was part of a randomized controlled trial in which participants (*N* = 354) with self-reported ED symptoms were randomized to: 1) eight weeks of Featback, consisting of psychoeducation and a fully automated monitoring- and feedback system, 2) Featback with low-intensity (weekly) therapist support, 3) Featback with high-intensity (three times a week) therapist support, 4) a waiting list. Participants were assessed at baseline, post-intervention, and 3-month follow-up. Cost-utility acceptability curves were constructed.

Results: No significant differences between the study conditions were found regarding quality-adjusted life-years (*p*=.55) and societal costs (*p*=.45), although the mean costs per participant were lowest in the Featback condition with low-intensity therapist support (€1951), followed by Featback with high-intensity therapist support (€2032), Featback without therapist support (€2102), and the waiting list (€2582). Featback seemed to be cost-effective as compared to the waiting list. No clear preference was found for Featback with or without therapist support.

Discussion: A fully automated Internet-based intervention for ED symptoms with no, low-, or high-intensity therapist support represented good value for money when compared to a waiting list. This finding may have important implications for clinical practice, as both the unguided- and guided intervention could allow for more efficient care and widespread dissemination, potentially increasing the accessibility and availability of mental health care services for individuals with ED symptoms.

Introduction

Eating disorder (ED) course and outcome vary depending on the type and severity of the ED, but, in general, can be regarded as rather unsatisfactory. In terms of anorexia nervosa (AN) and bulimia nervosa (BN), approximately half of the patients show full recovery, whereas 30% show improvement and 20% display a chronic course (Keel & Brown, 2010; Steinhausen, 2002; Steinhausen & Weber, 2009) Remission rates for binge eating disorder seem to be more favorable than AN and BN, with most estimates varying between 55% and 80% (Keel et al., 2010). Furthermore, ED often co-occur with other psychiatric illnesses (Hudson, Hiripi, Pope, & Kessler, 2007) and mortality rates are relatively high (Arcelus, Mitchell, Wales, & Nielsen, 2011; Harris & Barraclough, 1998).

The economic burden of ED is substantial. The societal costs of ED can be divided into healthcare costs, including pharmaceutical and healthcare utilization costs, as well as non-healthcare costs, including costs related to absences due to illness or losses in productivity at work (Simon, Schmidt, & Pilling, 2005; Stuhldreher et al., 2012). Numerous studies (Dickerson et al., 2011; Grenon et al., 2010; Krauth, Buser, & Vogel, 2002; Mitchell et al., 2009; Striegel-Moore, Leslie, Petrill, Garvin, & Rosenheck, 2000) have estimated the direct costs for patients with an ED, including healthcare costs and non-medical costs such as transportation and social services. These costs varied substantially between the different studies and ED subtypes. The annual direct costs per patient with an ED were found to range from 127 USD to 8042 USD (Stuhldreher et al., 2012). To our knowledge, only two studies have investigated the indirect costs, being costs related to productivity losses due to illness related absence, reduced productivity, and premature death. Krauth et al. (2002) estimated the annual indirect costs for patients with AN at 4445 USD and for BN at 1528 USD, whereas another study (Stuhldreher et al., 2015) estimated the mean 3-month indirect costs of patients with AN to be €2492.

Health economic evaluations can inform decision making regarding how to optimally allocate (scarce) health-care resources. Unfortunately, economic analyses in the field of ED are scarce. A review by Stuhldreher et al. (2012) identified only two studies that met inclusion criteria, which were that costs and effects of at least two treatments were compared, and that costs beyond those of the intervention being studied were included. One study (Lynch et al., 2010) found that treatment as usual (i.e. help from a primary care provider or nutritionist, or self-referral to a specialty mental health organization), supplemented with a guided self-help intervention based on cognitive behavioral therapy (CBT) principles, was more effective and less costly than treatment as usual alone in patients with recurrent binge eating episodes. Another study (Byford et al., 2007) investigated the cost-effectiveness of specialist outpatient treatment (i.e. manualized

individual CBT, parental counseling with the individual, dietary therapy and multi-modal feedback) in comparison with inpatient treatment (i.e. multidisciplinary psychiatric approach with the aim of normalizing eating, restoring healthy weight and facilitating psychological change) and treatment as usual (i.e. a multidisciplinary, individual- and family-based approach, including care from dietitians and pediatricians) for adolescents with AN. Specialist outpatient treatment was found to dominate the other two treatments. Most recently, Crow et al. (2013) compared CBT to a stepped-care intervention for individuals with BN. Within the stepped-care intervention individuals could move from less intensive and expensive self-help, to the use of medication, and finally to high-intensity CBT consisting of eighteen 50-minute sessions over the course of four months. This stepped-care intervention appeared cost-effective in comparison to directly starting with high-intensity CBT.

