Just a click away... E-mental health for eating disorders

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Chapter 2

Treating eating disorders over the internet: A systematic review and future research directions

Published as:

Aardoom J.J., Dingemans A.E., Spinhoven P., van Furth E.F. (2013). Treating eating disorders over the internet: A systematic review and future research directions. *International Journal of Eating Disorders, 46,* 539-552.

Abstract

Objective: To review the literature regarding internet-based treatment of eating disorders (ED).

Method: Relevant studies were identified by searching electronic databases (including Medline, Embase, PsycInfo, and Web of Science). Eligible studies evaluated an internet-based treatment for ED, or an ED treatment that included at least one internet-based component.

Results: Twenty-one studies were included. Methodological quality varied. Internet-based treatments were superior to waiting lists in reducing ED psychopathology, frequency of binge eating and purging, and in improving (ED-related) quality of life. Internet-based treatment was more effective for individuals with less comorbid psychopathology, binge eating as opposed to restrictive problems, and individuals with binge eating disorder as opposed to bulimia nervosa. Higher levels of compliance were related to more improvements in ED symptoms. Study dropout ranged from 5.3% to 76.8%. Inclusion of face-to-face assessments and therapist support seemed to enhance study compliance. Overall, the internet can be considered an acceptable vehicle for delivering ED treatment.

Discussion: Future research should determine the utility of internet-based treatment by comparing them to face-to-face treatment. Research should furthermore focus on unraveling predictors and mediators of treatment outcome, compliance, and dropout respectively. Studies with good methodological quality are needed with reports according to CONSORT guidelines.

Introduction

Societies around the world are digitalizing as the availability and use of the internet has expanded tremendously over the past decade. In Europe for example, the number of internet users has grown 393.4 percent between 2000 and 2012 (Internet world stats, 2012). The field of e-mental health has grown in tandem. E-mental health refers to the use of information and communication technology, particularly the internet, to support and improve mental health conditions and mental health care (Riper et al., 2007). E-mental health comes with numerous benefits: it can reach individuals who would otherwise be hard to reach, for example individuals living in remote areas, or those who do not seek help out of shame or fear of stigmatization (Burns, Durkin, & Nicholas, 2009). E-mental health can provide anonymous and easily accessible service, in a convenient and cost and time efficient way (Hedman et al., 2011; Warmerdam, Smit, van Straten, Riper, & Cuijpers, 2010).

Easily accessible and anonymous care has a lot of potential in the field of eating disorders (ED), given that only a minority of patients with an ED seeks or receives mental health care (Hart et al., 2011; Keski-Rahkonen et al., 2007) due to social barriers such as fear of social stereotyping and stigma, as well as shame (Becker et al., 2010; Evans et al., 2011; Keski-Rahkonen et al., 2009), and barriers such as low motivation or high cost (Evans et al., 2011).

Numerous technology-based programs have been developed to treat and prevent ED. There have been two reviews of the literature regarding the use of technologies in the prevention, intervention, and treatment of ED (Engel & Wonderlich, 2010; Myers, Swan-Kremeier, Wonderlich, Lancaster, & Mitchell, 2004), including internet-based (self-help) programs delivered via telemedicine, telephone, e-mail, or text-messaging, and programs delivered by means of computer software, CD-ROMs, portable computers, or virtual reality techniques. However, neither of these reviews critically reviewed and summarized the methodological quality of the studies conducted, nor other issues such as the compliance, dropout rates, and satisfactoriness of internet-based programs. Both reviews concluded that the use of innovative methods for the prevention, intervention, and treatment of ED appeared promising, but that the empirical evidence for the effectiveness of such interventions was limited.

Given that the development of technology-based interventions, especially internet-based interventions, are booming and that numerous new studies have been published since 2010, the aim of this paper is to provide a state-of-the-art review specifically focusing on internet-based treatments for ED. Studies that investigated internet-based programs designed for (relapse) prevention purpose, and/or programs not

specifically targeting actual patients with a (subthreshold) ED (Bauer, Moessner, Wolf, Haug, & Kordy, 2009; Beintner, Jacobi, & Taylor, 2011; Heinicke, Paxton, Mclean, & Wertheim, 2007; Paxton, McLean, Gollings, Faulkner, & Wertheim, 2007; Stice, Rohde, Durant, & Shaw, 2012) are beyond the scope of this review. The literature regarding the effectiveness of internet-based treatments, compliance, study and treatment dropout, as well as the acceptability of such treatment delivery to the patients is discussed. The methodological quality of the studies reviewed is also examined.

Method

Relevant studies were identified by searching electronic databases (including Medline, Embase, PsycInfo, and Web of Science) for published literature up to January 23, 2013. The following key words were searched in titles and abstracts: 'e-mental health', 'e-health', 'internet-based', 'online', 'web-based', 'e-therapy', 'e-mail', combined with 'eating disorders', 'bulimia', 'anorexia', or 'binge eating'. In addition, the reference lists of relevant studies were checked for reports of other potentially relevant studies. Studies were eligible if they 1) evaluated an internet-based treatment for ED, or evaluated a treatment for ED that included at least one internet-based component (for example, internet-based guidance), 2) were published or in peer-reviewed journals, and 3) were published in English.

The studies identified in the search used different methods to calculate effect sizes. Therefore, we re-calculated the effect sizes of all included studies. Specifically, within-group effect sizes (Cohen's *d*) (Cohen, 1988) were calculated by subtracting the average score at post-test or follow-up from the average score at pre-test and dividing the result by the pooled standard deviation. Between-group effect sizes were calculated by subtracting the average post-test or follow-up score of the control group from the corresponding post-test or follow-up score of the study group, and dividing the result by the pooled standard deviation. The authors of the articles included in our review were approached for additional data in case (some of the) data necessary for calculating effect sizes were not reported in the article. Effect sizes were treated as missing whenever there was non-response or actually missing data (Nevonen, Mark, Levin, Lindström, & Paulson-Karlsson, 2006; Robinson & Serfaty, 2008). Effect sizes were only calculated for the most relevant and significant outcome measures, which we considered the frequency of binge eating and self-induced vomiting or purging behaviors, as well as global measures of ED pathology. Effect sizes of 0.20 to 0.49 can be regarded as small, effect sizes between 0.50 and 0.79 moderate, and effect sizes of 0.80 and higher as large (Cohen, 1988).

