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

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E-mental health for eating disorders

Jiska Joëlle Aardoom

Just a click away… E-mental health for eating disorders
Jiska Joëlle Aardoom
PhD dissertation

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Just a click away…

E-mental health for eating disorders

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Contents

Chapter 1

General introduction

This introductory chapter begins by providing the reader with a theoretical background and context of the research presented in this dissertation: E-mental health for eating disorders. Furthermore, this chapter provides a rationale for the research, explaining why E-mental health for eating disorders is worth investigation and how this research can help to address some important gaps in research and clinical practice. At the end of this chapter, the aims and outline of this dissertation are presented.

Eating disorders

Diagnostic classifications

Eating disorders are psychiatric disorders characterized by persistent disturbances of eating or eating-related behaviors that significantly impair physical health and psychosocial functioning (American Psychiatric Association, 2013). The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association, 2013) specifies several distinct eating disorders, including anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), and their variants. Anorexia nervosa is characterized by significantly low body weight due to a restriction of energy intake, intense fear of gaining weight or of becoming fat, and disturbances in self-perceived weight or shape. Two subtypes of AN can be distinguished: the restricting and the binge eating/purging type. Patients with the former subtype accomplish their weight loss primarily through food restricting and/or excessive exercise, whereas patients with the latter subtype engage in binge eating and purging behaviors such as self-induced vomiting or the misuse of diuretics, laxatives, or enemas. Patients with BN have recurrent binge eating episodes and inappropriate compensatory behaviors, both at least once a week for three months, and their self-evaluation is unduly influenced by their body weight and shape. Recurrent binge eating episodes are also a feature of BED, but patients with BED do not engage in inappropriate compensatory behaviors as do patients with BN. The diagnosis of other specified feeding or eating disorder (OSFED) captures clinically severe symptoms of a feeding or eating disorder that do not meet the diagnostic criteria for another feeding or eating disorder, and distinguishes five subtypes: atypical AN, subthreshold BN, subthreshold BED, purging disorder, and night eating syndrome. For example, the criteria for atypical BN and BED are met when individuals experience a low frequency or limited duration of binge eating episodes and/or compensatory behaviors. The diagnosis of OSFED was formerly referred to as eating disorder not otherwise specified (EDNOS) (American Psychiatric Association, 1994), that included BED as a subtype of this diagnostic category.

Prevalence

The lifetime prevalence of an eating disorder can be defined as the proportion of a population that had an eating disorder at any point in life. Lifetime prevalence estimates of DSM-5 diagnoses of AN have been found to vary between 0.8% and 4.2% (Smink, van Hoeken, & Hoek, 2013), and for BN between 1.6% and 2.6% (Keski-Rahkonen et al., 2009; Stice, Marti, & Rohde, 2013; Trace et al., 2012). Studies investigating the lifetime prevalence of BED on a community-level are scarce, but have been estimated at around 1.9% across several countries according to DSM-4 criteria, and somewhat higher according to the DSM-5 criteria: 2.3% (Smink, van Hoeken, Oldehinkel, & Hoek, 2014) and 3.0% (Stice et al., 2013). Preliminary data regarding the prevalence of OSFED shows varying results. More specifically, two studies have found estimates of around 0.6% (Allen, Byrne, Oddy, & Crosby, 2013; Smink et al., 2014), whereas the results of a study by Stice et al. (2013) demonstrated much higher estimates: 2.8% for atypical AN, 4.4% for subthreshold BN, 3.6% for subthreshold BED, and 3.4% for purging disorder.

Eating disorders are often developed during adolescence and early adulthood (Hudson, Hiripi, Pope, & Kessler, 2007; Kessler et al., 2013). The majority of patients with AN and BN are female (Bulik et al., 2006; Hudson et al., 2007; Kessler et al., 2013); the proportion of men has been found to vary from less than 10% (Hoek & van Hoeken, 2003) to up to 25% (Hudson et al., 2007). With respect to binge eating behaviors however, the gender differences in prevalence are less pronounced (Striegel-Moore et al., 2009) and recent literature even suggests that the number of males and females who experience binge eating behaviors is roughly equal (Mitchison & Mond, 2015).

Course and outcome

The course and outcome varies among the type, nature and severity of the eating disorder, but can be considered unsatisfactory. A large review of 119 studies covering 5,590 patients with AN found that less than half (i.e., 46%) of the patients fully recovered, one-third showed improvements with only partial or residual symptoms of AN, and 20% remained chronically ill (Steinhausen, 2002). For patients with BN the remission rates are somewhat higher, around 70% (Keel & Brown, 2010), and these patients tend to achieve remission faster as compared to patients with AN (Clausen, 2008; van Son, van Hoeken, van Furth, Donker, & Hoek, 2010). Nevertheless, a large review by Steinhausen et al. (2009) found the long-term chronicity rates of AN and BN to be quite comparable. Remission rates for BED seem to be more favorable than for AN and BN, with most estimates varying between 55% and 80% (Keel et al., 2010). The literature with respect to EDNOS/OSFED is scarce and requires further investigation, although preliminary results suggest that remission rates of the bulimic subtype are comparable to those of BN (Keel et al., 2010).

The mortality rate of AN ranks amongst the highest mortality rates of all psychiatric disorders (Chesney, Goodwin, & Fazel, 2014; Harris & Barraclough, 1998). Arcelus et al. (2011) in a meta-analysis demonstrated elevated mortality rates not only for patients with AN, but for patients with other eating disorders as well. Mortality rates were almost twice as high for individuals with an eating disorder as compared to the general population, whereas nearly six times higher for individuals with AN. It is estimated that suicide accounts for approximately 1 in 5 deaths in individuals with AN and BN (Smink et al., 2013).

Recovering from an eating disorder is a challenging and complex process (Federici & Kaplan, 2008; Keski-Rahkonen & Tozzi, 2005), and relapse is a common problem, even after successful treatment. Mostly, reported relapse rates following treatment of AN and BN range between 30 to 50% (Carter, Blackmore, Sutandar-Pinnock, & Woodside, 2004; Carter et al., 2012; Grilo et al., 2007; Halmi et al., 2002; Herzog et al., 1999; Keel & Mitchell, 1997; Keel, Dorer, Franko, Jackson, & Herzog, 2005; Olmsted, Kaplan, & Rockert, 1994; Olmsted, Kaplan, & Rockert, 2005; Richard, Bauer, Kordy, & COST Action B6, 2005; Strober, Freeman, & Morrell, 1997). Investigations of relapse in BED and EDNOS is limited, although rates for EDNOS might be similar to that of BN (Grilo et al., 2007), whereas three studies suggest somewhat lower relapse rates (10-28%) for BED (Agras, Telch, Arnow, Eldredge, & Marnell, 1997; Hilbert et al., 2012; Safer, Lively, Telch, & Agras, 2002).

Burden and costs

The vast majority of individuals with an eating disorder also meet the diagnostic criteria for one or more other psychiatric disorder, the most common being mood, anxiety, behavioral, and substance use disorders (Hudson et al., 2007; Kessler et al., 2013; Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011). Individuals with eating disorders are furthermore at elevated risk for medical complications and physical illnesses (Johnson, Cohen, Kasen, & Brook, 2002; Kessler et al., 2013; Mitchell & Crow, 2006), such as cardiovascular diseases, chronic fatigue, diabetes, obesity, chronic pain, musculoskeletal conditions, gastrointestinal complications, and metabolism problems. The burden of eating disorders is furthermore reflected in significant role impairments regarding work, household, and social relationships (Hudson et al., 2007; Kessler et al., 2013; Swanson et al., 2011). Also, eating disorders are known to negatively impact various important aspects of individuals' life, hence are associated with a poor quality of life (Engel, Adair, Las, & Abraham, 2009; Jenkins, Hoste, Meyer, & Blissett, 2011). Not only the wellbeing of patients is impaired, but the wellbeing of caregivers is also negatively affected as presented by high levels of psychological distress and burden amongst caregivers (Schmidt et al., 2016; Zabala, Macdonald, & Treasure, 2009), as well as impaired quality of life (de la Rie, van Furth, De, Noordenbos, & Donker, 2005).

The economic burden of eating disorders upon patients (Gatt et al., 2014) and society (Stuhldreher et al., 2012) is substantial. Cost-of-illness studies have shown the annual direct medical costs (e.g., health care and pharmaceutical costs) per patient to range between 1,288 to 8,042 US$ (Stuhldreher et al., 2012). On top of this direct medical costs there are indirect costs, that is, costs due to sickness absence or losses in productivity at work. Currently, only two studies have attempted to estimate the indirect costs for patients with AN, with resulting estimates of a total of 4,445 US$ (Krauth, Buser, & Vogel, 2002) per patient, and an estimated mean 3-month cost of €2,492 per patient (Stuhldreher et al., 2015). The indirect costs for patients with BN have only been estimated in one study, at 1,528 US$ per patient (Krauth et al., 2002).

Psychological treatments

What is the current evidence-base for psychological treatments of eating disorders? For children and adolescents with AN, family-based treatment that focuses on empowering the family to help restore the patient's weight, is the treatment of choice (Kass, Kolko, & Wilfley, 2013; National Institute for Clinical Excellence, 2004; Watson & Bulik, 2013; Wilson, 2005; Zipfel, Giel, Bulik, Hay, & Schmidt, 2015). For adults with anorexia nervosa there is no superior treatment approach, although specialized psychological treatment approaches such as cognitive behavior therapy, interpersonal psychotherapy, and specialist supportive clinical management, have been found to reduce symptoms in a considerable amount of patients (Kass et al., 2013; National Institute for Clinical Excellence, 2004; Watson et al., 2013).

The evidence-base for cognitive behavioral therapy for the treatment of bulimia nervosa and binge eating disorder is strong (National Institute for Clinical Excellence, 2004; Kass et al., 2013; Shapiro et al., 2007). Furthermore, there is emerging evidence that interpersonal psychotherapy could be equally effective as cognitive behavior therapy for these disorders, although treatment with interpersonal psychotherapy takes longer to achieve a similar result (Kass et al., 2013; National Institute for Clinical Excellence, 2004). Finally, there is preliminary evidence that self-help programs could be effective as a first step in the treatment of bulimia nervosa and binge eating disorder, and that such programs might even be as effective as cognitive behavior therapy when incorporated as a first step in a stepped-care model for the treatment of these disorders (Crow et al., 2013; Thiels, Schmidt, Troop, Treasure, & Garthe, 2001; Treasure et al., 1996; Perkins, Murphy, Schmidt, & Williams, 2006; Sysko & Walsh, 2008).

Given that eating disorders are characterized by high symptom fluctuation and considerable rates of diagnostic cross-over (Tozzi et al., 2005), and given that the different eating disorder subtypes share overlapping core psychopathology, there has been an

increasing interest in the investigation of enhanced cognitive behavior therapy (CBT-E): a transdiagnostic treatment for eating disorders (Fairburn, Cooper, & Shafran, 2003). This treatment focuses primarily on psychological and behavioral mechanisms that underlie and account for the maintenance of eating disorder psychopathology, such as clinical perfectionism, low self-esteem, mood intolerance, or interpersonal difficulties. The results of some recent studies investigating CBT-E are promising and suggest CBT-E to produce comparable effects as existing psychological treatments (Fairburn et al., 2015; Wonderlich et al., 2014; Zipfel et al., 2014).

Unfortunately, all above mentioned treatments for eating disorders still fail to help a substantial proportion of patients. Wilson et al. (2005) estimated that cognitive behavior therapy resulted in abstinence from binge eating and purging behaviors in approximately 30% to 50% of the cases with bulimia nervosa, and remission from binge eating in over 50% of the cases with binge eating disorder. Rates on abstinence, remission, and recovery rates for CBT-E in various eating disorder populations vary between 20% and 69.4% (Fairburn et al., 2015; Wonderlich et al., 2014; Zipfel et al., 2014).

Unmet need for mental health care

Despite the severity and burden of eating disorders, they often go undetected and the majority of individuals does not seek or receive mental health care for their eating disorder problems (Hart, Granillo, Jorm, & Paxton, 2011; Keski-Rahkonen et al., 2007; Keski-Rahkonen et al., 2009; Swanson et al., 2011). A systematic review by Hart et al. (2011) found that on average as few as 23.2% of patients with an eating disorder seek treatment. Several barriers to help-seeking have been identified, including amongst other things financial reasons (Cachelin, Rebeck, Veisel, & Striegel-Moore, 2001; Cachelin & Striegel-Moore, 2006; Hepworth & Paxton, 2007; Evans et al., 2011), as well as feelings of shame or fear of stigmatization (Becker, Hadley Arrindell, Perloe, Fay, & Striegel-Moore, 2010; Cachelin et al., 2006; Evans et al., 2011; Griffiths, Mond, Murray, & Touyz, 2015; Hepworth et al., 2007). Another important reason that prevents individuals from seeking help is the belief that one's eating disorder problems are not significant enough, or even non-existent, despite the presence of significant eating disorder psychopathology (Cachelin et al., 2001; Cachelin et al., 2006; Hepworth et al., 2007). Along similar lines, a study conducted in the Netherlands (de la Rie, Noordenbos, Donker, & van Furth, 2006) found that it took patients on average 3.6 years to recognize and acknowledge that they were suffering from an ED, and a further 4.2 to 6.3 years to seek treatment.

On top of the delay between the onset of symptoms and seeking treatment, there are significant delays between seeking and actually receiving treatment. A delay of 1.1 years was reported for 50% of the patients in a Dutch community-based sample (de la Rie

et al., 2006), due to reasons such as waiting lists, delays in the referral process, or being sent from one institution to another. Other studies have also reported on the lack of, or limited availability of specialized eating disorder services (Escobar-Koch et al., 2010; Rosenvinge & Klusmeier, 2000) as barriers to access of care. The barriers in seeking and receiving health care are unfortunate, as these may lead to higher symptom severity at the start of treatment, in turn making treatment more difficult. Furthermore, studies have demonstrated that a longer duration of eating disorder symptoms is associated with both poor outcomes and lower chances of recovery (Berkman, 2007; Fichter, Quadflieg, & Hedlund, 2006; Keel et al., 1997; Reas, Williamson, Martin, & Zucker, 2000; Steinhausen, 2002; Zipfel, Lowe, Reas, Deter, & Herzog, 2000). E-mental health has the potential to address the unmet need for health care.

E-(mental) health

There has been an increasing pressure on the sustainability of healthcare systems all over the world, including the Netherlands, due to increasing health care costs (Deloitte, 2015). Consequently, there is an increasing demand for change and innovation in order to deliver health care services and available resources in a more cost-effective manner, while at the same time striving to maintain or improve the quality of health care and outcomes. One such innovation that holds promise in addressing these challenges, pertains E-(mental) health. E-(mental) health is commonly defined as the use of information and communication technologies to support and/or improve (psychological) health care (Riper et al., 2007). Eysenbach (2001) however, has defined E-health in a more dynamic manner: *"E-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology."*.