Until now, no economic evaluations have been conducted regarding E-health interventions for ED. In the field of mental health in general, Donker et al. (2015) recently reviewed the literature with respect to the economic evaluations of Internet-based mental health interventions, including interventions targeting symptoms of depression, anxiety, smoking cessation, suicidal ideation, and harmful alcohol use. Both guided and unguided Internet-based interventions were demonstrated cost-effective in comparison to control groups that included treatment as usual, waiting lists, or attention control groups. Nevertheless, the evidence was more robust for guided interventions as compared with unguided interventions.

The aim of the current study was to investigate the cost-utility of fully automated Internet-based intervention 'Featback' with different levels of therapist support (i.e. none, once a week, and three times a week) in comparison to a waiting list for individuals with ED psychopathology.

Methods

Design and participants

This economic evaluation adopted a societal perspective, the preferred viewpoint for conducting a cost-effectiveness analysis which incorporates all costs and all health effects regardless of who incurs the costs and who obtains the effects (Gold, Siegel, Russell, & Weinstein, 1996). The economic evaluation was part of a randomized controlled trial comparing: 1) Internet-based intervention Featback, comprising psychoeducation and a fully automated monitoring and feedback system, 2) Featback with low-intensity (weekly) therapist support, 3) Featback with high-intensity (three times a week) therapist support, and 4) a waiting list. Participants were recruited via the Featback website and the website

of a Dutch pro-recovery-focused e-community ('Proud2Bme') for young women with ED problems. The inclusion criteria were age ≥ 16, access to the Internet, and self-reported ED symptoms as assessed by the Short Evaluation of Eating Disorders (Bauer, Winn, Schmidt, & Kordy, 2005) and the Weight Concern Scale (Killen et al., 1993). Ethical approval for the study was obtained from the Leiden University Medical Center ethics committee. After screening and providing informed consent, 354 participants were randomized to the study conditions with a block size of 40 and a 1:1:1:1 allocation ratio. Detailed information on the study methods can be found in the published study protocol (Aardoom, Dingemans, Spinhoven, Roijen, & van Furth, 2013). Furthermore, the effectiveness results of this study have been reported elsewhere (Aardoom et al., 2016). The current study included data that were collected at baseline, post-intervention (i.e. after eight weeks), and at 3-month follow-up (i.e. three months after the post-intervention assessment), resulting in a time horizon for the economic evaluation of five months.

Interventions

Featback

Featback consisted of psychoeducation as well as a fully automated monitoring and feedback system. Participants received a weekly invitation by e-mail asking them to complete a monitoring questionnaire consisting of eight 4-point Likert items assessing four dimensions: body dissatisfaction, excessive concern with body weight and shape, unbalanced nutrition and dieting, and binge eating and compensatory behaviors. After completion, a supportive feedback message was automatically generated according to a pre-defined algorithm taking into account their reported status (healthy range or unhealthy range) of each of the above-mentioned dimensions, as well as patterns of change (improved, deteriorated, or unchanged). The feedback messages contained social support by expressing interest in, and concerns about the participants' well-being. Positive reinforcement techniques such as encouragement were used to stimulate and/or maintain healthy behaviors and attitudes. Furthermore, the messages included tips and advice on how to counteract negative developments in reported ED-related symptoms. See Bauer et al. (2009) and our published study protocol (Aardoom et al., 2013) for more detailed information.

Featback supplemented with low-intensity support

Participants received Featback supplemented with low-intensity (weekly) therapist support by means of e-mail, chat and/or teleconference. An e-mail support session

included one e-mail reply from the therapist to the participant, whereas a chat or teleconference support session consisted of a 20-minute conversation. For each support session, participants could choose their preferred medium of support.

Featback supplemented with high-intensity support
Participants received Featback supplemented with high-intensity (three times a week) therapist support by means of e-mail, chat and/or teleconference.

Waiting list control condition (WLC)
Participants in the WLC waited five months before receiving Featback with low-intensity therapist support.

Participants in all study conditions were free to undergo any other type of intervention or treatment (i.e. usual care).

Measures

Health-related quality of life
Health-related quality of life was measured by the EuroQol (EQ-5D-3L) (EuroQol Group, 1990). This self-report questionnaire consists of five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension can be rated on three levels: no problems, some problems, and extreme problems. Someone's health state can be expressed by a five-digit number using the answer digits for each of the five dimensions. Thus, a total of 243 (3^5) distinct health states can be defined. Each health state was translated into a utility score ranging from 0 (death) to 1 (perfect health) using the Dutch tariff (Lamers, Stalmeier, & Krabbe, 2005). Quality-adjusted life-years (QALYs) were calculated over the course of five months using the area-under-the-curve method. In addition to the EQ-5D-3L, QALYs were also calculated using the Visual Analog Scale (VAS) ranging from 0 (worst imaginable health) to 100 (perfect health).