Authors JA and AD independently assessed the methodological quality of the studies included. Studies were categorized into one of the following levels of evidence (the lower the level, the higher the methodological quality) (Ghaemi & Soldani, 2003): level II: open randomized trials; level III: observational studies (a: non-randomized, controlled studies; b: large non-randomized, uncontrolled studies; c: medium-sized non-randomized, uncontrolled studies); level IV: small observational studies (non-randomized, uncontrolled); and level V: case series, case reports, expert opinions. Studies could not be categorized as level I evidence (double-blind randomized trials), as this is practically impossible in trials comparing internet-based treatment versus no treatment. In addition, the methodological quality of the randomized controlled trials was examined in further detail, using all six criteria from the *Cochrane Handbook* (Higgins & Green, 2011): 1) sequence generation, 2) allocation concealment, 3) blinding of outcome assessors, 4) incomplete outcome data, 5) selective outcome reporting, and 6) other sources of bias. The third criteria originally included blinding of both participants and therapists as well, but this was not taken into account in the current review given that it is practically impossible to blind participants and therapists in trials comparing treatment versus no treatment. In case of disagreement between the authors, consensus was achieved through discussion.

Given the limited number of randomized controlled trials and the heterogeneity of treatment programs and study populations, no attempt was made to perform a meta-analysis.

Results

Study characteristics

Table 1 summarizes the characteristics and results of each of the studies included in this review (*N* = 21). Two studies reported on the use of e-mail as an adjunct to (face-to-face) therapy in outpatient settings (Yager, 2001; Yager, 2003). Three other studies reported on cognitive behavioral therapy (CBT) delivered via e-mail (Robinson & Serfaty, 2001; Robinson & Serfaty, 2003; Robinson et al., 2008), hereafter referred to as e-mail therapy. One study investigated a cognitive behavioral self-help program with internet-based guidance (Ljotsson et al., 2007) and another study investigated an open trial of internet-based unguided self-help (Leung, Joyce Ma, & Russell, 2012). The majority of the included studies (*N* = 14) reported on internet-based CBT. Two of these were mainly qualitative (Sánchez-Ortiz, Munro, Startup, Treasure, & Schmidt, 2011; Sánchez-Ortiz et al., 2011a), exploring the views and experiences of participants, as well as the content of e-mails sent by therapists to participants, whereas the other twelve studies focused on the

effectiveness of internet-based CBT (Carrard et al., 2006; Carrard et al., 2011a; Carrard et al., 2011b; Carrard et al., 2011c; Fernández-Aranda et al., 2009; Jacobi, Völker, Trockel, & Taylor, 2011; Jones et al., 2008; Nevonen et al., 2006; Pretorius et al., 2009; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b; Wagner et al., 2012). These fourteen studies evaluated six different internet-based CBT programs. The programs utilized more or less the same structure and were based on existing (face-to-face) CBT manuals. Programs generally included several modules that participants had to work through in a predetermined sequence, amongst other things psychoeducation, cognitive restructuring, and behavior modification (for more details on included modules, see Table 1). In most of the programs, each treatment module had a pre-defined duration (often a week), during which participants needed to finish readings and complete accompanying exercises or assignments, after which the next module would become available. Weekly self-monitoring assessments such as food diaries needed to be completed as well, in order to gain insight into one's eating patterns and ED symptoms, and subsequent deteriorations or improvements.

As can be seen in Table 1, almost every treatment program mandated weekly contact between participants and their coaches (graduate psychology students) or licensed therapists. All of the studies targeted individuals who were 18 years or older, with the exception of a study by Jones et al. (2008) who targeted adolescents (e.g. high school students) and a study by Wagner et al. (2012) who included females aged 16-35. Inclusion criteria for all studies were (subthreshold) symptoms of bulimia nervosa, binge eating disorder, or eating disorder not otherwise specified, and excluded individuals with a body mass index below 18 or 17.5. Mean population ages ranged from approximately 15 to 43 years. The duration of the treatment programs was typically three to six months.

Methodological quality of the studies

Five studies aimed to qualitatively investigate the feasibility of treatment, or content of e-mails sent by therapists during the treatment programs. The level of evidence from low to high (the lower the level the higher the methodological quality): three had level V evidence (case series, case reports) (Robinson et al., 2003; Yager, 2001; Yager, 2003), one had level IV evidence (small non-randomized, uncontrolled observational studies) (Robinson et al., 2003), and one had level IIIc evidence (medium-sized non-randomized, uncontrolled studies) (Sánchez-Ortiz et al., 2011).

Another sixteen studies aimed to investigate the effects of internet-based treatment on ED(-related) symptoms. The level of evidence from low to high: three had level IV evidence (Carrard et al., 2006; Nevonen et al., 2006; Robinson et al., 2001), three had level IIIb evidence (large non-randomized, uncontrolled studies) (Carrard et al., 2011c;

Leung et al., 2012; Pretorius et al., 2009), two had level IIIa evidence (non-randomized, controlled studies) (Carrard et al., 2011b; Fernández-Aranda et al., 2009), and eight had level II evidence (open randomized trials) (Carrard et al., 2011a; Jacobi et al., 2011; Jones et al., 2008; Ljotsson et al., 2007; Robinson et al., 2008; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b; Wagner et al., 2012).

The eight randomized controlled trials (level II evidence studies) were further evaluated with the criteria from the Cochrane Handbook. The methodological quality of these studies varied: one study (Jacobi et al., 2011) only met two criteria, being seemingly free of selective outcome reporting (criterion 5) and free of other sources of bias (criterion 6). Two studies (Robinson et al., 2008; Wagner et al., 2012) met three criteria: criterion 5 and 6, as well as adequate sequence generation (criterion 1). Three studies (Carrard et al., 2011a; Ljotsson et al., 2007; Ruwaard et al., 2012) met four criteria: criteria 1, 5, and 6, as well as criterion 3, blinding of outcome assessors. Regarding the latter criterion it should be noted that all three studies (Carrard et al., 2011a; Ljotsson et al., 2007; Ruwaard et al., 2012) did not blind or report on blinding the outcome assessors, but that this was unlikely to create a risk for bias since outcome assessments were conducted online by self-report questionnaires only. Finally, two studies (Jones et al., 2008; Sánchez-Ortiz et al., 2011b) met five criteria: one study (Jones et al., 2008) met all criteria except allocation concealment (criterion 2), and the other study (Sánchez-Ortiz et al., 2011b) met all criteria except addressing incomplete outcome data. Seven of the eight randomized controlled trials failed to report reasons for missing data/dropout during the intervention period, therefore failing to meet criterion 4, addressing incomplete outcome data. None of the randomized controlled trials seemed to have followed the CONSORT rules for reporting on randomized controlled trials (Eysenbach & CONSORT-EHEALTH Group, 2011; Schulz, Altman, & Moher, 2010), as numerous criteria were rated as 'unclear' (e.g. not reported on).

Effectiveness of internet-based treatments for eating disorders

All of the studies that investigated time effects of internet-based treatment demonstrated significant improvements in ED pathology over time for patients with a (sub threshold) ED (see Table 1). Corresponding within-group effect sizes, referring to the magnitudes of time effects of internet-based treatments, were predominantly large for measures of binge eating (Carrard et al., 2011a; Jones et al., 2008; Pretorius et al., 2009; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b) and measures of global eating pathology (Carrard et al., 2011a; Fernández-Aranda et al., 2009; Pretorius et al., 2009; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b), both from pre- to post-treatment and from pre-treatment to follow-up.