E-health services can encompass a wide variety of interventions and systems, including electronic health records, psychoeducational programs, self-assessment tools, e-consults with a mental health professional, and extensive treatment programs that individuals can work through with or without the help from a therapist or coach. It follows that E-health services can be applied in many areas of health care targeting a wide range of populations, and serving a wide range of different goals. For example, stimulating self-management and empowerment of patients, informing patients, improving communication between mental health care professionals and patients, improving access

to care, and prevention and early detection, as well as early intervention and treatment of (mental) health problems.

E-health has potential to help decrease the treatment gap of eating disorders by reaching more individuals more quickly. By offering anonymous interventions, barriers related to feelings of shame or fear of stigma and being judged can be reduced, thereby lowering the threshold for seeking help. The convenience and flexibility could be enhanced, as individuals can access interventions modules or information at any time and from any place. Potentially, health care services for eating disorders can be delivered in a more cost-effective manner.

Disease management and E-mental health at Rivierduinen Eating Disorders Ursula

Giving the need for decreasing barriers to care as well as to improve the accessibility, availability, efficiency, and quality of health care services for individuals with eating disorder problems, Rivierduinen Eating Disorders Ursula implemented a stepped-care disease management model in 2009. The former treatment model included day treatment, inpatient treatment, and outpatient treatment. With the introduction of the stepped-care disease management model, several low-threshold interventions have been added as options for care in order to bridge the gap between individuals with an eating disorder in the community and health care services. In addition, the inclusion of these low-threshold interventions could help to improve early detection and intervention of eating disorder problems, and to fast-track individuals to tailored care meeting the individuals' needs.

The website http://www.hulpbijeetproblemen.nl/ provides on overview of the health care services that are offered as part of the stepped-care program by Rivierduinen Eating Disorders Ursula. In the order of lowest to highest with respect to the intensity and degree of tailoring: website and e-community 'Proud2Bme', Internet-based self-help intervention 'Featback', e-mail support from expert patients ('Ervaringsdeskundigheid'), and treatment at our clinical program. This dissertation will focused on Proud2Bme and Featback. Proud2Bme (http://www.proud2bme.nl/) has been developed as a healthy alternative for pro-eating disorder websites and provides a safe, positive, fun, and pro-recovery focused environment. It offers a wide array of information and personal stories as well as platforms for interaction (i.e. forum and chat) with peers and professionals. Internet-based self-help intervention Featback (http://www.featback.nl) comprises psychoeducation and a fully automated self-monitoring and feedback system. By means of this system, individuals can monitor their eating disorder symptoms by means of a short weekly questionnaire, after which they receive a tailored feedback message that is automatically generated according to a pre-defined algorithm. The feedback messages

contain social support and advice on how to counteract on their reported symptoms. In case of severe symptoms, a psychologist from our clinical prorgram contacts the individual and will offer him/her a telephone, e-mail, or chat consult. In this consult, the individual is supported and helped where possible and is furthermore stimulated to seek further (professional) help when needed.

To summarize

Eating disorders represent a significant public mental health concern, which places a large burden on patients, their relatives, and wider society. Unfortunately, there is a wide treatment gap: many eating disorders go undetected and the majority of patients does not seek and receive mental health care. Amongst the minority who does receive treatment, treatments appear to be only moderately effective. Hence, there is a need to improve the current health care services and to decrease barriers to care for eating disorders. Furthermore, there is a need to make health care services more widely available and more easily accessible. E-mental health has much potential in addressing these challenges and provides promising ways to enhance health care for patients with an eating disorder. In addition, E-mental health may also provide an answer to the increasing pressure to establish sustainable health care systems, by delivering innovative ways to increase the efficiency of health care services and to deliver interventions and resources in a more cost-effective manner.

Aims and outline of this dissertation

The aim of this dissertation is to investigate whether and how E-health can help to improve health care for individuals with eating disorder symptoms, thereby focusing on the evaluation of two of the E-health interventions of Rivierduinen Eating Disorders Ursula: the e-community Proud2Bme and the self-help intervention Featback. This aim is pursued by conducting several different studies, each with their own research aims and questions as presented below.

Chapter 2 contains a systematic review of the published literature up until 2013 with respect to the treatment of eating disorders over the Internet. What is the state-of-the-art of Internet-based treatment for disorders, and what are important directions for future research? This Chapter includes a critical evaluation of the methodology of conducted studies, and discusses the effectiveness, predictors of outcome, compliance and dropout rates, as well as the acceptability of Internet-based treatments. Also, directions for future research are presented.

In Chapter 3, we report on a cross-sectional study of the website and e-community 'Proud2Bme': a healthy alternative for pro-eating disorder websites that provides a safe, positive, and pro-recovery focused environment. Research aims are to investigate whether, and to what extent, participants experience empowering processes and outcomes as a result of visiting Proud2Bme. The second aim was to examine correlates of empowering processes and outcomes. More specifically, can certain user characteristics be identified that are related to the experience of empowerment?

Chapter 4 presents the study protocol of a randomized controlled trial investigating Internet-based intervention 'Featback'. Featback comprises psychoeducation, as well as a fully automated self-monitoring and feedback system. This Chapter includes a more detailed description of Featback, as well as the design and procedures of the research trial. Subsequently, Chapter 5 to 8 report on the results of different research questions as part of this randomized controlled trial.

Chapter 5 focuses on the question of whether Featback is effective in reducing eating disorder psychopathology and comorbid symptoms. Furthermore, the added value of different intensities of therapist support is examined, by comparing participants' symptom levels and satisfaction with the intervention when offered Featback without therapist support, Featback with low-intensity therapist support (once a week), and Featback with high-intensity therapist support (three times a week). Finally, participants' experiences with Featback are reported on.

In Chapter 6, potential moderators of intervention outcomes within the Featback trial are examined. Is Featback more effective for some individuals than others? Can subgroups of individuals be identified that show better outcomes when provided low-intensity of high-intensity therapist support on top of the fully-automated Featback intervention?

In Chapter 7, potential mediators of change in eating disorder psychopathology during the intervention period of Featback are examined, thus examining possible mechanism that might explain how or why Featback works.

Chapter 8 reports on the economic evaluation of Featback in comparison to a waiting list control condition, including cost-effectiveness and cost-utility analyses. What are the costs and health benefits of Featback in comparison to a waiting list, and is adding a certain amount of therapist support good value for money?

In Chapter 9, all digital therapist communication within the therapist support sessions of Featback is qualitatively examined. What do therapists actually do within the online support sessions as offered in addition to Featback? And can therapist behaviors predict participants' outcome and satisfaction?

In Chapter 10, we aimed to discuss the emerging findings, issues, and opportunities regarding E-health for eating disorders in the past few years (2013-2015). How effective are self-help interventions, treatment, and relapse prevention programs? What is the potential of Smartphone applications in treating eating disorders? Opportunities and challenges for the development and implementation of E-health for eating disorders are furthermore discussed.

Finally, Chapter 11 contains a summary and general discussion of the main findings. Furthermore, the strengths and limitations are considered, and implications and directions for future research as well as clinical practice are presented.

Chapter 2

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

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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.

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Chapter 3

Internet and patient empowerment in individuals with symptoms of an eating disorder: A cross-sectional investigation of a pro-recovery focused e-community

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Abstract

Introduction: Many individuals with eating disorder problems seek information and support online. There are however numerous websites that promote eating disordered behaviors. The website and e-community 'Proud2Bme' was developed as a healthy alternative for pro-eating disorder websites, providing a safe, positive, and pro-recovery focused environment. It offers a wide array of information and personal stories, as well as platforms for interaction such as a forum and chat. The first aim of this study was to investigate whether, and to what extent, empowering processes and outcomes are experienced by participants on Proud2Bme. The second aim was to examine correlates of empowering processes and outcomes.

Methods: Participants (*n* = 311) were recruited via an online survey on Proud2Bme. Correlations were examined and *T*-tests and ANOVAs were conducted.

Results: Exchanging information, finding recognition, and sharing experiences were the empowering processes most often reported by participants. The most pronounced empowering outcome was feeling better informed. To a smaller degree, increased help-seeking behavior, increased optimism and control over the future, and increased confidence in treatment and the relationship with the therapist were reported. Lower levels of general empowerment, younger age, and more interactive usage patterns of the website were positively associated with the experience of empowering processes and outcomes.

Discussion: Offering a platform where individuals can share their experiences and find recognition might be one of the most important ingredients for successful e-health initiatives aimed at improving patient empowerment. Moreover, in the field of eating disorders specifically, such initiatives offer a healthy alternative to the harmful and negative effects of pro-eating disorder websites.

Introduction

The Internet is a dynamic and continually evolving medium that has become an important source of health information (Kummervold et al., 2008). In 2007, 83.5% of young women in Europe used the Internet for health purposes. The current percentage probably is even higher, given that the number of Internet users continues to grow: between 2007 and 2012 the number of Internet users in Europe has gone from approximately 322 million to 519 million, a 61% increase (Internet world stats, 2012).

By using the Internet as an important means of seeking and retrieving health information and of seeking and providing support, individuals can take a more active and self-managing role in their own healthcare. Health self-management and patient empowerment are closely related concepts. Although the concept of patient empowerment is not a well-defined construct and many definitions exist, most definitions focus on individuals' capacity to make decisions about their health and to have, or take control over aspects of their lives that relate to health (McAllister, Dunn, Payne, Davies, & Todd, 2012). Targeting patient empowerment is important, as it can heighten the quality of care and is of interest in reducing economic costs of healthcare. As stated by Wallerstein in a World Health Organization report (2006), empowerment strategies can lead to outcomes as ends in themselves, but can also serve as intermediate steps to health outcomes. Wallerstein (2006) concluded that targeting patient empowerment can lead to improved self-regulated disease management, more efficient use of health services and improved mental health outcomes.

This article builds on the empowerment construct developed by van Uden-Kraan et al. (2008), who distinguish between empowering processes and outcomes. Empowering processes can be defined processes by which individuals take control over their lives and the management of their disease (Menon, 2002), such as exchanging information and helping others. Empowering outcomes refer to states of feeling psychologically enabled, such as improved acceptance of the illness or an increased sense of optimism and control over the future. Van Uden-Kraan et al. (2008) found that patients with breast cancer, arthritis, and fibromyalgia who participated in online patient support groups experienced a range of empowering processes and outcomes as a result of their participation. Comparable results were found in a group of participants using an online support group for individuals with a chronic physical illness (Bartlett & Coulson, 2011).

The development of empowering strategies as websites and e-communities in the field of eating disorders seems especially important in light of the existence of many pro-eating disorder websites that serve as portals to connect people who suffer from disordered eating, encouraging disordered eating behaviors (Rouleau & von Ranson,

2011). Rouleau et al. (2011) in a review on pro-eating disorder websites concluded that although such websites often contain potentially harmful components, users perceive social support as one of the key functions of pro-eating disorder websites. Indeed, commonly reported reasons for visiting pro-eating disorder websites are a desire for support, interaction with others, and meeting others with an eating disorder (Csipke & Horne, 2007; Wilson, Peebles, Hardy, & Litt, 2006). It is therefore important to develop e-health initiatives that can fulfill these same desires, however in a reliable, healthy, positive, and recovery-focused manner instead of a potentially harmful one.

In May of 2009, a Dutch website called Proud2Bme (http://www.Proud2Bme.nl) was launched as a healthy alternative to pro-eating disorder websites. Proud2Bme offers a wide array of information and provides a social e-community to open up communication about eating disorders with peers, family, and health care professionals. It offers anonymous and low-threshold support and aims to increase empowerment, by raising awareness and creating acknowledgement, as well as enhancing self-management and promoting and facilitating help-seeking behavior. The website has become a popular e-community for individuals with eating problems. To date the effects of visiting a pro-recovery e-community like Proud2Bme on patient empowerment have not been investigated.

The first aim of this study was to investigate whether, and to what extent, specific empowering processes and outcomes are experienced on Proud2Bme. The second aim was to explore potential correlates of empowering processes and outcomes. The following variables were selected as potential correlates: age, eating psychopathology, general empowerment, symptom duration, treatment status, user activity, time since first visit, and interactivity of use. Regarding the latter, it has been found that individuals who do not actively participate (so-called lurkers) in online support groups for HIV/AIDS as well as for breast cancer, fibromyalgia and arthritis, reported less empowerment in terms of social wellbeing and receiving useful information and social support (Mo & Coulson, 2010; van Uden-Kraan, Drosseart, Taal, Seydel, & Van de Laar, 2008).

Method

Recruitment, procedure and design

Proud2Bme was launched in May 2009. Proud2Bme is an interactive e-community aimed at empowering individuals with symptoms of an eating disorder and promoting a positive body image and healthy lifestyle. It offers a wide array of information, personal stories, and experiences about eating disorders, as well as platforms for interaction by means of a forum and group chats, and blogs that cover everything from health, beauty, news, and

entertainment. Everyday, new blogs and input are published on the website. Visitors can furthermore interact with peers, psychologists, dieticians and expert patients. Expert patients are individuals who have experienced eating disorder problems themselves, but who have recovered and who can subsequently use their knowledge and skills to help others who experience eating disorder problems. Daily group chats are moderated by a psychologist, an expert patient or a dietician. Weekly moderated thematic group chats are arranged discussing all kinds of topics, for example binge eating, eating disorders and personality disorders, family problems, and fear of weight gain. All posted input on the website is moderated by employees of our center. This makes Proud2Bme a safe, positive, and pro-recovery environment where individuals can anonymously share their problems and find support and recognition. Because all content is moderated, the quality of the material posted is high and reliable. Any threatening, destructive, or negative comments, tips, or advice are deleted from the website. Visitors to the e-community automatically have access to all content without having to register or login, except for forum- and chat activities, for which one has to follow a simple registration procedure.

Participants were recruited between May and July 2012 by presenting a link on the homepage to an online survey. Any visitor who indicated having eating problems was eligible to participate in the study. No ethical approval was required because this study only included questionnaires and could be completed voluntarily and anonymously: no personal health information could be connected to specific persons (i.e. IP addresses were deleted).

Measures (online survey)

Socio-demographic and descriptive information

Participants were asked to provide information about socio-demographic characteristics, including age, gender, and level of education. Furthermore participants were asked about their usage patterns on the website, their reasons for visiting the website, their satisfaction with the website, the duration of their eating disorder symptoms (derived by asking participants when (year and month) they first suspected they had an eating disorder problem), as well as their treatment status.