Costs
Healthcare costs included costs related to the intervention, health care utilization and medication. Intervention costs included the time investment of psychologists when an alarm signal was received in case participants showed severe deteriorations in symptoms (i.e. 10 minutes for each alarm signal in order to send a standardized e-mail(Aardoom et al., 2013)) multiplied by their hourly pay rate (€44.05). Costs related to the amount of therapist support were estimated by multiplying the amount of therapist investment (i.e.

25 minutes for one support session: 5 minutes for preparation and 20 minutes for support session) by their hourly pay rate (€21.50). Supervision costs were based on multiplying time investments (i.e. four 2-hour group supervision sessions and two individual half-an-hour supervision sessions) by the hourly pay rate of all therapists (€21.50) and one supervisor (€44.05). To calculate the supervision costs per participant, the total amount of supervision costs was divided by the number of participants who received therapist support.

The utilization of health care services was assessed with the Trimbos/iMTA questionnaire for Costs associated with Psychiatric Illness (TiC-P) (Hakkaart-van Roijen, Donker, & Tiemens, 2002). The recall period included 2 months (pre- to post-intervention) and 3 months (post-intervention to 3-month follow-up). The costs were calculated by multiplying health care use (i.e. the number of contacts with the health care provider) with their standard cost prices using the Dutch guidelines for cost research in health care (Hakkaart-van Roijen, Tan, & Bouwmans, 2010). Medication costs were obtained from the National Healthcare Institute (2015).

Non-healthcare costs were assessed with the Health and Labor Questionnaire (SF-HLQ) (van Roijen L., Essink-Bot, Koopmanschap, Bonsel, & Rutten, 1996). These costs were related to productivity losses at work, including absence from paid work (i.e. absenteeism), production losses due to reduced efficiency (i.e. presenteeism), and difficulties in performing unpaid work such as domestic tasks. The recall period for non-healthcare costs was one month. Costs were extrapolated by multiplying the reported costs by the number of months in-between the corresponding assessment periods. Costs related to absenteeism were calculated according to the friction cost method. More specifically, the number of hours that participants were absent from their paid job was multiplied by the average gross hourly wage per paid working individual in the Netherlands, based on age and gender (Hakkaart-van Roijen et al., 2010). Presenteeism costs were calculated based on the HLQ method, in which participants had to indicate how many hours of work they would need to catch up for all the work they were unable to perform because of health problems. These hours of work were then multiplied by the average gross hourly wage per paid working individual in the Netherlands, based on age and gender (Hakkaart-van Roijen et al., 2010). Finally, costs related to difficulties in performing unpaid work were calculated by multiplying the number of hours that others had to take over for participants in performing usual household tasks by the average gross hourly wage earned by a domestic worker (Hakkaart-van Roijen et al., 2010). All costs were adjusted to the year 2015 according to the Dutch consumer price index (Statistics Netherlands, 2015).

Analyses

Statistical analyses were performed according to the intent-to-treat approach, including all participants who underwent randomization. The majority of missing data were handled by conducting multiple imputation using predictive mean matching for numerical variables, and using (multinomial) logistic regression for categorical variables. However, variables concerning the number of appointments with a dietician, or homeopath or acupuncturist, were imputed using regression-based imputation. These variables showed very little variance and included only a few values that were higher than the minimum value of 0, which made it difficult to find matching cases. Health care utilization costs of the following health care providers were combined given their highly skewed data which would have led to an unreliable imputation process: 1) general practitioner and company physician, 2) physiotherapist and occupational therapist, 3) social worker, psychologist/psychiatrist, consultation office for alcohol and drug addiction, and self-help groups, 4) outpatient hospital services and emergency care services, and 5) admission/stay at psychiatric institutions, sheltered housing, and accompanied housing. Multiple imputations were conducted in statistical software program R version 3.02, taking into account interactions in the data (Doove, Van Buuren, & Dusseldorp, 2014). For each variable with missing data, the number of predictor variables was determined by the rule of thumb of 15 cases per potential predictor (Stevens, 2009). The variables that were most strongly associated with the outcome variable were chosen as predictors for the missing data on the outcome variable. To this end, the following measures of association were used: 1) correlation, if both the outcome variable and the predictor variable were numerical, 2) the square root of partial η^2 if one of the variables was categorical and the other one was numerical, and 3) Cramér's V if both the outcome and predictor variable were categorical. A total of 100 imputed datasets were generated, of which the results were pooled according to Rubin's rules (Rubin, 1987).