Table 1: An overview of the internet-based eating disorder treatment studies included in this review (*N* = 21), organized by level of evidence.

Study	Study population	Condition(s)	Treatment program	Program duration	Follow-up	Outcome measures	Significant results: $p \leq .05$. Effect sizes (Cohen's *d*) are presented within parentheses	
							Time (within-group effect): Pp *d* = *d* pre- to post intervention Pf *d* = *d* pre-intervention to follow-up	**Interaction time x condition (between-group effect):** Post *d* = *d* at post-intervention Fu *d* = *d* at follow-up
Effect studies: open randomized controlled trials								
Ljotsson et al., 2007	69 Individuals (65 females, 4 males) (mean age treatment condition 35.5, *SD* = 11.4) with full or sub-threshold BN or BED	- Internet-based guided self-help (IB-GSH) - WLC	IB-GSH: - Self-help book included psychoeducation, and a structured self-help program consisting of 6 modules: self-monitoring, importance of regular eating pattern, alternative activities, problem-solving, dieting and related forms of avoidance, and relapse prevention - Support: participants were instructed to contact their coach (a graduate psychology student) at least once a week - Unmoderated discussion forum	3 months	6 months	EDE-Q, objective binge eating episodes, purging behavior, EDI-2, BSQ, MADRS, SWLS, SCQ	Not reported	EDEQ global (post *d* = 1.15), all EDE-Q subscales, objective binge eating episodes (post *d* = 0.68), EDI-2 subscales drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, and interoceptive awareness, BSQ, MADRS, SWLS, SCQ
Jones et al., 2008	105 Individuals (73 females, 32 males) (mean age treatment condition 15.0, *SD* = 1.0) with full or subthreshold BED	- iCBT - WLC	iCBT: *"Student Bodies 2-BED"* - Semi-structured program that incorporated cognitive-behavioral principles, combining psychoeducation and behavioral interventions such as self-monitoring, goal setting, stimulus control, and appetite awareness and introduces emotion regulation skills - Asynchronous discussion group moderated by a research assistant - Option of face-to-face meetings with a mentor	16 weeks	9 months	BMI, EBI, all binge eating episodes (objective + subjective), objective overeating episodes, PACE+, CES-D	Not reported for BMI. All binge eating episodes (pp *d* = -0.93, pf *d* = -0.80)	BMI, all binge eating episodes (Fu *d* = 0.06)

Robinson & Serfaty, 2008	97 Individuals (93 females, 4 males) (mean age total sample 24.5, *SD* not reported) with BN, BED or EDNOS	- E-mail therapy (ET) - Unguided self-directed writing (USW) - WLC	ET: - Two e-mail contacts with a clinician a week that incorporated: eliciting a history, completing a diary of diet and feelings, identifying and restructuring cognitive styles, encouraging regular meals and examining behavioral factors exacerbating the eating disorder USW: - Participants were instructed to write two e-mails a week about difficulties they were experiencing (without receiving any feedback)	3 months	No follow-up	QEDD, BDI, BITE, desired weight	Not reported	*ET versus WLC*: QEDD *ET versus USW*: None *USW versus WLC*: None
Carrard et al., 2011a	74 Females (mean age total sample 36.0, *SD* = 11.4) with full or subthreshold BED	- iCBT - WLC	iCBT*: "Salut BED*" - Structured program that included eleven modules, which incorporated lessons and exercises covering motivation, self-monitoring, binge triggers, meal plans, strategies to prevent binges, physical activity, problem-solving, assertiveness, automatic thoughts, cognitive restructuring, and relapse prevention - Support: participants were required to contact their clinician at least once a week	6 months	6 months	EDI-2 subscales, EDE-Q, objective binge eating episodes, TFEQ, SCL-90R, BDI-II, RSES, IWQOL, BMI	EDI-2 subscales drive for thinness, bulimia, and body dissatisfaction, EDE-Q global (pp *d* = -1.19), objective binge eating episodes (pp *d* = -0.95), SCL-90R global, BDI-II	EDI-2 subscales drive for thinness, bulimia, body dissatisfaction, and interoceptive awareness, EDE-Q global (post *d* = 0.39), EDE-Q subscale shape concern, objective binge eating episodes (post *d* = 0.45), TFEQ subscale hunger, RSES, IWQOL global, BMI
Jacobi et al., 2011	126 Females (mean age total sample 22.3, *SD* = 2.9) with sub-threshold ED	- iCBT - WLC	iCBT: "*Student Bodies+"* - Structured program that included eight modules, incorporating cognitive and affective factors, socio-cultural norms and peer norms, and behavioral factors. - Support: coach (graduate psychology student) contacted participants once a week	8 weeks	6 months	EDE-Q, objective binge eating episodes, subjective binge eating episodes, all binges, purging behavior, SCID, WCS, EDI, BSI, BDI, GSI	Not reported	EDE-Q global (Fu *d* = 0.50), all binges (Fu *d* = 0.43), purging behavior(Fu *d* = 0.33)

Study	Study population	Condition(s)	Treatment program	Program duration	Follow-up	Outcome measures	Significant results: $p \leq .05$. Effect sizes (Cohen's *d*) are presented within parentheses	
							Time (within-group effect): Pp *d* = *d* pre- to post intervention Pf *d* = *d* pre-intervention to follow-up	**Interaction time x condition (between-group effect):** Post *d* = *d* at post-intervention Fu *d* = *d* at follow-up
Sánchez-Ortiz et al., 2011b	76 Females (mean age total sample 23.9, *SD* = 5.9) with BN or EDNOS	- iCBT - WLC	iCBT: "*Overcoming Bulimia Online"* - Structured program that included eight modules incorporating cognitive behavioral as well as motivational strategies and psychoeducation - Clinician support once every 1-2 weeks	3 months	3 months	EDE, objective binge eating episodes, self-induced vomiting and purging behavior, HADS, WHOQOL-BREF	EDE global (pp *d* = -1.29, pf *d* = -1.75), EDE subscales dietary restraint, weight concerns, and shape concerns, objective binge eating episodes (pp *d* = -0.80, pf *d* = -1.07), self-induced vomiting (pp *d* = -0.49, pf *d* = -0.76), purging behavior (pp *d* = -0.60, pf *d* = -0.87), HADS	EDE global (post *d* = 1.25, Fu *d* = 0.99), objective binge eating episodes (post *d* = 0.40), EDE subscales shape concern and dietary restraint, HADS, WHOQOL-BREF subscales psychical, psychological, and social.
Ruwaard et al., 2012	105 Individuals (104 females, 1 male) (mean age iCBT 30.0, *SD* = 10) with full or subthreshold BN	- iCBT - Unguided self-help (USH) - WLC	iCBT: "*Interapy"* - Structured program that included ten modules incorporating amongst other things psychoeducation, awareness training, motivation, self-control and self-monitoring, cognitive restructuring, behavioral experiments, body experience, self-esteem and relapse prevention. - Support: 25 scheduled clinician feedback moments (+/- 13 hours) USH: - Participants received a hard copy of a self-help book, based on the same CBT principles as applied in the iCBT - Online body image journal - Moderated discussion group	20 weeks	1 year	Binge eating and purging, EDE-Q, BAT	EDE-Q global (pp *d* = -1.22, pf *d* = -1.17), binge eating (pp *d* = -1.04, pf *d* = -0.96), purging (pp *d* = -0.75, pf *d* = -0.66), BAT	*CBT versus WLC*: EDE-Q global (post *d* = 0.51), binge eating (post *d* = 0.44), purging (post *d* = 0.45), BAT *CBT versus USH*: EDE-Q global (post *d* = 0.37), binge eating (post *d* = 0.72), purging (post *d* = 0.53) *USH versus WLC*: None