Eating psychopathology

The Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 2008) is a self-report questionnaire measuring eating psychopathology. It assesses both the frequency of core eating disordered behaviors and the core attitudinal features of eating psychopathology over the past 28 days. Items assessing the latter are answered on a 7-

point Likert scale and include questions about restraint, concerns about weight, concerns about shape, and concerns about eating. A global mean score of eating psychopathology was calculated by summing and averaging all attitudinal items. Higher scores reflect greater eating psychopathology. The EDE-Q has demonstrated reliability and validity (see Berg et al. (2011) for a review). This study demonstrated the internal consistency of the EDE-Q global score to be excellent (α = .94), in line with an earlier study by our research group (Aardoom, Dingemans, Slof Op't Landt, & van Furth, 2012).

Empowering processes and outcomes as a result of visiting the website

A questionnaire developed by van Uden-Kraan et al. (2009) was used to assess the experience of empowering processes and outcomes as a result of visiting Proud2Bme, asking individuals how frequently they experienced empowering processes on the website. The questionnaire assesses five types of processes: 'exchanging information' (nine items), 'exchanging social support' (twelve items), 'finding recognition' (four items), 'helping others' (two items), and 'sharing experiences' (two items). Based on an earlier study by van Uden-Kraan et al. (2008), we added a sixth empowering process: 'entertainment' (four items). All items could be answered on a 4-point Likert scale, ranging from 'seldom or never' to 'often'. Example items are: "*How often does it happen on Proud2Bme that you experience the sense of 'not being the only one?"* (finding recognition) and *"How often does it happen on Proud2Bme that someone pays you a compliment?"* (exchanging social support). Mean scores per process were calculated. Consistent with van Uden-Kraan et al. (2009), most empowering process scales showed good internal consistency (Cronbach's α range .76 - .95), except for the process 'finding recognition' (Cronbach's α .64). One item ("Does it ever happen that by visiting the website you realize that you are not so bad off after all?") was removed from this subscale, given that this resulted in an acceptable Cronbach's α of .72.

Empowering outcomes were measured by 38 items in the form of statements that began with 'Through my visit of the website…'. Seven types of outcomes were assessed: 'feeling better informed' (four items), 'improved acceptance of the illness' (five items), 'increased optimism and control over the future' (eight items), 'enhanced self-esteem' (three items), 'enhanced social wellbeing' (two items), 'feeling more confident in the relationship with the therapist' (eleven items), and 'feeling more confident with the treatment' (five items). We added an eighth empowering outcome, 'help-seeking behavior' (three items), given that one of the aims of the website is to promote and facilitate help-seeking behavior. All items could be answered on a 5-point Likert scale ranging from 'completely disagree' to 'completely agree'. Example item are: *"Through my visits of Proud2Bme, I feel like I have more (correct) knowledge at my disposal to deal*

better with my illness" (feeling better informed) and *"Through my visits of Proud2Bme, I am more able to think along with my therapist about my treatment"* (feeling more confident in the relationship with the therapist). Mean scores per outcome were calculated. Most empowering outcome scales showed good internal consistency (Cronbach's α range .77 - .92). Conversely, the empowering outcome scale 'increased social wellbeing' consisting of only two items demonstrated low internal consistency (Cronbach's α = .51), and was therefore not taken into account in further analyses.

Given that the original questionnaire was specifically developed for individuals with somatic diseases who participated in online support groups, some minor adaptations in the phrasings were made ('online support group' was changed to 'website', 'illness' to 'eating problems', 'physician' to 'therapist'). Participants without a treatment history would not be presented questions concerning empowering outcomes related to treatment and the relationship with their therapist. Non-interactive users, the so-called lurkers (e.g., those who had never posted any message on the website including the forum and never participated in a chat) would not be presented questions concerning their experiences of empowering processes that required interactive activities online: 'sharing experiences', 'exchanging emotional support', and 'helping others'.

General empowerment status

Besides the experience of empowering processes and outcomes as outlined above, it is informative to assess the participants' general empowerment status as well. The experience of empowering processes and outcomes (for example feeling better informed or having found recognition as a result of visiting the website) does not necessarily tell us something about how empowered participants feel in general. Boevink et al. (2008a) conceptually explored the concept of empowerment in a sample of 56 individuals with chronic psychiatric symptoms. Subsequently, an empowerment questionnaire (Dutch Empowerment Questionnaire (NEV) was developed (Boevink, Kroon, & Giesen, 2008b), consisting of 40 questions which can be answered on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The questionnaire consists of six subscales: 'professional help' (example item: 'My therapist is there when I need him/her'), 'social support' (example item: 'I am supported by the people that I love'), 'self-will' (example item: 'I am able to deal with my vulnerabilities'), 'a sense of belonging' (example item: 'I feel like I belong to something'), 'self-management' (example item: 'I am able to set limits'), and 'engagement of the community' (example item: 'Society is considerate to individuals with psychological problems'). The questionnaire demonstrated high internal consistency and good concurrent validity (Boevink et al., 2008b). A global measure of general empowerment status was calculated by summing and averaging the score of all

items (range 1-5). Higher scores reflect higher levels of general empowerment. In the current study, only the global scale of this questionnaire was used, which showed high internal consistency (Cronbach's α = .93).

Statistical analyses

Pearson's correlations (for normally distributed variables) and Spearman's correlations (for non-normally distributed variables) were calculated between each of the empowering processes and outcomes and age (years), eating psychopathology (EDE-Q), general empowerment (NEV), time since first visit (years), and symptom duration (years). In addition, *T*-tests and ANOVAs were conducted to examine whether experiences of empowering processes and outcomes differed according to one's self-reported eating disorder diagnosis (yes/no), interactivity of use (poster/lurker), treatment status (yes, current/yes, in the past/no), and frequency of website visits (not so frequent/frequent/very frequent). To correct for multiple comparisons, the alpha level of 0.05 was divided by 13 (the total number of empowerment processes and outcomes), rendering an alpha level of 0.004. In case of significant ANOVA *F*-tests, post-hoc analyses with a Bonferroni correction were conducted to further examine group differences. All statistical analyses were performed in SPSS version 19.

Results

Sample characteristics

A total of 318 individuals participated in the online survey. Seven participants were excluded because they indicated not to have eating problems, resulting in a sample size of 311. Some questions addressed towards the end of the online survey were not completed by all participants, and hence part of these data missing is missing. A total of 226 participants (73%) completed the whole online survey. The study sample consisted of mainly women (99.6%), with age ranging from 13 to 40 (M = 20.2, SD = 5.0). The average symptom duration was 4.6 years (range 0 - 25.3) and the majority of participants reported to be diagnosed with an eating disorder (70.1%). The time since first visit of Proud2Bme ranged from 0 to 38 months, with a mean of 19.8 months (approximately 1.7 years). The majority of participants (76.5%) indicated themselves to be very frequent visitors, visiting the website every day to several times a day. The mean EDE-Q score of participants was 3.4 (SD = 1.1), indicating considerable levels of eating psychopathology (Aardoom et al., 2012). More information on demographic, health, and user characteristics can be found in Table 1.

Table 1. Demographic, health and user characteristics of participants (*N*=311) [a] in online survey.

	***M* (*SD*)**	**Range (median)**	***n* (%)**
Gender (*n* = 250)			
Male			1 (0.4)
Female			249 (99.6)
Age (*n* = 250)	20.2 (5.0)	13-48 (19)	
Education [b] (*n* = 250)			
Low			25 (10.0)
Middle			79 (31.8)
High			145 (58.2)
Diagnosed ED (n = 311)			
Yes			218 (70.1)
No, but ED symptoms			93 (29.9)
Symptom duration in years (*n* = 289)	4.6 (4.4)	0-25.3 (3)	
Eating disorder Treatment (*n* = 295)			
Yes, currently			133 (45.1)
Yes, in the past (not at the current)			78 (26.4)
No, never			84 (28.5)
Time since first visit in years (*n* = 245)	1.7 (0.9)	0-3.2 (1.7)	
Eating pathology (EDE-Q) (*n* = 252)	3.4 (1.1)	0.1-4.8 (3.7)	
Satisfaction with website (*n* = 245)			
Very dissatisfied			2 (0.8)
Dissatisfied			3 (1.2)
Neither satisfied nor unsatisfied			14 (5.7)
Satisfied			121 (49.4)
Very satisfied			105 (42.9)
Frequency of website visits [c] (*n* = 247)			
Not so frequent			12 (14.9)
Frequent			46 (18.6)
Very frequent			189 (76.5)
General Empowerment (NEV) (*n* = 226)	2.8 (0.5)	1.3-4.6 (2.8)	
Average duration of website visit (*n* = 247)			
Less than 10 minutes			25 (10.1)
10-30 minutes			132 (53.4)
30-60 minutes			57 (23.1)
More than 60 minutes			33 (13.4)
Interactivity of use [d] (*n* = 242)			
Posters			211 (87.2)
Lurkers			31 (12.8)

[a] Some questions addressed towards the end of the online survey were not completed by all participants and hence part of these data is missing.

[b] Categorization was based on the Dutch educational system.

[c] Not so frequent = Once a month or less; Frequent = Once a week to several times a month; Very frequent = Daily to several times a day.

[d] Posters = those who had ever posted a message on the website (including forum and chat); Lurkers= Those who had never posted any message on the website (including forum and chat).

Participants on average reported 4.24 (SD = 1.75) reasons for accessing the website. The most popular reason given for accessing the website was wanting to read about personal stories and the experiences of others (83.1%). Other popular reasons were to enjoy or relax (69.2%) or to find information on eating problems (65.2%). Finding help (53.8%), helping others (48.2%), talking to fellow sufferers (43.7%), and finding information on issues such as health and beauty (36.8%) were other reported reasons. The least popular reason, although still given by almost a quarter of this study sample (23.5%), pertained wanting to talk with a professional.

Empowering processes and outcomes

The most frequently experienced empowering process was 'exchanging information', followed by 'finding recognition' and 'sharing experiences': half of the participants reported experiencing these processes at least regularly (see Table 2). The empowering outcome experienced to the strongest degree was 'feeling better informed' (see Table 2). To a lesser degree, participants experienced the outcomes 'increased help-seeking behavior', 'increased optimism and control over the future', 'increased confidence in treatment', and 'increased confidence in relationship with therapist'. The empowering outcomes 'improved acceptance of the illness' and 'increased self-esteem' were generally not experienced.

Correlates of empowering processes and outcomes

Correlations between empowering processes and outcomes are presented in Table 3. The processes 'amusement' and 'exchanging social support' showed among the highest correlations with a number of outcomes. Results of potential correlates of empowering processes and outcomes are shown in Table 4. General empowerment status was significantly associated with most of the empowering processes and outcomes as a result of visiting Proud2Bme. That is, having a lower general empowerment status was associated with higher levels of reported empowerment as a result of visiting Proud2Bme. Age showed significant negative associations with several empowerment processes, meaning that a younger age was associated with higher self-reported levels of taking control over one's live and the management of one's disease. Furthermore, posters reported having experienced entertainment more often than lurkers and also experienced a higher increase in confidence in the relationship with their therapist and a higher increase in the acceptance of the illness relative to lurkers (see Table 4). Thus, active involvement and interaction with others was associated with more empowerment. Shorter symptom duration was only significantly associated with the experience of exchanging information (Spearman's ρ = -.21) and feeling better informed (Spearman's ρ =

-.26), which were also more often reported to be experienced by very frequent website visitors compared to frequent or not so frequent website visitors (F (2,24) = 5.71, p < .004).

Table 2: Empowering processes and outcomes experienced by survey participants as a result of visiting the website Proud2Bme.

	n	*M* (*SD*)	*Median*
Empowerment Processes [a]			
Exchanging information	243	3.26 (0.51)	3.33
Finding recognition	243	3.08 (0.69)	3.00
Sharing experiences	208	2.61 (0.98)	3.00
Exchanging social support	209	2.26 (0.74)	2.00
Entertainment	243	2.26 (0.74)	2.00
Helping others	209	2.10 (0.81)	2.00
Empowerment Outcomes [b]			
Feeling better informed	237	3.67 (0.85)	3.75
Increased help-seeking behavior	228	3.39 (1.01)	3.33
Increased optimism and control over the future	231	3.33 (0.62)	3.38
Increased confidence in treatment	109	3.32 (0.64)	3.40
Increased confidence in relationship with therapist	109	3.25 (0.64)	3.27
Improved acceptance of illness	237	2.89 (0.96)	3.00
Increased self-esteem	231	2.73 (0.96)	3.00

[a] Answered on a 4-point Likert scale: 1 = Seldom to never; 2 = Sometimes; 3 = Regularly; 4 = Often

[b] Answered on a 5-point Likert scale: 1 = Completely disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Completely agree

Mixed results were found regarding levels of eating psychopathology. Higher levels of eating psychopathology were associated with more frequent experiences of finding recognition and increased help-seeking behavior, but also associated with lower increased in self-esteem (see Table 4). Participants who had never been in treatment reported to feel better informed because of Proud2Bme compared to participants who did receive treatment in their past, however, the former group reported less increased help-seeking behavior and less improved acceptance of the illness than individuals who were currently in treatment. Finally, shorter time since first visit of the website was significantly associated with the experience of feeling better informed (Spearman's ρ = -.21, p < .004).

Discussion

The first aim of this study was to investigate whether, and to what extent, specific

empowering processes and outcomes were experienced as a result of visiting a pro-recovery website called 'Proud2Bme' for individuals with eating problems. The second aim was to explore potential correlates of empowering processes and outcomes. Visiting Proud2Bme was associated with becoming an active partner in the management of one's eating disorder problems. Visitors reported experiencing a range of empowering processes and outcomes as a result of visiting the website. Regarding empowering processes, participants most frequently reported exchanging information, finding recognition, and sharing experiences. These findings are highly comparable to findings of two studies focusing on online support groups for patients with breast cancer, fibromyalgia, and arthritis (Bartlett et al., 2011; van Uden-Kraan, Drossaert, Taal, Seydel, & Van de Laar, 2009). Our results are also in line with a study by McCormack (2010), who found that the primary function of an online support group for individuals with anorexia nervosa was to encourage others, along with providing informational support and sharing personal experiences. In terms of empowering outcomes, visiting Proud2Bme was positively associated with participants' feeling of being informed, in line with findings of van Uden-Kraan et al. (2009). To a smaller degree, participants reported that visiting the website resulted in increased help-seeking behavior, increased optimism and control over the future, and increased confidence in treatment and the relationship with their therapist. Overall, results seem to suggest that initiatives like Proud2Bme are a promising tool for the empowerment of individuals with eating disorder symptoms, encouraging and helping them to take control over their lives and the management of their disease.