Cost-utility analyses were conducted with the QALYs as derived from the EQ-5D-3L scores and the societal costs. The uncertainty regarding mean costs and effects per participant was estimated using bootstrapping in Microsoft Excel, simulating 1000 bootstrap samples per imputed dataset. The results of the bootstrapping were represented in cost-utility acceptability curves. These curves illustrate the probability that an intervention is cost-effective in comparison with the alternative for a range of ceiling ratios, which are the maximum amount of societal costs decision makers are willing to pay for one unit change in outcome. An intervention is cost-effective as compared with the alternative if it has a higher net benefit, with the net benefit being defined as willingness to pay * effects (i.e. QALYs) – societal costs.

Two sensitivity analyses were conducted by repeating the cost-utility analyses 1) using the VAS as a utility measure, and 2) using the change in utilities as assessed by the EQ-5D from baseline, in order to account for baseline difference in utility scores.

Results

Sample characteristics

A total of 354 participants were assessed at baseline: 87 participants in the Featback condition without a therapist, 88 and 89 participants in the Featback conditions with low- and high-intensity therapist support respectively, and 90 participants in the WLC. Two hundred seventy-three participants (77%) were assessed at post-intervention, and 202 (57%) at 3-month follow-up. Study dropout rates did not significantly differ between the conditions at post-intervention ($\chi^2(3)=4.35$, $p=.23$), although at 3-month follow-up the WLC participants dropped out of the study less often than participants who received Featback without or with low-intensity therapist support ($\chi^2(3)=15.69$, $p=.001$).

Table 1 presents the baseline characteristics of study participants. Significant differences between the conditions were found regarding age, duration of ED psychopathology, marital status, and utility scores as measured by the VAS. There were no significant baseline differences regarding the other demographic variables or the utility scores as measured by the EQ-5D. Participants demonstrated high levels of ED psychopathology, as reflected in their mean EDE-Q score (4.2, *SD*=0.9) that is comparable to the norm for treatment-seeking patients with an ED in our specialized clinical program (Aardoom, Dingemans, Slof Op't Landt, & van Furth, 2012). Moreover, approximately 97% of the study participants scored above the clinical significance cut-off point of 2.2 (Dingemans et al., 2016).

Outcomes: Utilities

The mean utility scores and QALYs over the course of 5 months for the different study conditions are presented in Table 2. The utility scores as measured by the EQ-5D increased over time in all conditions, however the QALYs were not significantly different across study conditions.

Outcomes: Societal costs

The societal costs for the different study conditions over the course of five months are presented in Table 3. As shown in Table 3, the study conditions showed significant differences regarding intervention costs, homeopath and acupuncturist costs, mental health care costs, costs related to admission/stay at psychiatric institutions, sheltered

Table 1. Baseline characteristics of the study population. Data (non-imputed) are provided in means (SD) or numbers (percentages).

	Waiting list control (*n*=90)	Featback (*n*=87)	Featback +Low-intensity therapist support *n*=88)	Featback +High-intensity therapist support (*n*=89)	Statistics
Gender					$\chi^2(3)=2.02$
Male	0 (0.0%)	1 (1.1%)	1 (1.1%)	2 (2.2%)	
Female	90 (100.0%)	86 (98.9%)	87 (98.9%)	87 (97.8%)	
Marital status					$\chi^2(6)=13.22$*
Married/living together	11 (12.2%)^{A}	28 (32.2%)^{A,B}	17 (19.3%)^{A,B}	21 (23.6%)^{B}	
Single/living alone	79 (78.8%)	58 (66.7%)	71 (80.7%)	67 (75.3%)	
Divorced	0 (0.0%)	1 (1.1%)	0 (0.0%)	1 (1.1%)	
Education level					$\chi^2(6)=7.69$
Low	10 (11.1%)	4 (4.6%)	4 (4.5%)	7 (7.9%)	
Intermediate	17 (18.9%)	16 (18.4%)	26 (29.5%)	19 (21.3%)	
High	63 (70.0%)	67 (77.0%)	58 (65.9%)	63 (70.8%)	
Use of psychotropic medication					$\chi^2(3)=3.35$
Yes	25 (28.4%)	21 (24.7%)	17 (19.5%)	16 (18.2%)	
No	63 (71.6%)	64 (75.3%)	70 (80.5%)	72 (81.8%)	
Paid job					$\chi^2(3)=0.27$
Yes	49 (55.7%)	46 (54.1%)	49 (56.3%)	49 (56.3%)	
No	39 (44.3%)	39 (45.9%)	38 (43.7%)	38 (43.7%)	
Age (years)	22.8 (6.6)^{A}	24.7 (7.1)^{A,B}	23.0 (7.0)^{A}	26.3 (9.2)^{B}	$F(3,350)=4.17$**
Duration ED problems (years)	5.7 (5.6)^{A}	8.1 (6.9)^{A,B}	6.5 (5.8)^{A,B}	8.2 (7.7)^{B}	$F(3,346)=3.05$*
Global ED psychopathology (EDE-Q)	4.1 (1.1)	4.2 (0.8)	4.4 (0.9)	4.0 (0.8)	$F(3,113)=1.54$
Global AN psychopathology (SEED-AN)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	$F(3,347)=0.24$
Global BN psychopathology (SEED-BN)	1.5 (0.7)	1.4 (0.7)	1.5 (0.7)	1.5 (0.6)	$F(3,349)=0.30$
Utility score EQ-5D	0.65 (0.28)	0.63 (0.27)	0.60 (0.28)	0.63 (0.28)	$F(3,258)=0.39$
Utility score Visual Analog Scale	0.63 (0.17)	0.60 (0.17)	0.55 (0.16)	0.57 (0.17)	$F(3,258)=3.03$*