Wagner et al. 2012	155 Females (mean age iCBT condition 24.2, *SD* = 4.5) with BN purging type or EDNOS with binge eating or purging	-iCBT - Guided bibliotherapy (BIB-GSH)	iCBT: "*Salut BN"* - Structured program that included seven modules consisting of lessons, exercises and examples, incorporating motivation, self-observation, behavior modification, problem solving, cognitive restructuring, assertiveness, and relapse prevention - Support: weekly e-mails from clinician BIB-GSH: *"Getting better bit(e) by bit(e)"* Self-help manual based on CBT. Content, structure and e-mail support similar to IB-GSH, but with additional topics such as drug misuse and sexuality.	4-7 months	7 months and 18 months	Objective binge eating, compensatory behaviors (vomiting, laxative misuse, excessive sports, fasting), EDI-2	Objective binge eating (pp *d* = -0.24, pf (month 7) *d* = -0.32, pf (month 18) *d* = -0.49), vomiting (pp *d* = -0.33, pf (month 7) *d* = -0.36, pf (month 18) *d* = -0.53), laxative misuse (pf (month 18) *d* = -0.18), excessive sports misuse (pf (month 18) *d* = -0.38), fasting (pp *d* = -0.40, pf (month 7) *d* = -0.41, pf (month 18) *d* = -0.61), EDI-2 total (pp *d* = -0.51, pf (month 7) *d* = -0.73, pf (month 18) *d* = -0.65)	No significant interaction effects were found
Effect studies: non-randomized controlled studies								
Fernández-Aranda et al., 2009	62 Females (mean age total sample 23.7, *SD* = 3.6) with BN	- iCBT -WLC	iCBT: "*Salut BN"* (see above)	4 months	No follow-up	EDI, EAT, BITE, binge eating and self-induced vomiting, TCI-R	EDI total (pp *d* = -0.60), subscales bulimia, interpersonal distrust and maturity fears, BITE subscale symptom (pp *d* = -1.36)	EDI subscale maturity fears, BITE subscale symptom (post *d* = 0.67), self-induced vomiting (post *d* = 1.32)
Carrard et al., 2011b	42 Females (mean age iCBT 42.9, *SD* = 11.4) with full or subthreshold BED	- iCBT - WLC	iCBT*:" Salut BED"* (see above)	6 months	6 months	EDE-Q, objective binge eating episodes, EDO, TFEQ, BDI-II, SCL-90R, IWQOL-Lite	Not reported	EDE-Q subscale shape concern, TFEQ subscale hunger, BDI-II, SCl-90R global, IWQOL global and subscales physical condition, self-esteem, sexual life, public distress, and work
Carrard et al., 2011c	127 Females (mean age 24.7, *SD* = 5.1) with (sub threshold or full- BN	iCBT	iCBT: "*Salut BN"* (see above)	4 months	2 months	EDI-2, binge eating, self-induced vomiting, physical activity frequency, SCL-90R	EDI-2 all subscales, binge eating (pp *d* = -0.64), self-induced vomiting (pp *d* = -0.83), physical activity frequency, SCL-90R global	Not applicable

Study	Study population	Condition(s)	Treatment program	Program duration	Follow-up	Outcome measures	Significant results: $p \leq .05$. Effect sizes (Cohen's *d*) are presented within parentheses	
							Time (within-group effect): Pp *d* = *d* pre- to post intervention Pf *d* = *d* pre-intervention to follow-up	**Interaction time x condition (between-group effect):** Post *d* = *d* at post-intervention Fu *d* = *d* at follow-up
Pretorius et al., 2009	101 Individuals (98 females, 3 males) (mean age 18.8, *SD* = 1.6) with BN or EDNOS	-iCBT	iCBT: "*Overcoming Bulimia Online"* See above, but: - In addition: a moderated forum - Clinician support once a week	3 months	3 months	EDE, objective binge eating episodes, self-induced vomiting, and use of laxatives, BMI, treatment expectation, experience of treatment, CSRI	EDE-global (pp *d* = -7.09, pf *d* = -5.49), EDE all subscales, objective binge eating episodes (pp *d* = -4.44, pf *d* = -4.42), self-induced vomiting (pp *d* = -3.57, pf *d* = -3.68), use of laxatives, BMI, CSRI	Not applicable
Fong Leung et al., 2013c	280 Individuals (172 females, 8 males) (mean age 26, *SD* not reported), with a full or subthreshold ED	Internet-based pure self-help (IB-SH)	IB-SH: "*Smart Eating"* - Self-help modules included issues related to healthy eating, family education, health assessment and monitoring, motivation enhancement, self-help strategies, and psychological health promotion	1 month	No follow-up	EDE-Q, binge eating, self-induced vomiting, use of laxatives, compulsive exercise, dieting, EDI-III, BDI-III, BAI, MSCARED, SF-36	EDE-Q global (pp *d* = -0.65), EDE-Q all subscales, binge eating (pp *d* = -0.28), compulsive exercise, dieting, EDI-III, BDI-III, MSCARED, SF-36	Not applicable
Effect studies: small-sized* (50 > *n* > 10*) non-randomized, uncontrolled studies								
Robinson & Serfaty, 2001	23 Females (mean age not reported) with BN, BED, or EDNOS	E-mail therapy (ET)	ET: -Participants kept a food diary and eating disorder symptoms and problems experienced, and sent it to their clinician every 3 days - 2 E-mail contacts with a clinician a week	3 months	No follow-up	BITE, BDI, BMI	BITE subscales symptom (pp *d* = -0.58) and severity (pp *d* = -0.43), BDI	Not applicable