Overall, participants did not report increased self-esteem or acceptance of the illness as a result of visiting the e-community, which is in contrast to the findings of van Uden-Kraan et al. (2009). This discrepancy might be explained by the fact that low self-esteem is one of the core characteristics of eating disorders (Fairburn et al., 2003) whereas for breast cancer, fibromyalgia, and arthritis it is not. Furthermore, individuals with an eating disorder generally experience shame because they feel responsible for creating and maintaining their eating problem (Troop, Holbrey, & Treasure, 1998). This may be different from individuals with somatic disorders, who might have less difficulty with accepting their problems and who ask for help more easily.

The second aim of the study was to examine potential correlates of empowering processes and outcomes. Note that although correlations do not imply causality, significant correlations are discussed and speculated on in light of possible underlying causes of these relations in an attempt to interpret study results. The processes 'amusement' and 'exchanging social support' showed among the highest correlations with a number of outcomes, which may indicate that these processes are important in order to

Table 3: Pearson correlation coefficients for empowering processes and outcomes.

	7. Empowering outcome feeling better informed	8. Empowering outcome improved acceptance illness	9. Empowering outcome increased confidence in treatment	10. Empowering outcome increased optimism and control over the future	11. Empowering outcome increased self esteem	12. Empowering outcome increased confidence in relationship with therapist	13. Empowering outcome increased help-seeking behavior
1. Empowering process exchanging information	.49** (n=237)	.32** (n=237)	.30** (n=109)	.38** (n=231)	.30** (n=231)	.31** (n=109)	.25** (n=228)
2. Empowering process finding recognition	.30** (n=237)	.25** (n=237)	.20* (n=109)	.19** (n=231)	.11 (n=231)	.29** (n=109)	.20** (n=228)
3. Empowering process entertainment	.33** (n=237)	.35** (n=237)	.40** (n=109)	.41** (n=231)	.42** (n=231)	.40** (n=109)	.22** (n=228)
4. Empowering process exchanging social support	.27** (n=206)	.43** (n=206)	.29** (n=98)	.41** (n=201)	.40** (n=201)	.26** (n=98)	.29** (n=199)
5. Empowering process helping others	.20** (n=206)	.35** (n=206)	.23* (n=98)	.37** (n=201)	.34** (n=201)	.15 (n=98)	.16* (n=199)
6. Empowering process sharing experiences	.18** (n=206)	.36** (n=206)	.19 (n=98)	.33** (n=201)	.31** (n=201)	.17 (n=98)	.21** (n=199)

* =p < .05

** p < .01

Table 4: Correlates of empowering processes and outcomes as a result of visiting the website Proud2Bme, corrected for multiple comparisons (α = .004).

	Age	**Eating psychopathology (EDE-Q)**	**General empowerment (NEV)**	**Interactivity of use** [A]	**Treatment status** [B]
	Spearman's *ρ* (*n*)	**Spearman's *ρ* (*n*)**	**Pearson *r* (*n*)**	***t (df)***	***F (df)***
Empowerment processes:					
Exchanging information	-.21 (243)*	.08 (243)	-.11 (226)	0.05 (240)	4.19 (2,240)
Finding recognition	-.29 (243)*	.27 (243)*	.01 (226)	-2.71 (240)	2.62 (2,240)
Sharing experiences	-.18 (208)	.06 (208)	-.24 (198)*	-	5.46 (2,205)
Exchanging social support	-.22(209)*	.07 (209)	-.19 (198)	-	4.41 (2,206)
Entertainment	-.29 (243)*	.03 (243)	-.25 (226)*	-2.88 (240)*	1.74 (2,240)
Helping Others	-.11 (209)	-.10 (209)	-.34 (198)*	-	3.47 (2,206)
Empowerment Outcomes:					
Feeling better informed	-.21 (237)*	-.03 (237)	-.13 (226)	-0.67 (235)	6.88 (2,234)* Yes current > Yes past Yes past < No never
Increased help-seeking behavior	.03 (228)	.22 (228)*	-.08 (226)	-2.61 (226)	5.63 (2,225)* Yes current > Yes past Yes current > No never
Increased optimism and control over the future	-.10 (231)	-.08 (231)	-.44 (226)*	-0.90 (229)	0.90 (2,228)
Increased confidence in treatment	-.09 (109)	-.10 (109)	-.41 (109)*	-2.74 (107)	-
Increased confidence in relationship with therapist	-.08 (109)	.03 (109)	-.30 (109)*	-3.52 (107)*	-
Improved acceptance of the illness	-.10 (237)	-.09 (237)	-.35 (226)*	-2.90 (235)*	10.59 (2,234)* Yes current > Yes past Yes current > No never
Increased self-esteem	-.01 (231)	-.26 (231)*	-.47 (226)*	-0.05 (229)	1.32 (2,228)

* = $p \leq .004$

[A] Posters = those who had ever posted a message on the website (including forum and chat); Lurkers = those who had never posted any message on the website

[B] Yes current = Yes, currently in treatment; Yes past = Yes, received treatment in the past but currently not in treatment; No never = Never received treatment

Note: EDE-Q = Eating Disorder Examination Questionnaire; NEV = Dutch Empowerment Questionnaire

experience empowering outcomes. Lower levels of general empowerment status were significantly associated with higher levels of reported empowering processes and outcomes as a results of visiting Proud2Bme, which may suggest that the website especially empowers those who seem to need it the most (e.g., less empowered individuals). Younger age was associated with higher self-report levels of experienced empowering processes, possibly because the e-community Proud2Bme focuses on adolescents which for example may lead to younger individuals being better able to find recognition in the posted stories. Results furthermore suggest interactivity to be a potential important aspect of improving empowerment.

Interestingly, shorter time since first visit of Proud2Bme was associated with the empowering outcome feeling better informed, which might suggest that participants can experience empowerment because of their website visits rather quickly. This might also suggest that the reason for visiting Proud2Bme changes over time and that Proud2Bme thus seems to provide in different needs as time goes. Another interesting finding was that participants who had never been in treatment reported lower levels of increased help-seeking behavior and improved acceptance of the illness relative to participants who were currently in treatment. One may expect the website to have less impact on individuals who were already in treatment, given that these individuals may already be more empowered as a result of their treatment. It is valuable to realize that both the so-called underserved individuals who seek help late or even never access treatment (Moessner & Bauer, 2012), as well as individuals who are currently undergoing treatment reported experiencing empowerment. In addition, approximately half of the participants who were currently in treatment reported having sought help as a result of visiting the website. This suggests that by providing a safe, positive, and recovery focused environment, E-health initiatives such as Proud2Bme may help to bridge the gap between the need for treatment and actual treatment.

Results of this study should be considered in light of the following limitations. First, the cross-sectional design of this study does not permit inferring causal relationships. Patient empowerment could have been enhanced by external factors, although we explicitly asked participants how they felt empowered by their visits to the website. Yet participants might not be completely capable of assessing which specific factors in their lives influenced them to feel a certain way. Although challenging, future research should ideally investigate the effects of E-health initiatives on patient empowerment by means of prospective studies. Second, the present study sample may not necessarily be representative for the entire group of individuals visiting the website (selection bias). There is a possibility that only individuals who perceive the website as empowering completed the survey, or that the website is only empowering for those who visit the

website frequently. Although with respect to the latter, results demonstrated an association for frequency of website visits with only two empowering processes and none of the empowering outcomes. Third, the retrospective design of this the current study comes with the risk of recall bias. Recall bias could have resulted both in over- and underestimation of true patient empowerment. This study is also limited by the use of solely subjective self reported assessments. Finally, this study did not investigate possible disempowering effects of visiting Proud2Bme.

In conclusion, results of this study demonstrated that a broad range of visitors reported experiencing empowering processes and outcomes as a result of visiting Proud2Bme, encouraging and helping them to take control over their lives and the management of their disease. Furthermore, results suggested Proud2Bme to have a potential in bridging the gap between the need for treatment and the actual treatment received, by means of providing a safe, positive, and recovery focused environment. This study can provide a relevant contribution to the process of developing best practices in E-health. That is, offering a platform on which individuals can share their experiences and find recognition may be one of the most important ingredients for successful e-health initiatives aimed at improving patient empowerment. Our results suggest that the success of e-communities not only depends on the level of qualitatively good information, but also on the possibility of interactive involvement and on being a 'fun place' where individuals can enjoy their selves. The constantly changing content of the website through the active involvement of many volunteers, might contribute to the success of Proud2Bme. In the field of eating disorders specifically, e-health initiatives as Proud2Bme not only have the potential to increase empowerment in individuals with symptoms of an eating disorder, but also offer a healthy alternative to the harmful and negative effects of pro-eating disorder websites.

Chapter 4

An Internet-based intervention for eating disorders consisting of automated computer-tailored feedback with or without supplemented frequent or infrequent support from a coach: Study protocol for a randomized controlled trial.

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Abstract

Background: Several Internet-based interventions for eating disorders have shown their effectiveness. Still, there is a need to refine such interventions, given that most existing programs seem to be limited by their static 'one-size-fits-all' approach. 'Featback', an Internet-based intervention for symptoms of eating disorders provides a more individualized approach. It exists of several components (psychoeducation, a fully automated monitoring and feedback system, and support from a coach), which can be matched to participants' needs and preferences. Until now, it is unclear whether online self-help interventions for eating disorders with support are more effective than those without. The aims of the current study are 1) to examine the relative effectiveness of (the different components of) Featback, 2) to examine predictors, moderators and mediators of intervention responses, 3) to report on practical experiences with Featback, and 4) to examine the cost-effectiveness of Featback.

Methods: Individuals aged 16 years or older, with mild to severe eating disorder symptoms will be randomized to one of the four study conditions. In condition one, participants receive the basic version of Featback, consisting of psychoeducation and a fully automated monitoring and feedback system. In conditions two and three, participants receive the basic version of Featback supplemented with the possibility of infrequent (weekly) or frequent (three times a week) e-mail, chat, or Skype support from a coach respectively. The fourth condition is a waiting list control condition. Participants are assessed at baseline, post-intervention (8 weeks), and at 3- and 6-month follow-up (the latter except for participants in the waiting list control condition). Primary outcome measures are disordered eating behaviors and attitudes. Secondary outcome measures are eating disorder-related quality of life, self-stigma of seeking help, self-esteem, mastery and support, symptoms of depression and anxiety, repetitive negative thinking, motivation to change, user satisfaction, compliance, and help-seeking attitudes and behaviors.

Discussion: This study aims to provide more insight into the (cost-) effectiveness of Internet-based interventions for eating disorders, particularly those with and without professional support, as well as different levels of support.

Background

Despite the disabling nature of mental disorders, many individuals with mental health problems do not receive treatment (Kohn, Saxena, Levav, & Saraceno, 2004). Suggested reasons for this treatment gap include stigma, embarrassment, lack of recognition of symptoms and preference for self-reliance (Gulliver, Griffiths, & Christensen, 2010; Sareen et al., 2007). New technologies can possibly bridge the gap between the need and the actual received treatment, by providing ways to reach individuals who are otherwise hard to reach. For example, the anonymity of Internet-based interventions can decrease barriers that exist in more intensive (face-to-face) treatment. Internet-based interventions also offer other advantages over traditional face-to-face interventions, such as cost-effectiveness and widespread dissemination. Accessibility and convenience can be enhanced as Internet-based interventions are available 24 hours a day and can be accessed at any place. It is not surprising that the field of e-mental health is rapidly growing: more and more Internet-based interventions for mental disorders have been developed and investigated over the past years. Numerous programs have proven to be effective, particularly in preventing and reducing symptoms of depression and anxiety (Andersson et al., 2009; Cuijpers et al., 2009; Spek et al., 2007).

In the field of eating disorders (ED), a recent review demonstrated the superiority of Internet-based therapy over waiting lists for the reduction of ED psychopathology, the frequency of binge eating and purging, and also for the improvement of the (ED-related) quality of life (Aardoom, Dingemans, Spinhoven, & van Furth, 2013). Regarding the preventive intervention of ED, numerous studies have evaluated an Internet-based intervention called 'Student Bodies' (Bruning Brown, Winzelberg, Abascal, & Taylor, 2004; Celio et al., 2000; Graff Low et al., 2006; Jacobi et al., 2007; Taylor et al., 2006; Winzelberg & Taylor, 1998; Winzelberg et al., 2000; Zabinski et al., 2001), existing of psychoeducation, a web-based body image journal (allowing participants to monitor events that trigger body image dissatisfaction) and an online asynchronous discussion group. A meta-analytic review (Beintner et al., 2011) demonstrated 'Student Bodies' to be effective in reducing ED-related attitudes, such as weight and shape concerns and a negative body image.

Despite these promising findings, there is a need to refine the Internet-based interventions for ED as the existing interventions seem to be limited by their static, 'one-size-fits-all' approach. The Internet-based program 'Es[s]prit' (Bauer et al., 2009) possibly constitutes a step forward. It combines prevention and (early) intervention of ED and exists of several components: psychoeducation, a fully automated symptom monitoring and feedback system, a forum, and chat sessions (either individual or in group) with a coach. The use and intensity of the components can be adapted according to the

participant's needs (a so-called 'stepped-care approach'). The core module of the program is the monitoring and feedback system. Once a week, participants are invited to complete a monitoring assessment which appraises ED-related attitudes and behaviors. Subsequently, automatic feedback messages are generated and send to participants. The feedback messages do not only provide support by expressing interest in, and concerns about the participants' well-being, but also contain advice on how to counteract negative developments in ED-related symptoms.

Es[s]prit was developed in Germany (Bauer et al., 2009) and has been translated and adapted into several other languages. Until now, preliminary studies of Es[s]prit show promising results and suggest the intervention to be feasible and acceptable for college students (Bauer et al., 2009; Lindenberg, Moessner, Harney, McLaughlin, & Bauer, 2011), as well as for women who completed inpatient or outpatient treatment for bulimia nervosa or eating disorder not otherwise specified (Gulec et al., 2011). Furthermore, Lindenberg et al. (personal communication) investigated the effectiveness of YoungEs[s]prit, primarily focusing on the prevention of ED in high-school students aged 13-16. The results demonstrated that within one year, the incidence rate of ED was significantly lower in the group of students who received the YoungEs[s]prit intervention as compared to a control group. There is a need to systematically investigate the Dutch translation of Es[s]prit, called 'Featback', focusing on both the prevention and intervention of ED. Moreover, the effectiveness of the different components of Featback (and thus the different levels of support) has yet to be established, and no cost-effectiveness analysis of the program has been conducted.