* p ≤ .05, ** p ≤.01

ED=Eating disorder; EDE-Q=Eating Disorder Examination Questionnaire; SEED=Short Evaluation of Eating Disorders; AN= Anorexia nervosa; BN=Bulimia nervosa; EQ-5D = 3-level version of the EuroQol

Note: Significant group differences were further investigated using Bonferonni post-hoc comparisons: different superscript letters indicate significant differences between the conditions.

housing, and accompanied housing, and finally, costs due to substitution of unpaid work. However, the total societal costs including all healthcare and non-health care costs were not significantly different between the conditions. Nevertheless, the societal costs were highest in the WLC (see Table 3).

Table 2. Mean utility scores and corresponding quality-adjusted life years (QALYs) for Internet-based intervention 'Featback' provided with different levels of therapist support. Data are based on the pooled results of 100 multiple imputed datasets.

	Waiting list control (*n*=90)	Featback (*n*=87)	Featback +Low-intensity therapist support *n*=88)	Featback +High-intensity therapist support (*n*=89)	Statistics
Utility score EQ-5D					
Baseline	0.65	0.64	0.60	0.63	
Post-intervention	0.67	0.69	0.65	0.67	
Three-month follow-up	0.68	0.71	0.64	0.69	
QALYs	0.27	0.28	0.26	0.27	$F(3,350)=0.71$, $p=.55$
Utility score Visual Analog Scale					
Baseline	0.63	0.60	0.54	0.57	
Post-intervention	0.62	0.62	0.59	0.61	
Three-month follow-up	0.62	0.66	0.60	0.66	
QALYs	0.25	0.25	0.24	0.25	$F(3,350)=0.78$, $p=.51$

EQ-5D = 3-level version of the EuroQol; QALY= Quality-adjusted life-years

Cost-utility

Figure 1 presents the cost-utility acceptability curve. For a willingness to pay between €0 and €20,000, the three Featback conditions demonstrate higher probabilities (22% - 47%) of achieving the highest net benefit in comparison to the WLC (1% - 5%). Thus, for this range of willingness to pay, Featback could be considered a preferred strategy in comparison to a waiting list, although no clear preference for Featback with or without support was apparent. When society is willing to pay €20,000 or more per QALY gained, Featback without therapist support has the highest probability (42% - 54%) of achieving the highest net benefit, closely followed by Featback with high- intensity therapist support (30% - 38%), and Featback with low-intensity therapist support (1% - 17%) and the WLC (5% - 15%).

As can be seen in the upper part of Figure 2, comparable results were found in the first sensitivity analyses when using the VAS as utility measure. The results of the second sensitivity analyses using the change in utilities from baseline as assessed by the EQ-5D are presented in the bottom of Figure 2. Overall, the results show that for all willingness to pay values (€0 - €100,000) Featback with different levels of therapist support are cost-effective strategies in comparison to a waiting list, with no clear preference for one of the three Featback conditions.

Table 3. Societal costs for the different study conditions over the course of 5 months (2015, in €). Data are based on the pooled results of 100 multiple imputed datasets.