Carrard et al., 2006	45 Females (mean age 26.2, *SD* not reported) with BN purging type or EDNOS	iCBT	iCBT: "*Salut BN"* (see above)	4 months	2 months	EDI-2, binge eating, self-induced vomiting, excessive exercising, misuse of appetite suppressants, use of laxatives, diuretics, and enemas, SCL-90R	EDI-2 all subscales, binge eating, self-induced vomiting, SCL-90R global	Not applicable
Nevonen et al., 2006	38 Females (mean age 21.1, *SD* = 1.6) with BN or EDNOS	iCBT	iCBT: "*Salut BN"* (see above)	6 months	2 months	EDI-2,binge eating, self-induced vomiting, RAB-R, SCL-90R	EDI-2 subscales drive for thinness, bulimia, body dissatisfaction, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, and asceticism, self-induced vomiting (pf *d* = -0.46) SCL-90R global	Not applicable
Qualitative studies: medium-sized 100 > n > 50) non-randomized, uncontrolled studies								
Sánchez-Ortiz et al., 2011	71 Females (mean age not reported) of study above	iCBT	iCBT: "*Overcoming Bulimia Online"* (see above)	3 months	No follow-up	Qualitative study, exploring the content of emails sent by clinicians to participants	Not applicable	Not applicable
Qualitative studies: small-sized (50 > n > 10) non-randomized, uncontrolled studies								
Robinson & Serfaty, 2003	29 Females (mean age not reported) with BN, BED or EDNOS	E-mail therapy (ET)	ET: -Participants kept a food diary and eating disorder symptoms and problems experienced, and sent it to their clinician every 3 days - 2 E-mail contacts with a clinician a week	3 months	No follow-up	Qualitative study exploring experiences and acceptability of e-mail therapy	Not applicable	Not applicable
Qualitative studies: case-series (n > 10)								

Study	Study population	Condition(s)	Treatment program	Program duration	Follow-up	Outcome measures	Significant results: $p \leq .05$. Effect sizes (Cohen's *d*) are presented within parentheses	
							Time (within-group effect): Pp *d* = *d* pre- to post intervention Pf *d* = *d* pre-intervention to follow-up	**Interaction time x condition (between-group effect):** Post *d* = *d* at post-intervention Fu *d* = *d* at follow-up
Yager, 2003	3 Females with an eating disorder (aged 13, 16 and 21 years old)	See Yager, 2001	See Yager, 2001	See Yager, 2001	No follow-up	See Yager, 2001	Not applicable	Not applicable
Sánchez-Ortiz et al., 2011a	9 Females (mean age 23.2, *SD* = 3.5) of study above	iCBT	iCBT: "*Overcoming Bulimia Online"* (see above)	3 months	No follow-up	Qualitative study, exploring views and experiences of iCBT participants	Not applicable	Not applicable
Yager, 2001	4 Females with an eating disorder (aged 17, 18, 22 and 50 years old)	E-mail as therapeutic adjunct to face-to-face therapy	E-mails as therapeutic adjunct to face-to-face therapy were primarily supportive (including words of encouragement)	Variable	No follow-up	Qualitative study, exploring the use of e-mail as therapeutic adjunct to face-to-face therapy	Not applicable	Not applicable

Note (in alphabetical order): BAI: Beck Anxiety Inventory; BAT: Body Attitude Test; BDI: Beck Depression Inventory; BED = binge eating disorder; BITE: Bulimic Investigatory Test Edinburgh; BMI = Body Mass Index; BN = bulimia nervosa; BSI: Brief Symptom Inventory; CES-D: Center for Epidemiologic Studies Depression Scale; BSQ: Body Shape Questionnaire; CSRI: Client Service Receipt Inventory; EAT: Eating Attitudes Test; EBI: Evaluating binge eating (adapted from the EDE for use with an adolescent population); ED = Eating disorder; EDE: Eating Disorder Examination; EDE-Q: Eating Disorder Examination Questionnaire; EDI: Eating Disorder Inventory; EDNOS = eating disorder not otherwise specified; EDO: Eating Disorder in Obesity; HADS: Hospital Anxiety and Depression Scale; iCBT: Internet-based cognitive behavioral therapy; IWQOL-Lite: Impact of Weight on quality of Life short form; MADRS: Montgomery Åsberg Depression Rating Scale; MSCARED: Motivational Stages of Change for Adolescents Recovering from an Eating Disorder; PACE+: Dietary fat screening measure; QEDD: Questionnaire for Eating Disorders; RAB-R: Rating of Anorexia and Bulimia Interview-Revised; RCT = Randomized controlled Trial; RSES: Rosenberg Self-Esteem Scale; SCID: Structural Clinical Interview for DSM IV Axis 1 Disorders; SCL-90R: Symptom Checklist-90-Revised; SCQ: Self-Concept Questionnaire; SF-36: 36-item Short Form Health Survey; SWLS: Satisfaction With Life Scale; TCI-R: Temperament and Character Inventory-Revised; TFEQ: Three-Factor Eating Questionnaire; WCS: Weight Concern Scale; WHOQOL-BREF: World Health Organization Quality of Life scale brief version; WLC = waiting list control condition.

Results regarding purging behavior were mixed (Carrard et al., 2011c; Nevonen et al., 2006; Pretorius et al., 2009; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b; Wagner et al., 2012).

As can be seen in Table 1, nine studies evaluating eight different treatment programs found that internet-based treatment was more effective in reducing global ED pathology, frequency of binge eating and/or purging behavior as compared to a waiting list (Carrard et al., 2011a; Carrard et al., 2011b; Fernández-Aranda et al., 2009; Jacobi et al., 2011; Jones et al., 2008; Ljotsson et al., 2007; Robinson et al., 2008; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b). Conversely, some studies failed to find superior effects for binge eating (Carrard et al., 2011b; Fernández-Aranda et al., 2009), purging behavior (Ljotsson et al., 2007; Sánchez-Ortiz et al., 2011b), and/or global ED pathology as compared to a waiting list condition (Carrard et al., 2011b; Fernández-Aranda et al., 2009). Between-group effect sizes refer to the magnitudes of the differences in changes between internet-based treatment conditions and waiting list control conditions. Between-group effect sizes for significant results of global ED pathology, binge eating, and self-induced vomiting or purging behaviors can be found in Table 1. Because of the limited number of studies that compared internet-based treatment to waiting list control conditions, and missing or incomplete data reports on top of that, it is hard to reach a reliable conclusion. Between-group effect sizes for binge eating were primarily small at post-treatment (Carrard et al., 2011a; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b) and follow-up (Jacobi et al., 2011; Jones et al., 2008). As for purging behaviors, effect sizes at post-treatment varied from small (Ruwaard et al., 2012) to large (Fernández-Aranda et al., 2009). However, this large effect size was obtained through a study with a lower level of evidence: a non-randomized controlled trial, whereas the small effect size was obtained through a randomized controlled trial. Only one effect size for purging behavior was reported at follow-up, which was small (Jacobi et al., 2011). Results regarding measures of global ED pathology varied: effect sizes ranged from small to large at post-treatment (Carrard et al., 2011a; Fernández-Aranda et al., 2009; Ljotsson et al., 2007; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b) and ranged from moderate to large at follow-up (Jacobi et al., 2011; Sánchez-Ortiz et al., 2011b). Overall, results seem to suggest that internet-based treatment is of limited value in reducing purging behaviors, is of value in reducing binge eating and is of particular value in reducing ED pathology (e.g., maladaptive cognitions).