The evaluation of the necessity and importance of adding more personalized levels of support is important as it is associated with an increase in costs and may furthermore limit the availability of the intervention, given the need for a sufficient number of coaches. Nevertheless, providing (extra) support seems to be beneficial: studies in the field of depression and anxiety suggest that Internet-based interventions with support are more effective than those without (Andersson et al., 2009; Spek et al., 2007). However, the degree of provided support varies considerably and the most adequate quantity of support in order to achieve positive effects of an intervention is yet unknown. Two Internet-based intervention studies, one for social phobia (Berger et al., 2011) and one for panic disorder (Klein et al., 2009b), failed to identify an incremental effect of higher/more frequent levels of support, although both studies had small sample sizes. Tate et al. (2006) compared e-mail counseling, computer-automated tailored counseling and no counseling in an Internet weight loss program. After six months, participants in the e-mail counseling group achieved significant greater weight loss than participants in the computer-automated feedback. Given these mixed results on the necessity and importance of

personalized support, the current study could help to gain more insight in the potential incremental effects of different levels of support on the effectiveness of an intervention.

This randomized controlled trial will compare four conditions: 1) a basic version of Featback consisting of psychoeducation and a fully computerized monitoring and feedback system, 2) see 1, supplemented with the possibility of infrequent, weekly e-mail, chat or Skype support from a coach, 3) see 1, supplemented with the possibility of frequent(three times a week) e-mail, chat or Skype support from a coach, and 4) a waiting list control condition (WLC). The WLC can be regarded as a care-as-usual condition, given that all participants are free to undergo any other sort of intervention. The three active intervention conditions are developed in a stepped-care framework, starting with the least intensive intervention and moving up to (the possibility of) more intensive components. Participants are assessed at baseline (T0), post-intervention (T1: 8 weeks), and at 3- (T2) and 6-month follow-up (T3). Participants in the WLC condition will not be measured at T3, as they will be offered the intervention of condition two after T2.

The primary aim of the current study will be to investigate the effectiveness of (the different components of) Featback. The second aim is to investigate potential predicting, moderating and mediating variables in order to gain insight into when or for whom this intervention works, as well as how it works. The third aim of this study is to report on the practical experiences of Featback, such as the user satisfaction and the (intensity of) use of the different components. Finally, the fourth aim of this study is to examine the cost-effectiveness of Featback.

Methods

Design

This study is a randomized control trial including three active intervention conditions and a waiting list control condition (for more details: see Study conditions). Ethical approval has been obtained by an independent medical ethics committee (CCMO no. NL40085.058.12).

Sample

Inclusion criteria will be deliberately kept broad, given that we aim to reach a broad population of individuals with eating problems. Participants will have to: 1) be sixteen years of age or older, 2) report at least mild ED symptoms (as assessed by the Short Evaluation of Eating Disorders (SEED) (Bauer, Winn, Schmidt, & Kordy, 2005)) or show at least some risk for the development of an ED (as defined by scoring 40 or higher on the Weight Concern Scale (WCS) (Killen et al., 1993)), and 3) have access to a computer,

iPhone, iPad, Smartphone or laptop with an Internet connection. The second criterion (reporting at least mild ED symptoms), includes the following symptoms: a BMI of 18.5 or less, self-induced vomiting, binge eating episodes, excessive exercise or use of laxatives for at least once a week over the past four weeks, and a body distortion showing that one's estimated BMI is at least 2 points higher than one's actual BMI.

Procedure and randomization

Participants will be recruited through advertisements on websites (among others Proud2Bme (http://www.proud2bme.nl)), and/or academic schools, magazines, newspapers, health care centers, and patient unions. Interested individuals can apply for participation by sending an e-mail to the researcher, who will send them an information letter and invite them to complete an online informed consent and screening questionnaire. After completion, individuals receive an e-mail with feedback on the severity of their ED symptoms, and those who meet the inclusion criteria will be invited to complete the baseline questionnaire for the study. After completion of the baseline questionnaire, participants will be randomized to one of the four study conditions and will be notified by e-mail. The randomization allocation will be conducted by an independent researcher, who will create random-number tables by means of SPSS. Randomization will take place in blocks of 40 participants. The number of participants (N = 10) in each block will be equal for the four conditions. The allocation sequence will be concealed from the main researcher involved in the enrolment and assignment of participants, thus preventing foreknowledge of the intervention assignment.

Study conditions

1) Basic Featback

Participants will receive access to the website of Featback (http://www.Featback.nl) where comprehensive information on ED can be found (e.g., psychoeducation). In addition, participants will have access to a monitoring and feedback system. On a weekly basis, participants will receive an e-mail inviting them to complete a monitoring questionnaire. This monitoring questionnaire consists of eight items assessing cognitive and behavioral correlates of four dimensions: 1) body dissatisfaction, 2) excessive concern with body weight and shape, 3) unbalanced nutrition and dieting, and 4) binge eating and compensatory behaviors. Answers can be given on a 4-point Likert scale ranging from 1 to 4. After completion of the monitoring assessment, feedback messages are automatically generated according to a pre-defined algorithm. The feedback messages are individually tailored. That is, they are based on the functionality of reported ED-related attitudes and

behaviors (functional versus dysfunctional), as well as patterns of change (improved, deteriorated or unchanged). For detailed information about the feedback algorithm, see Bauer et al. (2009). Subsequently, the generated feedback is send to the participants using Web-Akquasi data management software (Percevic, 2004). In case of severe eating disorder symptoms, action is taken (see 'Ethical precautions and crisis management' for more details).

2) Basic Featback + Infrequent support
Participants will receive the basic Featback intervention as described above, supplemented with the possibility of infrequent, weekly e-mail, chat and/or Skype support from a coach.

3) Basic Featback + Frequent support
Participants will receive the basic Featback intervention as described above, supplemented with the possibility of frequent (three times a week) e-mail, chat and/or Skype support from a coach.

4) Waiting list control condition (WLC)
Participants in this condition will be assigned to a waiting list, for the purpose of providing a comparison group for the active intervention conditions. Participants will be offered the intervention of condition two after a waiting period of five months (T2).

Support from a coach
Participants will be able to schedule support sessions through different mediums: e-mail, chat or Skype. Coaches will be instructed to e-mail participants in case participants do not schedule any appointments or in case participants do not show up at scheduled support sessions, and to repeat this process twice per non-response. Chat and Skype sessions will imply 20 minutes with a coach. An e-mail session will contain one reply by e-mail from the coach to the participant (who will be instructed to e-mail his/her coach beforehand). The methodology of chat sessions is based on a 5-phase model, containing 1) warm welcome, 2) clarifying the question, 3) determining the goal of the conversation, 4) concrete elaboration of the goal of the conversation, and 5) closing the circle. More detailed information on the model can be found in the handbook written by Schalken et al. (Schalken et al., 2010). E-mail support is based on the following phases: 1) extracting the question, 2) formulating an answer, and 3) checking/re-reading the message and sending it. All coaches will follow an intervention protocol that includes all guidelines for the provision of support.

Support will be provided by master level students in clinical psychology and/or individuals with a degree in the field of psychology. All coaches will undergo an intensive 2-day training from an external company ('Stichting E-hulp'), specifically focused on the delivery and methodology of online support. Coaches will be taught the basic principles for delivering online support, and they will practice with case materials throughout the training. Monthly face-to-face supervision sessions will be organized by the main researcher, a psychologist and an experienced psychotherapist as a matter of routine professional and ethical care, as well as to reinforce adherence to the protocol. Individual supervision will also be provided to all coaches during their first month as online coach. Hereafter, the support sessions between coaches and participants will be regularly checked at random. A forum, in the form of a secured Facebook community, will be available for questions and discussion of scenarios in between the face-to-face supervision sessions, and coaches will furthermore be free to contact the supervisors at any time.

Ethical precautions and crisis management

Coaches are instructed to refer participants who report suicidal ideation to the website 113Online (http://www.113online.nl). This organization aims to prevent suicide. It employs psychologists, psychiatrists, and a large group of fully trained volunteers, who are accessible via telephone and chat day and night. Furthermore, action is taken when screening or monitoring data show that a participant's BMI is equal or lower than 15 or a participant reports being engaged in self-induced vomiting, binge eating or use of laxatives at least one times a day over the past four weeks. Subsequently, in case a participant is in condition one (basic Featback) or four (waiting list control, only screening data), the Featback team will send an e-mail with the message that ones test scores indicate severe ED symptoms and that if one is not yet in treatment, we strongly recommend seeking professional help. In case a participants is in condition two or three, the Featback team will check whether one or more support sessions are planned for the week, and if not, will contact the participant with the message that we believe that their test scores indicate severe ED symptoms and that we strongly recommend to make use of one or more support sessions. In these support sessions, the alarm signals will function as a starting point for the conversation and participants will be stimulated to seek professional help. In case participants do not sign in for any support session during the week, the Featback team will send an e-mail as described for participants in condition one.

Assessments

All assessments are self-reports and will be conducted online. Table 1 depicts an overview of the assessment instruments that will be used throughout each stage of the study. The

Table 1: Overview of the assessment instruments used throughout each stage of the study.

Assessment	Screening	T0: Baseline	Weekly Monitoring: even weeks	Weekly Monitoring: uneven weeks	T1: Post-intervention	T2: 3-month follow-up	T3: 6-month follow-up[b]
Weight Concern Scale (WCS)	X	-	-	-	-	-	-
Short Evaluation of Eating Disorders (SEED)	X	X	-	-	X	X	X
Short Evaluation of Eating Disorders II (SEED-II)	-	-	X	X	-	-	-
Demographics and other information	-	X	-	-	-	-	-
Monitoring questionnaire	-	-	X	X	-	-	-
Patient Health Questionnaire 4 (PHQ-4)	-	X	-	X	X	X	X
Perseverative Thinking Questionnaire (PTQ)	-	X	-	X	X	X	X
Eating Disorder Examination Questionnaire (EDE-Q)	-	X	-	-	X	X	X
Self stigma of seeking help	-	X	-	-	X	X	X
Self-esteem, mastery & support	-	X	-	-	X	X	X
Eating Disorder-related Quality of Life (ED-QOL)		X	-	-	X	X	X
Motivation to change	-	X	-	-	X	X	X
Session Rating Scale (SRS)	-	-	X[A]	-	-	-	-
User satisfaction questionnaire	-	-	-	-	X[B]	-	-
Attrition follow-up question	-	-	X[C]	X[C]	X[C]	X[C]	X
Help-seeking attitudes and behavior questionnaire	-	-	-	-	X	X	X
Quality of life (EuroQol: EQ-5D)	-	X	-	-	X	X	X
Trimbos/iMTA questionnaire for Costs associated with Psychiatric Illness	-	X	-	-	X	X	X

[A] Only asked after participants' first week of participation.

[B] Not send to participants who are randomized to the waiting list control condition.

[C] Send to participants who fail to complete the monitoring assessment, or the T1, T2 or T3 assessment respectively.

primary outcome measures are ED behaviors and ED attitudes (SEED (Bauer et al., 2005), EDE-Q (Fairburn et al., 2008)). Secondary outcome measures contain ED-related quality of life (ED-QOL (Engel et al., 2006)), self-stigma of seeking help (Vogel, Wade, & Haake, 2006), self-esteem, mastery and support (Bovier, Chamot, & Perneger, 2002), symptoms of depression and anxiety (PHQ-4 (Kroenke, Spitzer, Williams, & Löwe, 2009)), repetitive negative thinking (PTQ (Ehring, Raes, Weidacker, & Emmelkamp, 2012)), motivation to change (Genders & Tchanturia, 2010; Bewell & Carter, 2008), user satisfaction, as well as compliance and help-seeking attitudes and behaviors. Cost-effectiveness will be evaluated by means of the reported quality of life (EQ-5D (EuroQol Group, 1990)) and medical and societal costs (Trimbos/iMTA questionnaire for Costs associated with Psychiatric Illness: TiC-P (Hakkaart-van Roijen, Donker, & Tiemens, 2002)).

The following variables will be tested as potential predictors or moderators of intervention response: demographic variables (age, gender, educational level), motivation to change (importance, ability and readiness to change), severity of ED symptoms (SEED (Bauer et al., 2005), EDE-Q (Fairburn & Beglin, 1994)), severity of symptoms of depression and anxiety (PHQ-4 (Kroenke et al., 2009)), early working alliance (SRS: V3 (Duncan et al., 2003)) and compliance.

Mediator variables and their corresponding dependent variable will be measured frequently throughout this study, being at T0 and T1, as well as once every two weeks in between T0 and T1. The variables repetitive negative thinking (PTQ (Ehring et al., 2012)) and symptoms of depression and anxiety (PHQ-4 (Kroenke et al., 2009)) will be tested as mediators of intervention outcome, being symptoms of ED as measured by the SEED (Bauer et al., 2005).

Weight Concerns Scale (WCS)

The WCS (Killen et al., 1994) is a 5-item questionnaire that assesses fear of weight gain, worry about weight and body shape, importance of weight, diet history, and perceived fatness. The WCS has demonstrated test-retest reliability and predictive validity (Killen et al., 1994) and was furthermore found valid in identifying students at risk for the development of an ED (Jacobi, Abascal, & Taylor, 2004).

Demographics and other information

A self-designed questionnaire will assess gender, age, educational level, country of origin and work situation, perceived severity levels of eating problems (including a question asking participants whether they have ever been diagnosed with an ED), and treatment status. Furthermore, the questionnaire asks participants how many days they have been

sick during the previous 3 months, their average Internet usage during a typical week/day, and their average school/work performance during the previous 3 months.

Eating Disorder Examination Questionnaire (EDE-Q)

The EDE-Q (Fairburn et al., 2008) has been developed as a self-report questionnaire version of the Eating Disorder Examination (EDE) (Cooper, Cooper, & Fairburn, 1989), a semi-structured interview measuring ED psychopathology. The EDE-Q assesses both the frequency of core ED behaviors and the core attitudinal features of ED pathology over the past 28 days. Items assessing the latter are answered on a 7-point Likert scale ranging from 0 'not one day/not at all' to 6 'every day/markedly', and include questions about restraint, concerns about weight, concerns about shape and concerns about eating. A global score of eating psychopathology will be calculated by summing and averaging all the individual items. Higher scores are indicative of a higher ED psychopathology. The EDE-Q has demonstrated reliability and validity (see Berg et al., (2011), for a review).

Short Evaluation of Eating Disorders (SEED)

The SEED (Bauer et al., 2005) is a brief self-report measure for the assessment of key ED symptoms. It assesses the three main symptoms of anorexia nervosa (degree of underweight, fear of weight gain and distortion of body perception) and bulimia nervosa (amount of binge eating, amount of compensatory behavior and over concern with body shape and weight). Total severity indexes can be calculated for each of the two diagnoses (range 0-3), with higher scores reflecting higher severity indexes. The behavioral measures (bingeing, excessive exercising and compensatory behaviors) are assessed over the previous four weeks. The SEED has demonstrated construct validity and criterion-related validity, and was furthermore shown to be sensitive to symptom change (Bauer et al., 2005). Given that the SEED will be administered every week during the intervention period as well, the four-week timeframe for the behavioral measures is adapted to a timeframe of one week. This adapted questionnaire will be referred to as SEED-II.