	Mean costs per participant (% of individuals who incurred costs)				Statistics
	Waiting list control (WLC) ***n*=90**	**Featback (FB)** ***n*=87**	**Featback + Low-intensity therapist support (FBL)** ***n*=88**	**Featback + High-intensity therapist support (FBH)** ***n*=89**	
Total health care costs	1964 (96.5%)	1676 (94.8%)	1412 (100.0%)	1524 (100.0%)	*F*(3,350)=0.68
Total intervention costs	0 (0.0%)	3 (2.3%)	53 (100.0%)	107 (100.0%)	*F*(3,350)=183.60***a
Total health care utilization costs	1964 (96.5%)	1673 (94.8%)	1359 (97.4%)	1417 (91.2%)	*F*(3,350)=1.00
General practitioner and company physician	90 (74.3%)	92 (75.9%)	91 (71.7%)	90 (72.4%)	*F*(3,350)=0.29
Dietician	1 (38.2%)	2 (59.5%)	2 (56.2%)	1 (44.2%)	*F*(3,350)=3.80*b
Homeopath and acupuncturist	0 (27.0%)	0 (36.3%)	0 (31.9%)	0 (27.1%)	*F*(3,350)=2.17
Physiotherapist and occupational therapist	18 (11.1%)	78 (24.3%)	68 (17.5%)	99 (29.3%)	*F*(3,350)=1.82
Mental health care[1]	920 (77.9%)	1115 (79.2%)	1043 (78.0%)	995 (71.7%)	*F*(3,350)=3.57*b
Outpatient hospital services and emergency care services	47 (11.7%)	44 (17.9%)	109 (24.9%)	56 (41.8%)	*F*(3,350)=2.56
Admission/stay at psychiatric institutions, sheltered housing, and accompanied housing	856^{A} (12.3%)	324^{A,B} (4.6%)	29^{B} (1.4%)	166^{A,B} (44.2%)	*F*(3,350)=3.67*c
Medication[2]	32 (44.9%)	18 (50.5%)	17 (52.2%)	10 (39.9%)	*F*(3,350)=0.95
Total non-healthcare costs	618 (70.1%)	426 (76.3%)	539 (62.4%)	508 (66.7%)	*F*(3,350)=1.00
Absenteeism	85 (47.8%)	153 (50.2%)	94 (28.4%)	47 (34.4%)	*F*(3,350)=2.39
Presenteeism	448 (43.1%)	246 (46.1%)	233 (38.1%)	298 (42.2%)	*F*(3,350)=1.39
Substitution of unpaid work	85^{A} (10.7%)	27^{A} (10.7%)	212^{B} (20.1%)	163^{A,B} (16.2%)	*F*(3,350)=5.21**d
Total societal costs	2582 (98.7%)	2102 (97.9%)	1951 (100.0%)	2032 (100%)	*F*(3,350)=0.45

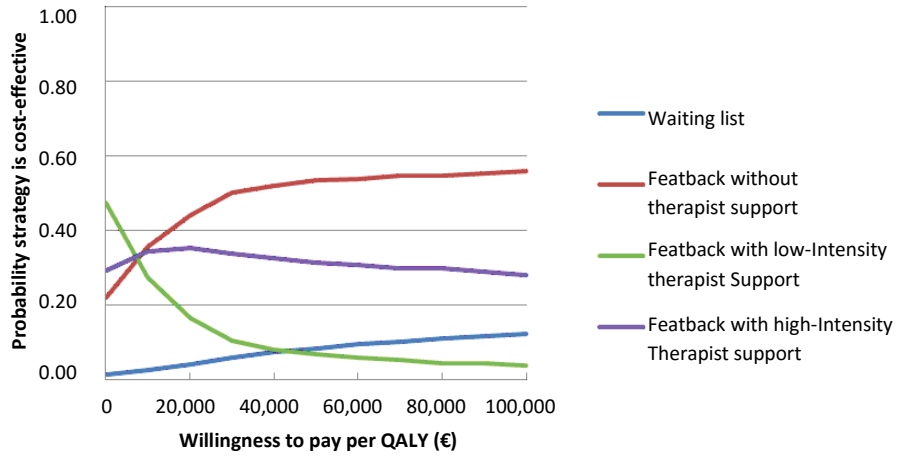
* p≤.05, ** p≤.01, *** p≤.001

Statistics: significant group differences were further investigated using post-hoc comparisons: a = WLC & FB < FBL < FBH, b = WLC < FB, c = WLC > FBL, d = WLC & FB < FBL

[1] Including appointments with a social worker, psychologist, psychiatrist, consultation office for alcohol and drug addiction, and participation in self-help groups

[2] Including tranquilizers (ADHD, anxiety, sleep problems), antidepressants, antipsychotics, as well as drugs for epilepsy, osteoporosis, and intestines and stomach

Figure 1. Cost-utility acceptability curve for Internet-based intervention 'Featback' provided with different levels of therapist support as compared to a waiting list control condition.