The majority of the studies included data on abstinence rates of binge eating and/or compensatory behaviors (Carrard et al., 2006; Carrard et al., 2011c; Carrard et al., 2011a; Carrard et al., 2011b; Fernández-Aranda et al., 2009; Jacobi et al., 2011; Ljotsson et al., 2007; Pretorius et al., 2009; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b; Wagner et al., 2012). Although the timeframe and criteria used to define abstinence varied across

these studies, we did review the abstinence rates in order to provide an overall picture. The abstinence rates varied from 10% (Pretorius et al., 2009) to 45% (Carrard et al., 2011b) at post-treatment, and from approximately 15% (Wagner et al., 2012) to 55% (Carrard et al., 2011b) at follow-up. In addition, five studies (Carrard et al., 2011b; Fernández-Aranda et al., 2009; Ruwaard et al., 2012; Carrard et al., 2011a; Jacobi et al., 2011) found the proportion of abstainers to be significantly higher in internet-based treatment conditions as compared to waiting list control conditions.

Several studies demonstrated superior effects of internet-based treatments compared to waiting lists in terms of (ED-related) quality of life (Ljotsson et al., 2007; Carrard et al., 2011a; Sánchez-Ortiz et al., 2011b; Carrard et al., 2011b). Findings with respect to the effectiveness in terms of general psychopathology and depression are inconsistent: some studies found superior effects of internet-based treatment compared to waiting lists (Ljotsson et al., 2007; Sánchez-Ortiz et al., 2011b; Carrard et al., 2011b), whereas others did not (Carrard et al., 2011a; Jacobi et al., 2011; Robinson et al., 2008; Jones et al., 2008).

Three studies (Ruwaard et al., 2012; Robinson et al., 2008; Wagner et al., 2012) compared internet-based CBT to an active control condition. However, studies varied in their type of active control condition, and one study had insufficient power (2008), rendering results inconclusive.

Predictors of treatment response

Five studies (Fernández-Aranda et al., 2009; Carrard et al., 2011c; Jacobi et al., 2011; Ljotsson et al., 2007; Wagner et al., 2012) identified predictors of treatment response. More improvements in symptoms were reported for individuals with less comorbid psychopathology (Carrard et al., 2011c). Furthermore, two studies (Fernández-Aranda et al., 2009; Wagner et al., 2012) found that higher baseline levels of ED pathology (e.g. higher BMI and disordered eating attitudes, and higher drive for thinness respectively) were associated with more improvements in symptoms. However, one of these studies (Wagner et al., 2012) also found a lower frequency of binge eating at baseline to be related to a more positive long-term outcome. A study by Jacobi et al. (2011) found internet-based treatment to be superior to a waiting list in terms of ED pathology, but only among a group of individuals who reported binge eating episodes at baseline, not among a group of individuals who reported restrictive eating as their sole initial symptom. The authors suggested that for the latter group, the intervention presumably needs a more specific focus on enhancing motivation, changing restrictive eating patterns, and discussing and stressing the consequences and dangers of restrictive eating, in order to achieve significant effects on ED pathology (Blake, Turnbull, & Treasure, 1997). Finally,

Ljotsson et al. (2007) found that after controlling for baseline values, the magnitude of the effect of internet-based treatment in terms of binge eating was substantially higher for individuals with binge eating disorder than for individuals with bulimia nervosa (Cohen's *d* of 0.73 and 0.11 respectively). Although the authors stress that this finding should be interpreted with caution given that confounding variables may be present, this finding is consistent with a cohort study showing that individuals with binge eating disorder have a better prognosis than individuals with bulimia nervosa (Fairburn, Cooper, Doll, Norman, & O'Connor, 2000). To summarize, these preliminary results suggest that internet-based therapy for ED is more effective for individuals with less comorbid psychopathology, individuals with binge eating versus restrictive problems, and individuals with binge eating disorder versus bulimia nervosa.

Compliance in internet-based treatments for eating disorders

Three studies reported relatively low levels of compliance, with approximately half of the participants completing only a fraction or less than half of available treatment sessions (Jones et al., 2008; Nevonen et al., 2006; Pretorius et al., 2009). Four studies reported relatively moderate levels of compliance in that participants completed on average +/- 70% of the available treatment sessions (Sánchez-Ortiz et al., 2011b), or that approximately two-thirds of the participants completed between half and all of the available treatment steps (Fernández-Aranda et al., 2009; Jacobi et al., 2011; Wagner et al., 2012). Three studies found relatively moderate to high levels of compliance, with results indicating that approximately three-fourths of the participants completed the majority to all of the available treatment modules (Carrard et al., 2006; Carrard et al., 2011a; Ruwaard et al., 2012). Overall, it may be concluded that the levels of compliance in internet-based treatments for ED vary considerably.

On examination of these treatment compliance rates in relation to study characteristics, the highest compliance rates were found in studies with older populations. The mean population ages of studies with relatively low compliance were approximately 15, 19 and 21 (Jones et al., 2008; Nevonen et al., 2006; Pretorius et al., 2009), those with moderate compliance between 22 and 24 (Fernández-Aranda et al., 2009; Jacobi et al., 2011; Sánchez-Ortiz et al., 2011b; Wagner et al., 2012), and those with relatively high compliance between 26 and 36 (Carrard et al., 2006; Carrard et al., 2011a; Ruwaard et al., 2012). Another interesting finding is that different levels of compliance were found for the same internet-based CBT program ('Salut BN') across four different studies (Carrard et al., 2006; Fernández-Aranda et al., 2009; Nevonen et al., 2006; Wagner et al., 2012). These studies showed differences in population mean ages (with older populations showing more compliance), as well as differences in the country in which the study was conducted (low

compliance in the Swedish study, moderate compliance in the Spanish study and moderate to high compliance in the Swiss study). It may be that age and culture influenced treatment compliance, although many other factors might have influenced compliance levels, such as differences in baseline (ED-)pathology, the duration of the ED, motivation to change, or enhancement strategies such as the sending of reminders.

Compliance and baseline characteristics

Pretorius et al. (2009) found a positive relationship between the levels of compliance and baseline ED pathology: participants who completed four to eight sessions had higher baseline eating concerns than participants who completed fewer than four sessions. This finding suggests that a significant level of impairment must be experienced in order to comply with a treatment.