The Patient Health Questionnaire (PHQ-4)

The PHQ–4 (Kroenke et al., 2009) will be used to assess symptoms of depression and anxiety. The PHQ-4 consists of four items: two core anxiety items and two core depression items. Items can be answered on a 4-point Likert scale ranging from 0 'not at all' to 3 'nearly every day'. A total score (range 0-12) can be calculated by summing the scores of all four items. Higher scores are indicative of a higher pathology. Factorial and construct validity were demonstrated for the PHQ-4 (Kroenke et al., 2009).

Perseverative Thinking Questionnaire (PTQ)

The PTQ (Ehring et al., 2012) will be used as a global measure of repetitive negative thinking (e.g., worry and rumination). The questionnaire consists of 15 items assessing the repetitiveness, intrusiveness, difficulties to disengage, and unproductiveness of repetitive negative thinking, as well as the degree to which it captures mental capacity. The scale of the items ranges from 0 'never' to 4 'almost always' and assesses how often each of the characteristics as described above applies to the participants' thinking process. The Dutch PTQ demonstrated good internal consistency and satisfactory stability (Ehring et al., 2012). For the current study, we adapted the timeframe from 'in general' to 'in the previous four weeks' (T0, T1, T2, and T3 assessment) or 'in the previous week' (during the intervention) respectively, in order to increase the ability to detect weekly or monthly change.

Self-stigma of seeking help (SSOSH)

The 10-item SSOSH (Vogel et al., 2006) questionnaire will be used to assess one's self-stigma towards seeking psychological help. The questionnaire was developed to measure concerns about the loss of self-esteem and an overall sense of loss of value a person would feel if he/she would decide to seek help from a psychologist or any other mental health professional. The ten items can be rated on a 5-point Likert scale ranging from 1 'strongly disagree' to 5 'strongly agree'. Higher scores reflect higher self-stigma or a more negative stigma toward seeking psychological help. The questionnaire was found to have good psychometric properties (Vogel et al., 2006).

Self-esteem, Mastery and Support

Starting from existing instruments, Bovier et al. (Bovier et al., 2002) used factor analyses to develop four brief scales for the measurement of self-esteem (four items), mastery (four items), affective social support (two items) and confident/problem solving social support (four items). Affective support refers to the availability of people who express emotional involvement with, and care for a person, whereas confident/problem solving support refers to the availability of an individual one can confide in and receive advice from when a challenging situation occurs (Bovier et al., 2002). Items of all four brief scales can be answered on a 5-point Likert scale: higher scores represent higher self-esteem, mastery, affective- and confident support respectively. All four scales were found to demonstrate good internal and construct validity (Bovier et al., 2002).

Eating Disorders Quality of Life (ED-QOL)

The ED-QOL (Engel et al., 2006) is a disease-specific health-related quality of life measurement designed for individuals with ED symptoms. The ED-QOL consists of 25

items, assessing the influence of eating behaviors/body weight in four subscales: psychological (nine items), physical/cognitive (six items), financial (five items), and work/school (five items). A total score can be calculated by averaging the items of the four subscales. Higher scores are indicative of a lower quality of life. The ED-QOL demonstrated good convergent and discriminative validity, as well as test-retest reliability (Engel et al., 2006).

Motivation to change

Three items will be used to assess participants' motivation to change (Genders et al., 2010; Bewell et al., 2008): their perceived importance to change, their perceived ability/ confidence to change and their readiness to change. Questions can be answered on a 10-point Likert scale.

Session Rating Scale (SRS)

The SRS (Duncan et al., 2003) will be used to measure the working alliance between participants and their coaches, as well as to measure the perceived degree of support from the automated feedback messages and coaches respectively. The SRS consists of four items that assess four aspects of the working alliance: the relational bond, the degree to which desired goals and topics of the individual are discussed, an evaluation of the therapist's approach or method used, and an evaluation of the overall perception of the session by the individual. Instead of using a visual analogue scale, an 11-point Likert scale will be used to answer each of the four items, with '0' depicting a negative response and '10' depicting a positive response. The SRS demonstrated a high test-retest and internal consistency reliability, as well as an acceptable validity (Duncan et al., 2003).

User satisfaction questionnaire

A self-designed questionnaire was developed to assess the user satisfaction of Featback, such as the perceived quality of the support, whether Featback helped them to deal more effectively with their eating problems, and how satisfied they are with Featback in general. Participants are also asked to rate the individual components of Featback and to provide negative and positive comments about Featback.

Compliance

Two measures of compliance will be extracted from the database. The first measure of compliance will be the number of times a participant has completed the weekly monitoring assessment. The second measure of compliance will be the number of times a participant has completed a monitoring assessment after a completed assessment in the

previous week. This second measure of compliance is important because Featback is only programmed to compare obtained results with those of the previous week, not with those completed at earlier points in time. Thus, in case one has missed a monitoring assessment, but completes the next monitoring assessment a week later, results of the completed assessment cannot be compared to the previous results (e.g., results of the previous week are missing). Subsequently, progress or deterioration cannot be accurately monitored, which in turn can produce more general, less individually tailored feedback. To be able to further investigate dose-response relationships, the number of support sessions a participant has received will be recorded as well.

Attrition follow-up questions

According to Eysenbach (2005), there are two different processes of attrition. Dropout attrition refers to participants being lost to follow-up, thus not returning follow-up questionnaires. Non-usage attrition refers to participants who stop using the intervention. To be able to investigate the reasons for dropout and/or non-usage attrition, two attrition follow-up questions are designed: one in case participants fail to complete monitoring assessments and another one in case participants fail to complete the T1, T2 or T3 assessment.

Help-seeking attitudes and behavior questionnaire

Several questions will be used to assess participants' help-seeking attitudes and behavior, for example: whether participants generally believe that professional help is beneficial, and whether they believe that they need to seek professional help themselves. Furthermore, the questionnaire investigates whether participants intended to seek professional help and whether they actually sought professional help. Regarding the latter, the participants are also asked whether Featback has contributed to the decision to seek help. Finally, participants are asked if and how frequently they have made use of an e-mail or chat service in relation to their (eating) problems.

Quality of life (EQ-5D)

The EuroQol (EQ-5D) (EuroQol Group, 1990) generic health index is a standardized, patient-completed instrument which consists of five dimensions (i.e., 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). Thus, 243 distinct health states are defined, each with a unique utility score, ranging from 1 ('perfect health') to 0 ('death').

Direct Medical costs

For calculating the total direct medical costs, the Trimbos/iMTA questionnaire for Costs associated with Psychiatric Illness (TiC-P) (Hakkaart-van Roijen et al., 2002) will be used. The TiC-P measures the utilization of medical treatment such as the number of contacts with the general practitioner and multiple other care providers (e.g., medical specialists and paramedics) during the last three months, as well as the medication used. The costs will be calculated using the Dutch guidelines for cost calculations in health care (Hakkaart-van Roijen, Tan, & Bouwmans, 2010). Reference unit prices of the corresponding health care services will be applied. The cost-utility will be calculated by relating the difference in direct medical costs per patient receiving Featback and care as usual (waiting list condition) to the difference in terms of quality adjusted life years gained (cost-utility), yielding a quality adjusted life years estimate.

Sample size

The sample size calculation is based on an expected small between-group effect size (Cohen's *d*=.32) (Cohen, 1988). The calculation is conducted by the software program Power Analysis and Sample Size (PASS, 2008). The primary analysis will concern the hypothesis that the average level of eating pathology in the waiting list control condition is higher than the average level of eating pathology in the three active intervention conditions after a period of eight weeks (T1). Assuming an alpha of 0.05 and a power of 0.80 (β-1) in a one-way ANOVA study, we need sample sizes of 79 participants in each of the four groups whose means are to be compared using a planned comparison (e.g., planned contrast). Taking into account a baseline variable (e.g., T0 assessment) for which we assume a Pearson correlation of 0.5 with the outcome variable, and thus explaining 25% of the variance of the outcome variable, the sample size per group can be reduced with 25% and is thus calculated as 0.75 * 79 = 60 per group. In order to account for dropout, recently reviewed to be approximately 30% for Internet-based interventions (Melville et al., 2010), the definitive number of participants we will need to recruit is 10 / 7 * 60 = 86 participants per group, resulting in 344 in total.

Statistical analyses

All statistical analyses will be performed in SPSS version 19. A two-tailed significance level of α = .05 will be used throughout the analyses. All analyses will be based on an Intent-To-Treat (ITT) approach, including every participant who is randomly allocated to the intervention, regardless of one's withdrawal or deviation from the protocol (Hollis & Campbell, 1999). Regarding the effectiveness analyses, both ITT and completers analyses

will be conducted. Someone will be considered a completer in case he or she has completed both T0 and T1 assessments, and at least six monitoring assessments.

Pre-treatment differences between the conditions will be investigated using chi-square tests for categorical variables and ANOVAs for continuous variables. Linear mixed model analyses will be used to investigate the effectiveness and maintenance effects of Featback. Time contrasts will be created by means of dummy-coding. Within- and between-group effect sizes (Cohen's *d*) (Cohen, 1992) will be calculated based on the pooled standard deviation.

As recommended by Frazier, Tix and Barron (2004), potential categorical predictor or moderator variables will be dummy coded, and potential continuous predictor or moderator variables will be standardized. A significant two-way interaction between predictor and time indicates a predictor effect. A significant 3-way interaction between time, condition and moderator, indicates a moderator effect. Significant moderator effects of continuous variables will be interpreted by dichotomizing the moderator variable into subgroups of participants who score either low or high (e.g., below or above the sample mean) on the moderator variable. Separate mixed model analyses will then be repeated to examine interactions between condition and time within the low and high subgroups.

A cross-lagged panel design will be used to determine whether changes in mediator variables predict changes in ED symptoms, and not vice versa, as described by Burns et al. (2003). For all outcome and mediator variables, residualized change scores will be calculated for baseline (T0) to mid-intervention (week 4), as well as for mid- (week 4) to post-intervention (T1: week 8). Hereafter, hierarchical regressions will be performed, with mid- to post-intervention standardized change of the primary outcome measure as dependent variable, pre- to mid-intervention standardized change of the primary outcome measure, and mid- to post-intervention standardized change of the mediator variable as independent variables in the first step. In the second step, pre- to mid-intervention standardized change of the mediator variable will be entered into the regression equation. In addition, the inverse association (whether changes in the primary outcome variable predict changes in the mediator variable) will be tested and should not be significant.

Cost utility analysis

The aim of this economic evaluation is to assess the cost utility of Featback compared to the waiting list control condition. For examining the cost-effectiveness of Featback, the direct costs and quality of life scores will be calculated using SPSS, and normalized using Box-Cox transformations and power transformations. In case of missing data, the missing values in direct costs and quality of life scores per time unit will be imputed with a Markov

Chain Monte Carlo Multiple Imputation in SAS. Different variables, like scores on the WCS and SEED, age and gender will be included to get a better estimate. Propensity scores may be used to correct for baseline differences between groups. The uncertainty in the analysis will be assessed using bootstrapping in Excel. The results of the economic evaluation will be expressed in a cost-effectiveness acceptability curve. The acceptability curve illustrates the probability that the cost-effectiveness ratio will be accepted for different cost limits.

Discussion

One of the strengths of this study is the evaluation of the (cost-) effectiveness of the intervention, as well as the evaluation of the (cost-) effectiveness of the different levels of support. To our knowledge, this has not yet been investigated in the field of ED. Both a strength and a limitation of this study is that participants only have to meet three eligibility criteria (16 years of age or older, mild eating disorder symptoms or at risk for the development of an eating disorder, and internet access). A possible limitation could be the influence of the presence of comorbid disorders or the use of co-interventions or medication on study outcome measures; a possible strength is that many individuals who suffer from an ED have comorbid mental health problems such as depression, anxiety, substance dependence and personality disorders (Braun, Sunday, & Halmi, 1994; Rosenvinge, Martinussen, & Ostensen, 2000). Therefore, the broad inclusion criteria may well bear a close resemblance to reality, enhancing the external validity of the results, as well as being consistent with the aim of an applicable and easily accessible intervention for a broad population of individuals with symptoms of ED.

Another characteristic of this study that is both a strength and a limitation, is that measurements are conducted solely online. The advantages that come with online assessments are a reduction in research costs, maximization of the accessibility of participation, and participants being able to remain anonymous. However, the lack of face-to-face assessment(s) also means a lack of a diagnostic interview, and may furthermore reduce the commitment to the study and the intervention. In order to maximize compliance, motivational reminders will be send repeatedly, and individuals who complete all study assessments will take part in a lottery including gift vouchers and an iPod.

One of the limitations of this study concerns the lack of a 6-month follow-up for participants in the WLC condition, given that they will receive Featback with infrequent support from a coach after T2. This means that the relative long-term effectiveness of Featback, as compared to a waiting list control condition, cannot be examined.

Fortunately, the longer-term follow-up data of the different forms of feedback (without support, with infrequent support and with frequent support) will be available and examined.

Another limitation of this study is that due to the research questions and corresponding design of this study (a randomized controlled trial), it is impossible to fully preserve the stepped-care nature of Featback. Participants will be randomized to Featback without support or to Featback with infrequent or frequent support, which might not (always) match the preferences of participants.

Acknowledgements

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Chapter 5

Internet-based fully automated self-help with different levels of therapist support for individuals with eating disorder symptoms: A randomized controlled trial.

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Abstract

Background: Despite the disabling nature of eating disorders, many individuals with eating disorder (ED) symptoms do not receive appropriate mental health care. Internet-based interventions have potential to reduce the unmet needs by providing easily accessible health care services.

Objective: This study aimed to investigate the effectiveness of an Internet-based intervention for individuals with ED symptoms, called 'Featback'. In addition, the added value of different intensities of therapist support was investigated.

Methods: Participants (*N*=354) were aged sixteen years or older with self-reported ED symptoms, including symptoms of anorexia nervosa, bulimia nervosa, and binge eating disorder. Participants were recruited via the website of Featback and the website of a Dutch pro-recovery-focused e-community for young women with ED problems. Participants were randomized to: 1) Featback, consisting of psychoeducation and a fully automated self-monitoring and feedback system, 2) Featback supplemented with low-intensity (weekly) digital therapist support, 3) Featback supplemented with high-intensity (three times a week) digital therapist support, 4) a waiting list control condition. Internet-administered self-report questionnaires were completed at baseline, post-intervention (i.e. 8 weeks after baseline), and at 3- and 6-month follow-up. The primary outcome measure was ED psychopathology. Secondary outcome measures were symptoms of depression and anxiety, perseverative thinking, and ED-related quality of life. Statistical analyses were conducted according to an intent-to-treat approach using linear mixed models.