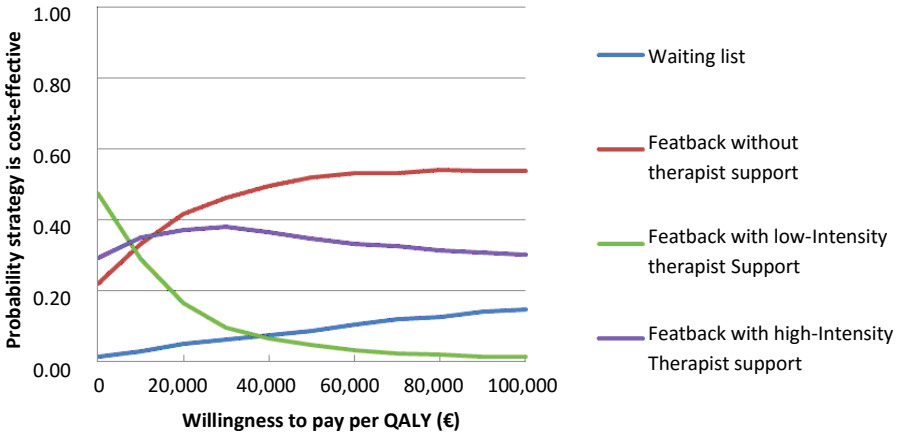
Note: QALY = Quality-Adjusted Life-Year as assessed by the EQ-5D

Discussion

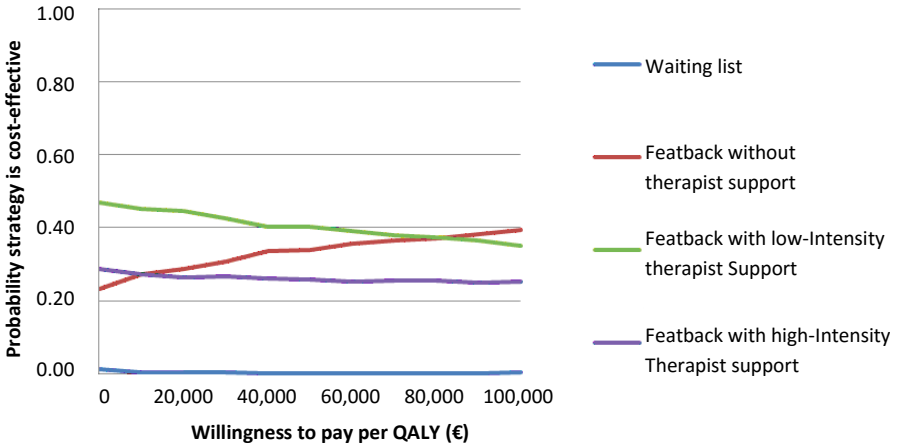
This study investigated the cost-utility of fully-automated Internet-based intervention 'Featback' provided along with different levels of therapist support (i.e. none, once a week, three times a week) in comparison to a WLC for individuals with ED symptoms. The results demonstrated no significant differences between the costs and effects for the four conditions. Nevertheless, cost-utility analyses as conducted from a societal perspective demonstrated that for willingness to pay values between €0 and €100,000 per QALY, Featback with no, low-, and high-intensity therapist support seemed to be cost-effective strategies as compared to a waiting list. From an economic viewpoint, no clear preference was found for Featback with or without therapist support.

Given that good quality economic evaluations in the field of ED are scarce (Stuhldreher et al., 2012), our study findings will also be compared to those of studies that economically evaluated Internet-based interventions for mental health conditions other than ED. The finding that both Featback with and without therapist support were cost-effective strategies as compared to a waiting list, is in line with several previous studies that have compared either a guided or unguided Internet-based intervention to a control group. More specifically, unguided Internet-based interventions have been found to be cost-effective in comparison to usual care for depression (Gerhards et al., 2010), and in

Figure 2. Results of two sensitivity analyses presenting the cost-utility acceptability curve for Internet-based intervention 'Featback' provided with different levels of therapist support as compared to a waiting list control condition.



Note: QALY = Quality-Adjusted Life-Year as assessed by a Visual Analog Scale



Note: QALY = Quality-Adjusted Life-Year as assessed by the EQ-5D and calculated by the change in utilities from baseline

comparison to a waiting list for suicidal ideation (van Spijker, Majo, Smit, van, & Kerkhof, 2012). Regarding the comparison of guided Internet-based interventions with control conditions, our findings are in line with findings by Lynch et al. (2010), who demonstrated that treatment as usual supplemented with a face-to-face guided self-help intervention based on CBT principles, was cost-effective as compared to treatment as usual alone in patients with recurrent binge eating episodes. Also, our results are

comparable to that of a study (Hollinghurst et al., 2010) in which a therapist-guided Internet-based intervention was found to be cost-effective as compared to usual care in the treatment of depression. Thus, preliminary evidence suggests that both unguided and guided Internet-based interventions for mental health problems represent good value for money when compared to usual care or a waiting list. If confirmed in future studies, this could have important implications for everyday practice. Both unguided and guided Internet-based interventions could allow for more efficient care and widespread dissemination, potentially increasing the accessibility and availability of mental health care services for individuals with ED symptoms.