Compliance and treatment outcome

Four studies (Carrard et al., 2011b; Carrard et al., 2011c; Nevonen et al., 2006; Robinson et al., 2008) found a positive association between the level of compliance and outcome. More specifically, higher compliance with the treatment program (as measured by the number of completed modules or sessions, the number of days completed in diaries, or the number of words written in e-mail therapy) was found to be associated with larger improvements in ED(-related) symptoms. This suggests that it is important to keep participants involved during the course of internet-based treatment, and that improving compliance might be a successful way to enhance the effectiveness of an internet-based treatment. Therapist support in internet-based treatment seems to play an important role in enhancing participants' motivation, and thereby improves treatment compliance (Carrard et al., 2006; Nevonen et al., 2006; Sánchez-Ortiz et al., 2011a). Interestingly however, one study found that the fewer the number of e-mails sent by participants to their coach, the more improvement in terms of quality of life (Carrard et al., 2011b). This might be explained by participants needing less contact as long as their overall status is acceptable or improved.

Treatment dropout in internet-based treatments for eating disorders

The term treatment dropout is not clearly defined in study reports on internet-based treatment. Treatment dropout could for example be defined as a failure to complete *all* treatment sessions, while it could also refer to a failure to complete a certain number or percentage of available treatment sessions (Melville, Casey, & Kavanagh, 2010). Only one of the included studies investigated participants' reasons for treatment dropout defined as those who discontinued using the online self-help program: participants reported a lack of motivation, energy or time, loss of interest, lack of benefit, as well as computer-related

difficulties (technical problems) (Leung et al., 2013c). It is unfortunate that reasons for treatment dropout are under-researched, since it could provide important information, such as (major) inhibitors or downsides of a treatment program, or the usefulness of such a program.

Treatment dropout and baseline characteristics

Four studies (Fernández-Aranda et al., 2009; Carrard et al., 2006; Carrard et al., 2011a; Ljotsson et al., 2007) found significant differences in baseline characteristics between participants who completed the full treatment and those who did not. Individuals with more severe baseline (ED) pathology dropped out of treatment more often than individuals with less severe baseline (ED) pathology, including those who were more anxious (Fernández-Aranda et al., 2009) or depressed (Jones et al., 2008), those who demonstrated higher frequencies of binge eating (Carrard et al., 2006) and self-induced vomiting (Carrard et al., 2006), as well as those with a higher drive for thinness (Carrard et al., 2011a) and more concerns about shape (Carrard et al., 2011a; Jones et al., 2008) and weight (Jones et al., 2008). Thus, it might be concluded that higher baseline levels of (ED) pathology are related to higher treatment dropout rates. It should be noted that the reasons for treatment dropout in the reviewed studies are unclear, and it is possible that more severe patients improve to such an extent that they do not need the treatment anymore.

Study dropout in internet-based treatments for eating disorders

Participants who drop out of treatment do not necessarily drop out of the study. This section reviews study dropout, referring to participants being lost to follow-up, thus those who fail to complete post-intervention or follow-up questionnaires (irrespective of whether or not they completed treatment). Study dropout in internet-based treatment conditions ranged from 5.3% to 76.8% at post-treatment (*M* = 26.3), and from 9.1% to 48.9% at follow-up (*M* = 28.8) (Carrard et al., 2006; Carrard et al., 2011c; Carrard et al., 2011a; Carrard et al., 2011b; Fernández-Aranda et al., 2009; Jacobi et al., 2011; Jones et al., 2008; Leung et al., 2013c; Ljotsson et al., 2007; Nevonen et al., 2006; Pretorius et al., 2009; Robinson et al., 2001; Robinson et al., 2008; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011b; Wagner et al., 2012). Notwithstanding the considerable variance in study dropout rates, study dropout rate seems to be comparable to the (weighted) average dropout rate found in a review of internet-based treatment for a broad range of psychological disorders (31%) (Melville et al., 2010).

Given the substantial variance in study dropout rates, we closely examined patterns of study dropout rates in relation to study characteristics, and found that studies including one or more face-to-face assessment demonstrated lower dropout rates (post-

treatment range 5.7% – 39.8% (*M* = 15.4), follow-up range 9.1% – 27.0%, *M* = 23.0)) (Carrard et al., 2011a; Carrard et al., 2011b; Fernández-Aranda et al., 2009; Jacobi et al., 2011; Jones et al., 2008; Ljotsson et al., 2007; Nevonen et al., 2006; Wagner et al., 2012) than studies that did not (post-treatment range 5.3% – 76.8% (*M* = 24.2), follow-up range 23.7% - 48.9%, (*M* = 36.9)) (Carrard et al., 2006; Carrard et al., 2011c; Leung et al., 2013c; Pretorius et al., 2009; Robinson et al., 2008; Robinson et al., 2001; Sánchez-Ortiz et al., 2011b; Ruwaard et al., 2012). Face-to-face meetings in internet-based treatments may reduce study dropout rates, although it should be noted that there is a risk that the loss of anonymity inherent in a face-to-face component may narrow the reach of the programs.

A study by Ruwaard et al. (2012) found study dropout rates in an internet-based CBT condition to be half that of an unguided self-help condition, in which participants only received a hard copy of a self-help book that was based on the same cognitive behavioral principles as the internet-based treatment. This suggests therapist support to be a critical determinant of study adherence.

Acceptability of internet-based treatments to individuals with an eating disorder

It is important to investigate the acceptability of internet-based treatments for ED, meaning how well individuals with an ED accept internet-based treatments. Overall, such treatments appear to be highly acceptable (Carrard et al., 2006; Carrard et al., 2011b; Carrard et al., 2011c; Jacobi et al., 2011; Leung et al., 2013c; Nevonen et al., 2006; Pretorius et al., 2009; Robinson et al., 2001; Robinson et al., 2003; Robinson et al., 2008; Ruwaard et al., 2012; Sánchez-Ortiz et al., 2011a). Participants indicated that the treatments were useful and pleasant, and easy to use. Participants furthermore indicated that they liked the convenience and flexibility of the treatments, and regarded the treatments as helpful in overcoming (some of their) problems. In some studies, doubtful comments or negative ratings were made (Carrard et al., 2011b; Pretorius et al., 2009; Robinson et al., 2001; Robinson et al., 2003; Robinson et al., 2008), for example about the coldness of e-mail communication and the impersonalness of online sessions. Although flexibility is reported as a major advantage in internet-based treatment, it also requires a lot of self-discipline and motivation, which some participants reported struggling with (Pretorius et al., 2009; Sánchez-Ortiz et al., 2011a). Overall, it might be concluded that internet is an acceptable and convenient medium for the delivery of treatment for ED, although it might not be the best or most appropriate delivery mode for everyone.