Results: The three Featback conditions were superior to a waiting list in reducing bulimic psychopathology (*d*=-0.16, 95% confidence interval (CI)=-0.31 to -0.01), symptoms of depression and anxiety (*d*=-0.28, 95%CI=-0.45 to -0.11), and perseverative thinking (*d*=-0.28, 95%CI=-0.45 to -0.11). No added value of therapist support was found in terms of symptom reduction, although participants who received therapist support were significantly more satisfied with the intervention than those who did not receive supplemental therapist support. No significant differences between the Featback conditions supplemented with low- and high-intensity therapist support were found regarding the effectiveness and satisfaction with the intervention.

Conclusions: The fully automated Internet-based self-monitoring and feedback intervention 'Featback' was effective in reducing ED and comorbid psychopathology. Supplemental therapist support enhanced satisfaction with the intervention but did not increase its effectiveness. Automated interventions such as Featback can provide widely disseminable, and easily accessible care. Such interventions could be incorporated within

a stepped-care approach in the treatment of ED, and help to bridge the gap between mental disorders and mental health care services.

Trial registration: Netherlands Trial Registry: NTR3646.
http://www.trialregister.nl/trialreg/admin/rctview.asp?TC=3646
(Archived by WebCite at http://www.webcitation.org/6fgHTGKHE).

Introduction

Eating disorders (ED) are serious psychiatric disorders characterized by high rates of comorbidity, chronicity, mortality, and relapse (Berkman, 2007; Hudson et al., 2007; Keel et al., 2010; Kessler et al., 2013; Smink et al., 2013). Unfortunately, despite the disabling nature of these disorders, many individuals with ED symptoms do not seek and receive appropriate mental health care (Hart et al., 2011; Hudson et al., 2007). Barriers to care include geographical or financial barriers, as well as fear of stigmatization and feelings of shame (Becker et al., 2010). E-mental health has the potential to reduce these barriers in help-seeking, as well as the unmet need for health care by providing easily accessible services.

Numerous Internet-based interventions for the prevention and treatment of ED have shown promising results (Aardoom et al., 2013; Beintner et al., 2011; Melioli et al., 2016). The results of a recent meta-analytic review (Melioli et al., 2016) demonstrated that Internet-based programs, of which the majority was based on cognitive behavioral principles, were successful in decreasing a range of ED-related symptoms including body dissatisfaction, symptoms of bulimia nervosa, shape and weight concerns, dietary restriction, and negative affect. Emerging research furthermore suggests that E-health interventions may reach underserved populations and increase access to regular healthcare (Aardoom, Dingemans, & van Furth EF, 2016). Despite the promising results, research into the effectiveness of such interventions is still in an early stage (Aardoom et al., 2013; Bauer et al., 2013; Loucas et al., 2014) and further high-quality studies are required.

Internet-based interventions can include many different components and can be provided with or without therapist support. In the field of depression and anxiety, it has been found that Internet-based interventions with therapist support were more effective than those without or those with only minimal therapeutic contact (Andersson et al., 2009; Spek et al., 2007). Direct comparisons of Internet-based mental health interventions with and without therapist support in randomized controlled trials are scarce, although a recent meta-analysis indeed demonstrated guided interventions to be superior to unguided interventions (Baumeister, Reichler, Munzinger, & Lin, 2015). However, studies investigating the optimal intensity of therapist support are rare (Baumeister et al., 2015), and it is currently unknown how much or how little therapist support is needed to realize a particular amount of additional improvement in health outcomes. To our knowledge only one study directly compared different intensities of therapist support in an Internet-based treatment for panic disorder (Klein et al., 2009b). This study demonstrated no significant differences between higher and lower intensities of therapist support.

Regarding E-health interventions in the field of ED, no studies have yet directly compared guided and non-guided interventions, nor have different intensities of therapist support been investigated.

In addition to the intensity of therapist support, another important factor is the way in which such support is provided. Tate et al. (2006) investigated the effectiveness of feedback on self-monitoring diaries provided by either a human counselor or a computer-automated program in an Internet-based weight loss program. Interestingly, at 3-month follow-up no significant differences in outcome were found between participants in the computer-automated counseling condition and the human counseling condition respectively. Along similar lines, a recent study demonstrated a Web-based intervention for mild to moderate depression symptoms to be equally effective when provided with human- versus automated support (Kelders, Bohlmeijer, Pots, & van Gemert-Pijnen, 2015). Hence, automated support may be an effective and widely disseminable means of providing support within Internet-based interventions, and it is important to further compare the effectiveness of such automated support to the effectiveness of different intensities of individual therapist support.

The current study evaluated self-help intervention *'Featback'* for individuals with ED symptoms. Featback comprises psychoeducation and a fully automated self-monitoring and feedback system. Self-monitoring is an important clinical technique that is often used in cognitive behavioral therapy (Cohen, Edmunds, Brodman, Benjamin, & Kendall, 2013), where it can amongst other things help to gain a more comprehensive understanding of one's psychopathology. By means of the monitoring- and feedback system, participants are invited to complete a weekly monitoring questionnaire assessing the core symptoms of ED: body dissatisfaction, excessive concern with body weight and shape, unbalanced nutrition and dieting, and binge eating and compensatory behaviors. After completion of the questionnaire, participants receive a feedback message which is automatically generated and tailored to their answers of the monitoring questions, containing social support and advice on how to counteract reported ED symptoms. Featback is aimed at individuals with all types of ED symptoms, which in line with the transdiagnostic theory that all ED (e.g., anorexia nervosa, bulimia nervosa, binge eating disorder) share the same core psychopathology, characterized by the over-evaluation of eating, shape, weight, and their control (Fairburn et al., 2003).

The first aim of this study was to investigate the effectiveness of Featback in reducing ED psychopathology and comorbid symptoms. The second aim was to investigate the added value of therapist support, and different intensities of therapist support. A randomized controlled trial was conducted comparing four conditions: 1) Internet-based intervention 'Featback', consisting of psychoeducation and a fully automated monitoring

and feedback system, 2) Featback supplemented with low-intensity (weekly) therapist support, 3) Featback supplemented with high-intensity (three times a week) therapist support, and 4) a waiting list control (WLC).

Method

Study design and procedure

This study was a four-arm randomized control trial. Ethical approval was obtained from the Leiden University Medical Center ethics committee. This committee granted exemption for parental consent for individuals aged between 16 and 18 years of age. Detailed information on the study methods, including the design, intervention conditions, measures, and ethical precautions and crisis management, can be found in the published study protocol (Aardoom, Dingemans, Spinhoven, Hakkaart-van Roijen, & van Furth, 2013).

Participants were recruited via the website of Featback (2016a) and the website of Dutch pro-recovery-focused e-community 'Proud2Bme' (2016b) for young women with ED problems. The eligibility criteria were 1) age ≥ 16 years, 2) access to the Internet, and 3) ED symptoms. The latter was defined as scoring ≥ 52 on the Weight Concern Scale (Killen et al., 1994) or reporting one or more of the following ED symptoms as assessed by the Short Evaluation of Eating Disorders (Bauer et al., 2005): a body mass index of ≤18.5, ≥ 1 binge eating episodes a week over the past four weeks, and/or engagement in ≥ 1 compensatory behaviors a week over the past four weeks.

After online completion of informed consent and the screening questionnaire including questions regarding the eligibility criteria, participants were invited to complete the baseline questionnaire. Thereafter, participants were randomly assigned to one of the four study conditions with a block size of 40 and an equal allocation ratio (1:1:1:1). An independent researcher who had no involvement in any other aspect of this study conducted the randomization allocation by means of computer-generated random numbers created in SPSS. She concealed the allocation sequence in a password-protected computer file from the main researchers until interventions were assigned, preventing researchers from having any prior knowledge of the upcoming condition assignments. Importantly, therapists were alternately assigned to low- versus high-intensity therapist support.

Interventions

Featback

All participants had access to the Featback website where comprehensive and general information on ED could be found (i.e., psychoeducation), for example the types of ED and symptoms, risk factors, causes, and comorbid problems. This information served primarily to educate participants about ED and to stimulate recognition and acknowledgement. The psychoeducation was purely self-guided, meaning that participants were free in choosing when and what to read. The monitoring and feedback system comprised a weekly invitation by e-mail to complete a monitoring questionnaire. This questionnaire consisted of eight 4-point Likert items assessing cognitive and behavioral correlates of the following four dimensions: 1) body dissatisfaction, 2) excessive concerns with body weight and shape, 3) unbalanced nutrition and dieting, and 4) binge eating and compensatory behaviors. After completion, an algorithm determines the patterns of change of each of these four dimensions: still in the functional/healthy range, still in the dysfunctional/unhealthy range, improvement from the dysfunctional to the functional range, or deterioration from the functional to the dysfunctional range. The four different patterns of change with respect to the four dimensions of ED symptoms, result in 4*4*4*4= 256 possible scenarios regarding a participant's status. For each possible scenario, 10 to 15 different feedback messages were pre-formulated in a database. After determining the status of a participant, the algorithm randomly selected one tailored feedback message out of this database and sent this to the participant accordingly. Hence, when a participant's status does not change over time, one would not receive the same message over and over again. All 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. The following is an example of a feedback message, which could be send to someone with dysfunctional overconcerns with body weight and shape, unbalanced nutrition and dieting (dysfunctional), as well as deteriorations in body dissatisfaction and symptoms of binge eating and compensatory behaviors: *"We are concerned with the changes in your body image and eating behaviors, however, we know that you have the ability to make healthy changes. Your body image and eating habits are closely linked. This week, try to eat regular, well-balanced meals and snacks, which might help to prevent the binge eating and/or compensatory behaviors and help you to feel better. If you continue to have negative thoughts about your body, it may be helpful for you to talk to someone about it, maybe a family member? Or a friend? Take care!".* The fully automated self-monitoring and feedback system was developed in Germany and for more detailed information on

this system, see the study by Bauer et al. (2009). A remainder was sent to participants by email each time they failed to complete a monitoring assessment.

Featback + Low-intensity therapist support
Participants received Featback as described previously supplemented with low-intensity (weekly) therapist support by means of e-mail, chat and/or audio teleconference (i.e. Skype). Participants could schedule support sessions in an online agenda where available time slots of the therapist were presented. For each support session, participants could choose their preferred medium of support. Therapists were instructed to send an e-mail to participants in case they did not schedule any support session(s) or in case they did not show up at (a) scheduled support session(s), and to repeat this process twice per non-response. Chat and teleconference sessions had a maximum duration of 20 minutes, whereas an e-mail session contained one e-mail reply from the therapist to the participant. The therapist support was independent of the monitoring-and feedback system. The chat methodology was based on a 5-phase model: 1) a warm welcome, 2) clarifying the question, 3) determining the goal of the conversation, 4) concrete elaboration of the goal of the conversation, and 5) closing the circle (Schalken et al., 2010). The e-mail methodology contained three phases: 1) extracting the question, 2) formulating an answer, and 3) checking and re-reading the message, and sending it (Schalken et al., 2010).

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

Waiting list control condition (WLC)
Participants were placed on a waiting list for five months, where after they were offered Featback with low-intensity therapist support.

In all four intervention conditions, participants were free to undergo any other type of intervention or treatment (i.e., usual care).

Therapists
The therapists were seven females who were either Master of Science students in clinical psychology or individuals with a master's degree in clinical psychology. All therapists underwent training in the delivery and methodology of online support. Furthermore, they received extensive information on ED and practiced with case material and expert patients

(i.e. someone who has experienced an ED themselves and has been successful in managing the disorder) before the start of the trial. Monthly face-to-face supervision sessions were organized by the main researcher (JA), a psychologist (MN) and an experienced psychotherapist (EvF) as a matter of routine professional and ethical care, as well as to reinforce adherence to the protocol. In addition, two individual supervision sessions were provided to all therapists during their first month. Thereafter, therapists' adherence to the protocol was regularly checked at random, by checking whether the chats and e-mails included the 5- and 3-phase model respectively.

Outcomes

All data were collected by means of Internet-administered self-report questionnaires at baseline, post-intervention (8 weeks after baseline), and at 3- and 6-month follow-up. Waiting list participants were offered Featback with low-intensity therapist support after the 3-month follow-up and were not assessed at 6-month follow-up.

The primary outcome measure was ED psychopathology as measured by the Short Evaluation of Eating Disorders (SEED) (Bauer et al., 2005) and the Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn et al., 2008). The SEED (Bauer et al., 2005) distinguishes between the main symptoms of anorexia nervosa (underweight, fear of weight gain, distortion of body perception) and bulimia nervosa (binge eating, compensatory behaviors, overconcern with body shape and weight). Total severity indexes were calculated for both dimensions. The SEED has demonstrated validity and was shown to be sensitive to symptom change (Bauer et al., 2005). Regarding the EDE-Q, a global score of ED psychopathology was calculated by summing and averaging 22 seven-point Likert items. The EDE-Q has demonstrated reliability and validity (Berg, Peterson, Frazier, & Crow, 2011), and the internal consistency reliability in the current sample was high (Cronbach's α=.88). Higher scores on both the SEED (range 0-3) and the EDE-Q (range 0-6) reflect higher ED psychopathology.

Secondary outcome measures included ED-related quality of life as assessed by the ED-related quality of life questionnaire (ED-QOL), a validated 25-item questionnaire assessing the influence of eating behaviors and body weight in the psychological, physical and cognitive, financial and work/school-related domain (Engel et al., 2006). The ED-QOL demonstrated excellent internal consistency reliability in this study sample (Cronbach's α=.92). Higher scores (range 1-5) reflect lower quality of life. Symptoms of depression and anxiety were measured using the 4-item Patient Health Questionnaire (PHQ-4). The PHQ-4 has demonstrated factorial and construct validity (Kroenke et al., 2009), and demonstrated good internal consistency reliability in the current sample (Cronbach's α=.83). Higher scores (range 0-12) reflect higher symptom severity. Finally, levels of

perseverative thinking (i.e., worry and rumination) were assessed using the Perseverative Thinking Questionnaire (PTQ) (Ehring et al., 2012). The PTQ demonstrated good internal consistency and satisfactory stability (Ehring et al., 2012). The internal consistency reliability in the current sample was excellent (Cronbach's α=.95). Higher scores are indicative of higher levels of perseverative thinking (scale 0-4).

Given that participants were free to undergo any other type of intervention, psychological health care service utilization (i.e. appointments with a dietitian, social worker, psychologist, psychiatrist, or psychotherapist) was assessed with the Trimbos/iMTA Questionnaire for Costs Associated with Psychiatric Illness: TiC-P) (Hakkaart-van Roijen et al., 2002). User satisfaction was assessed with two open-ended questions asking participants for their positive and negative feedback respectively. In addition, participants were asked to rate their satisfaction with the intervention and their satisfaction with their therapist on a 10-point Likert scale ranging from very dissatisfied (score of 1) to very satisfied (score of 10). Finally, two open-ended questions assessed the reasons for dropout attrition (i.e. not completing study questionnaires) and non-usage attrition (i.e. deregistration from the monitoring and feedback system).