Our finding that, from an economic viewpoint, no clear preference was found for the Internet-based intervention with or without therapist support, is in contrast with findings from a study that directly compared a guided and unguided Internet-based intervention for harmful alcohol use (Blankers, Nabitz, Smit, Koeter, & Schippers, 2012) and partly in line with a study investigating smoking cessation (Smit, Evers, de, & Hoving, 2013). Regarding harmful alcohol use, Blankers et al. (2012) demonstrated that guided Internet-based therapy was cost-effective in comparison to a similar therapy without therapist guidance. With respect to smoking cessation, Smit et al. (2013) economically evaluated an Internet-based intervention with counseling from a practice nurse, the same intervention without counseling, and usual care. The unguided intervention had the highest chance of being the most cost-effective treatment option when smoking abstinence was used as the outcome measure, whereas results were in favor of usual care when quality of life was used as the outcome measure in the analyses. In sum, the literature provides mixed results when directly comparing guided and unguided interventions. More studies are needed that directly compare Internet-based interventions with and without guidance, not only in the field of ED, but in the field of mental health in general as well. It is possible that the cost-effectiveness of unguided versus guided interventions may vary as a result of the target population (i.e. mild vs. severe mental health problems) and the content and intensity of the Internet-based intervention being studied (i.e. from low-intensity programs including psychoeducation and self-monitoring tools for example vs. high-intensity CBT).

A previous study by Crow et al. (2013) demonstrated that a stepped-care intervention, in which individuals could move from self-help, to medication, to CBT if necessary, was cost-effective in comparison to directly providing CBT. They discuss the potential value of a stepped-care approach in treating symptoms of BN, given that such approaches can be easily disseminated and can help to allocate the limited health care resources in a more efficient manner. Relating this to the current study findings, fully automated Internet-based interventions, such as Featback, have potential to provide cost-

effective care as (one of) the first step(s) in a stepped-care model for the treatment of ED. After Featback, more intensive treatment options, such as outpatient treatment, could be offered, and subsequently inpatient treatment, if needed. Hence, an interesting future study would be to investigate the cost-effectiveness of a stepped-care approach in comparison to treatment as usual. Especially since stepped-care interventions have also demonstrated promising results in terms of being a cost-effective alternative to usual care for older individuals with subthreshold levels of anxiety and depression (Veer-Tazelaar et al., 2010), generalized anxiety- or panic disorders in primary care (Goorden et al., 2014), and obsessive-compulsive disorders (Tolin, Diefenbach, & Gilliam, 2011).

The results of the cost-utility analyses have been presented for willingness to pay values between €0 and €100,000. Although the threshold for the societal willingness to pay for one QALY gained is arbitrary, values between €0 and €100,000 could be regarded within the realistic range of amounts to pay per QALY gained. For example, in the Netherlands specifically, a maximum amount of €80.000 has been established as acceptable by the Council for Public and Health Care (RVZ) (2006).

The current study has several limitations and strengths. Limitations include the retrospective assessment of the utilization of health care services and use of medication. The corresponding recall periods of two and three months could have introduced recall bias, which in turn could have led to an over- or underestimation of costs. Another limitation pertains to the missing data at post-intervention and 3-month follow-up. Furthermore, interventions costs are estimated based on the average salary of psychologists and MSc students in psychology. If in everyday practice the supervision and therapist support is provided by other types of therapists, this may lead to slightly different costs. A final limitation of this study is related to the relatively short study duration of approximately five months. It would have been interesting to see whether the obtained results hold for a follow-up period of at least one year. Strengths of this study include the use of broad eligibility criteria, by which we aimed to resemble daily clinical practice as much as possible. Another strength is the use of a broad societal perspective and subsequently the inclusion of indirect costs such as absenteeism and presenteeism, as these were often lacking in previous studies (Stuhldreher et al., 2012) although these costs can be substantial (Stewart, Ricci, Chee, Hahn, & Morganstein, 2003; Stuhldreher et al., 2015). A final strength is that two sensitivity analyses have been conducted in order to assess the robustness of the findings from the primary analysis.

In conclusion, fully automated Internet-based interventions such as Featback have potential to provide cost-effective care: a fully automated Internet-based intervention for ED symptoms provided with no-, low-intensity-, or high-intensity therapist support seemed to be cost-effective in comparison to a waiting list. If future research confirms this

finding, this could have important implications for everyday practice. That is, both the unguided- and guided intervention could allow for more efficient care and widespread dissemination, thereby potentially increasing the accessibility and availability of mental health care services for individuals with ED symptoms.