Yager (2001; 2003) explored the use of e-mail as an adjunct to (face-to-face) therapy in outpatient settings. Results showed that patients experienced the use of e-mail positively and generally found it to be helpful. For example, participants reported that they experienced the e-mail contact as encouraging and motivating, that it was a good way to

keep in touch with their therapist, and that it successfully raised awareness of their eating behaviors and problems.

Participants in several studies rated the support and contact with coaches as (highly) valuable, and commented that they liked the feeling of someone keeping an eye on them (Carrard et al., 2011b; Carrard et al., 2011c; Pretorius et al., 2009; Ruwaard et al., 2012). However, none of the included studies in this review extensively investigated whether a therapeutic alliance between therapist and patient was formed, and whether the alliance effects treatment outcomes. This is unfortunate, given that it has been suggested that therapeutic alliance is positively associated with treatment outcome in face-to-face treatment (Martin, Garske, & Davis, 2000) as well as in internet-based treatment (Knaevelsrud & Maercker, 2007).

Directions for future research

An important gap in the literature is the few direct comparisons of different internet-based treatments for ED, as well as the lack of direct comparisons of internet-based treatments to face-to-face treatments for ED. Fortunately, the first randomized controlled trial that compares internet-based group CBT with traditional face-to-face CBT is ongoing (Bulik et al., 2012). A point of particular interest when comparing internet-based treatment with face-to-face treatment, is that it should be carefully considered how to measure the outcomes. One could choose the outcomes to be completely assessed by self-report, or choose to include face-to-face assessments. Including the latter may narrow the reach of internet-based treatments, as individuals must then be seen for the assessments and thus loose their anonymity, while on the other hand, it might come with the advantage of lower dropout rates and higher compliance, as suggested in this review. Another gap in the literature is the lack of cost-effectiveness analyses for internet-based treatments of ED, which is important for the implementation of such interventions, particularly in light of ongoing pressure for savings in healthcare.

To date we know little about what types of individuals benefit from internet-based treatments. Preliminary findings suggest that individuals with less comorbid psychopathology (Carrard et al., 2011c), binge eating problems as opposed to restrictive problems (Jacobi et al., 2011), and binge eating disorder as opposed to bulimia nervosa (Ljotsson et al., 2007) show more improvement. However, findings should be replicated before drawing any firm conclusions. None of the studies included in this review considered mediation, e.g. processes of behavioral change. Therefore it is currently unknown how internet-based treatment exerts its positive effects. Examining mediators of

treatment response could be very useful in unraveling the mechanism(s) of change a particular treatment engenders, which in turn could help to improve treatment programs.

In this review, almost all of the internet-based treatment programs included support from a coach (e.g. a therapist or trained student), however with considerable variability in the frequency and amount of support. It would be interesting to focus on determining the most (cost-) effective dose of such support. Is a small amount of support just as effective as a more intensive amount of support? Are treatment programs with some sort of guidance more effective than those without? Studies in the field of depression and anxiety suggest that the latter indeed is the case (Andersson & Cuijpers, 2009; Spek et al., 2007). It is also interesting to investigate whether the amount of support can be diminished over the course of a treatment program, as one study suggested that less support is needed as participants' overall status improves (Carrard et al., 2011b). A final interesting topic for future research regarding support is to investigate whether support can be effectively provided by non-professionals, in place of licensed psychologists. One study included in this review demonstrated that therapists predominantly made supportive comments during internet-based CBT. Maybe support might not necessarily need to be provided by a licensed therapist, but might just as well be effectively provided by trained non-clinicians. Consistently, studies in the field of depression and anxiety have shown that internet-based treatment with non-clinical guidance (primarily supportive and encouraging guidance provided by a technician with no qualifications in health care or counseling) resulted in equally large clinical improvements as interventions with clinical guidance (guidance provided by a licensed psychologist including active engagement in participants' goal setting, problem solving, and discussion of strategies to overcome barriers to progress) (Robinson et al., 2010; Titov et al., 2010).

In the majority of the reviewed studies, information about the use of other interventions during the treatment and follow-up period is lacking. In evaluating the effectiveness of internet-based treatments in the future, it is important to monitor and report on the involvement of other interventions, as well as the use and/or change of medication. As for the design of future studies, more studies with a (longer) follow-up period are needed to examine the long-term (cost-) effectiveness of such treatments.

Finally, in light of the methodological limitations of the studies included in this review, we would like to propose some recommendations for future research methodology. To begin with, more randomized controlled trails should be conducted. Future studies should furthermore always include intent-to-treat analyses. All of the randomized controlled studies, but only one (Pretorius et al., 2009) of the eight observational studies conducted such an analysis, whereas the other studies conducted analyses of completers only. Results based on completer analyses could overestimate the clinical effectiveness of an

intervention, because participants who complete treatment may experience more symptom reduction over time as compared to those who drop out. Indeed, a direct comparison of effect sizes from intent-to-treat versus completer analyses in a study by Ljotsson et al. (2007) showed larger effect sizes in 13 out of 18 outcome measures for the completer analyses compared to the intent-to-treat analyses. Another recommendation for future studies is to focus on exploring the reasons for treatment dropout and non-compliance, since this could help to develop ideas and strategies that could improve compliance rates, and thereby possibly the effectiveness of treatment programs. A final recommendation for future studies is to always report on effect sizes, since statistical significance does not yield any information about the magnitude or importance of an effect. To conclude, it is important to focus on heightening both study quality and methodological quality in e-health trials for eating disorders, so that the potential evidence base of e-health for eating disorders can be reliably examined. Improving the standard of methodological quality is not only needed in the field of e-health for eating disorders, but appears to be an issue in e-health trials for psychiatric disorders in general (Kiluk et al., 2011). In addition, as proposed by Baker et al. (2010), we recommend researchers to follow the (proposed) CONSORT reporting criteria for research on (e-health) interventions (Eysenbach et al., 2011; Schulz et al., 2010). It offers a standard way for authors to prepare evaluation reports on (e-health) trials, which could help to improve the completeness and quality of reports.

Discussion

The current review indicates that the internet is a promising vehicle for delivering ED treatment. However, more research is needed to determine the utility of internet-based treatments by comparing them to face-to-face treatments for ED. Future studies should furthermore focus on unraveling predictors and mediators of treatment outcome, compliance and dropout rates respectively, in order to optimize internet-based treatment programs for ED. More effort should be made to investigate the reasons for non-compliance and treatment dropout, and the role of individual support (e.g. frequency, amount and provider/type of support) in internet-based treatments. Finally, more studies with good methodological quality are needed, and researchers should carefully follow the CONSORT reporting criteria to help improve the quality of study reports.

Acknowledgement

This study is partly supported by ProYouth, an European initiative for the promotion of mental health and the prevention of eating disorders in young people, and is co-financed

by the European Commission's Executive Agency for Health and Consumers in the Health Program (Contract No: 20101209).