Statistical analyses

All data were analyzed in SPSS version 22 using two-tailed tests and α=0.05. A target sample size of 344 participants was calculated by the software program Power Analysis and Sample Size version 8.0 (2008) to yield 80% power to detect an expected between-group (pooled Featback conditions versus WLC) difference at post-intervention with an effect size of 0.3, α=0.05, and an expected dropout rate of 30% (for more details on power calculation, see the paper by Aardoom et al. (2013)).

Possible differences in baseline characteristics, dropout rates and participants' experiences were investigated using chi-square tests and analysis of variances. All data were imputed using multiple imputation methods. Multiple imputations using predictive mean matching were conducted in statistical software program R version 3.02. Interactions were taken into account in the imputation procedure (Doove, Van Buuren, & Dusseldorp, 2014). Multiple imputation methods have several advantages over complete-case analyses or single imputation techniques and are therefore highly recommended (Schafer & Graham, 2002). 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). For example, in case the data of 300 participants would be available on a specific variable, 300/15=20 predictor variables could be used to predict missing data on this variable. Then, correlations between the outcome variable and all other variables were investigated, so that the variables that correlated the highest with the outcome

variable were chosen as predictors for the missing data on the outcome variables. A total of 100 imputed datasets were generated. Results from all imputed datasets were pooled according to Rubin's rules to account for the uncertainty associated with the imputations (Rubin, 1987).

The main analyses were conducted using linear mixed models including random intercepts. All analyses were conducted according to the intent-to-treat approach including all participants who underwent randomization. Three statistical models were specified including time and condition contrasts (for details on models and contrast coding, see Supplementary Material 1). Model 1 investigated whether the three Featback conditions (pooled) led to better outcomes than the WLC. Model 2 compared Featback without therapist support versus the two Featback conditions with therapist support (pooled). Model 3 compared Featback with low- versus high-intensity therapist support. Main analyses were repeated controlling for significant baseline differences between the conditions (i.e. age, marital status, and duration of ED psychopathology), and number of received psychological health care appointments. The latter was entered as covariate in order to examine intervention effects over and above usual care. Also, main analyses were repeated for completers of the intervention only, defined as participants who completed at least five monitoring questionnaires (Featback without therapist support), plus at least five to 13 therapist support sessions (Featback with low- versus high-intensity therapist support, respectively).

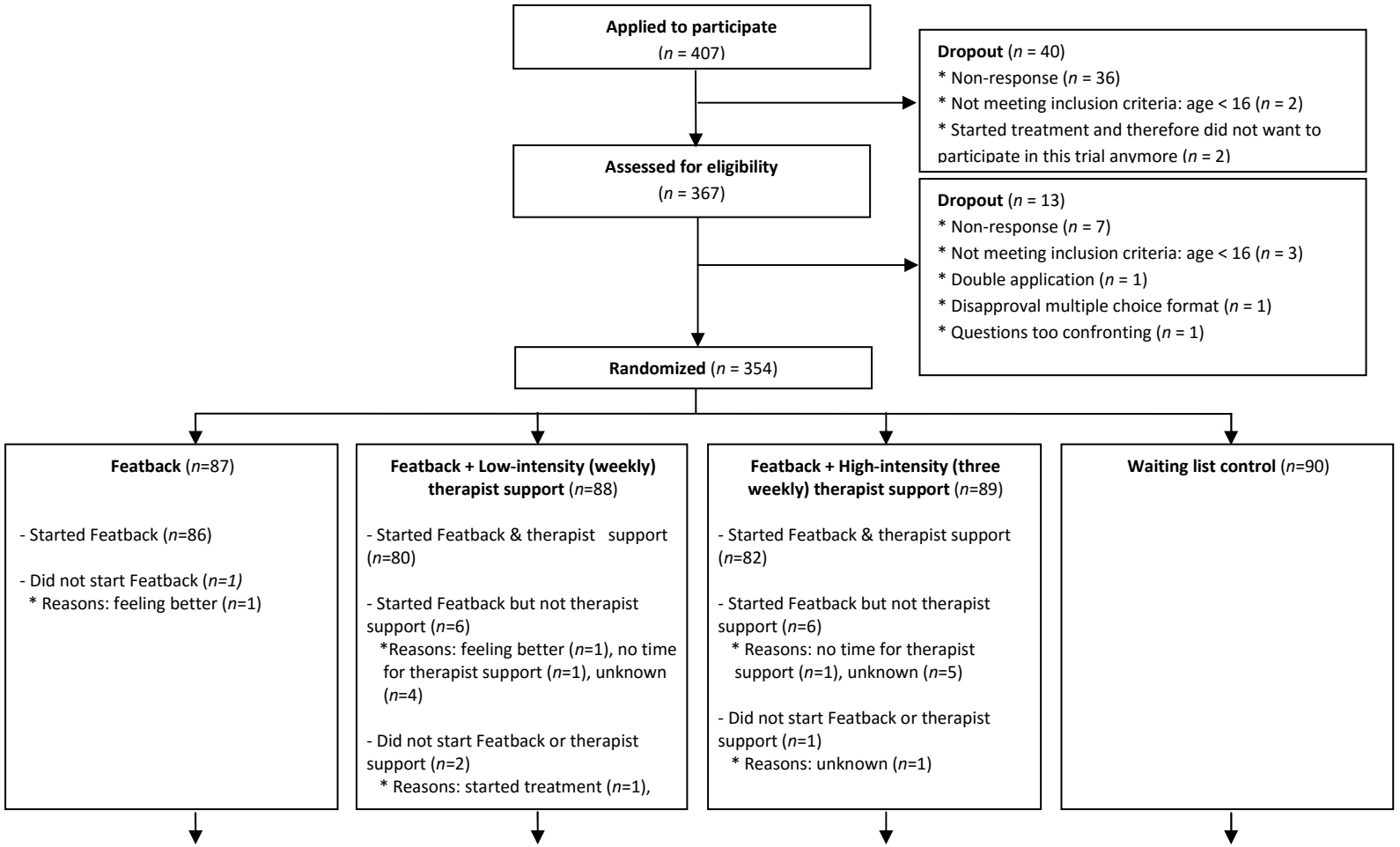
Effect sizes (*d*) were calculated by dividing the unstandardized coefficients of interaction effects (time X condition) by the pooled within-group standard deviation of the outcome measure at baseline (Feingold, 2015). The resulting effect sizes of all imputed dataset were summed and averaged. The two open-ended questions related to satisfaction with the intervention, both critical and positive, were qualitatively explored in order to provide an overview of participants' most frequently reported negative and positive comments.

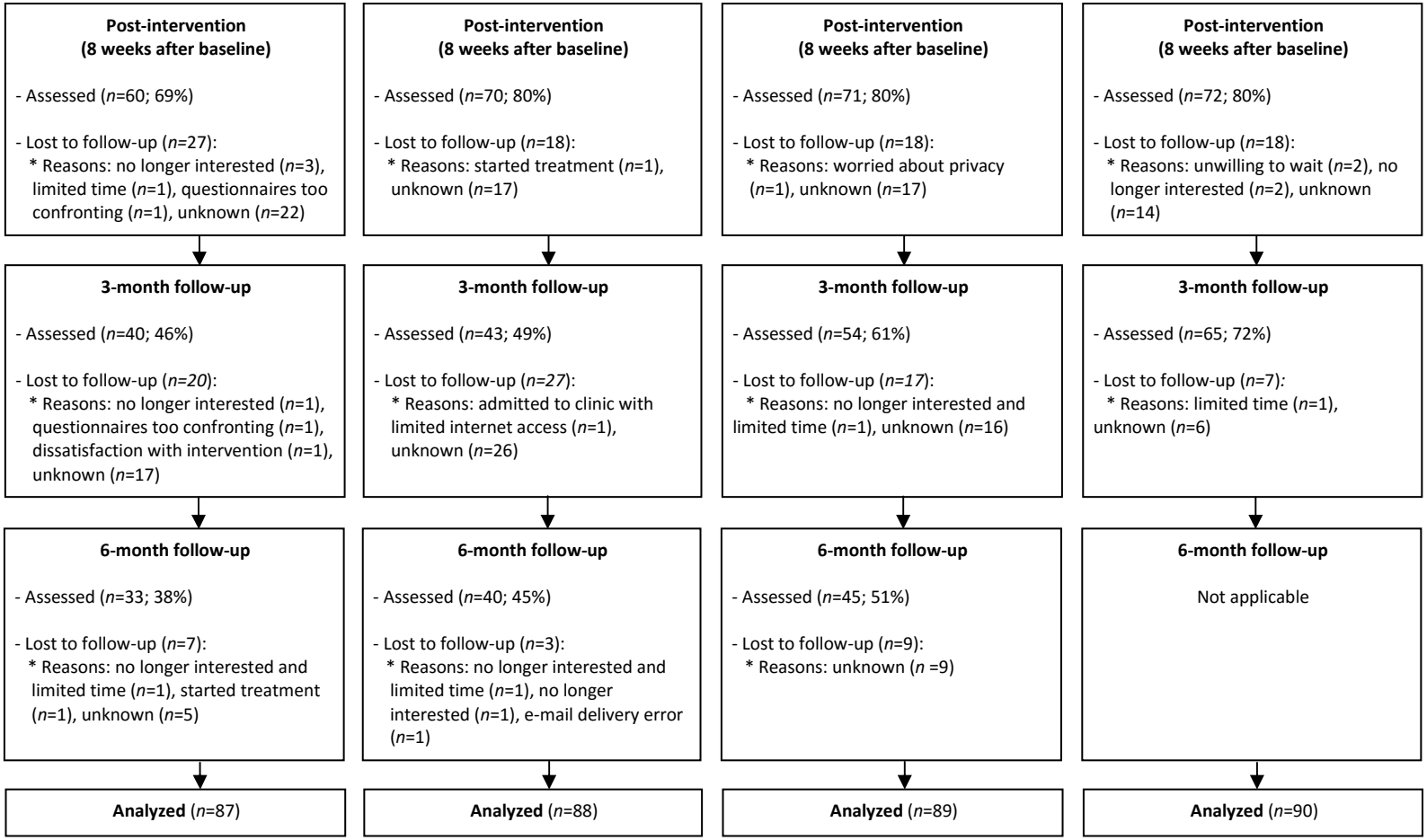
Results

Participants

Participants were recruited between November 7, 2012, and June 17, 2013. Follow-up was completed at March 3, 2014. Figure 1 presents the flow of participants through each stage of the trial. A total of 354 participants were assessed at baseline, 273 (77%) at post-intervention, 202 (57%) at 3-month follow-up, and 118 participants (45%) of the available three study conditions (*n*=264) at 6-month follow-up. Study dropout rates did not significantly differ between the conditions at post-intervention ($\chi^2(3)=4.35$, $p=.23$) and 6-

Figure 1. CONSORT diagram: Flow of participants through each stage of the randomized controlled trial




Post-intervention
(8 weeks after baseline)
- Assessed (n=60; 69%)
- Lost to follow-up (n=27):
* Reasons: no longer interested (n=3), limited time (n=1), questionnaires too confronting (n=1), unknown (n=22)
3-month follow-up
- Assessed (n=40; 46%)
- Lost to follow-up (n=20):
* Reasons: no longer interested (n=1), questionnaires too confronting (n=1), dissatisfaction with intervention (n=1), unknown (n=17)
6-month follow-up
- Assessed (n=33; 38%)
- Lost to follow-up (n=7):
* Reasons: no longer interested and limited time (n=1), started treatment (n=1), unknown (n=5)
Analyzed (n=87)
Post-intervention
(8 weeks after baseline)
- Assessed (n=70; 80%)
- Lost to follow-up (n=18):
* Reasons: started treatment (n=1), unknown (n=17)
3-month follow-up
- Assessed (n=43; 49%)
- Lost to follow-up (n=27):
* Reasons: admitted to clinic with limited internet access (n=1), unknown (n=26)
6-month follow-up
- Assessed (n=40; 45%)
- Lost to follow-up (n=3):
* Reasons: no longer interested and limited time (n=1), no longer interested (n=1), e-mail delivery error (n=1)
Analyzed (n=88)
Post-intervention
(8 weeks after baseline)
- Assessed (n=71; 80%)
- Lost to follow-up (n=18):
* Reasons: worried about privacy (n=1), unknown (n=17)
3-month follow-up
- Assessed (n=54; 61%)
- Lost to follow-up (n=17):
* Reasons: no longer interested and limited time (n=1), unknown (n=16)
6-month follow-up
- Assessed (n=45; 51%)
- Lost to follow-up (n=9):
* Reasons: unknown (n =9)
Analyzed (n=89)
Post-intervention
(8 weeks after baseline)
- Assessed (n=72; 80%)
- Lost to follow-up (n=18):
* Reasons: unwilling to wait (n=2), no longer interested (n=2), unknown (n=14)
3-month follow-up
- Assessed (n=65; 72%)
- Lost to follow-up (n=7):
* Reasons: limited time (n=1), unknown (n=6)
6-month follow-up
Not applicable
Analyzed (n=90)

month follow-up (χ^2(2)=2.87, p=.24), 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 (χ^2(3)=15.69, p=.001). No differences in non-usage attrition were found among the three Featback conditions (χ^2(2)=5.24, p=.07).

Baseline characteristics of participants are summarized in Table 1. Significant differences between the conditions were found regarding age, duration of ED psychopathology, and marital status, whereas no significant differences were found for any other baseline variables. No significant differences between the study conditions were found regarding the number of psychological health care appointments received (i.e., appointments with a dietician, social worker, psychologist, psychiatrist, or psychotherapist) during the intervention period (F(3,245)=0.29, p=.84). One hundred participants (40.2%) did not receive any psychological health care appointments during this period, whereas 149 participants (59.8%) did have such appointments (range 1-40).

Participants in the current study demonstrated severe levels of ED psychopathology: their EDE-Q scores were comparable to the overall norm for treatment-seeking patients with an ED in our clinical program (Aardoom et al., 2012). The mean EDE-Q score of 4.2 (SD=0.9) is furthermore markedly above the clinical threshold, as recent literature demonstrated reliable EDE-Q cut-off scores of >2.50 (Ro, Reas, & Stedal, 2015) and >2.12 (Machado et al., 2014). Approximately 96% (n=349) of the study participants scored above the cut-off score of 2.5. To provide a diagnostic impression of the study sample, we used the EDE-Q to approximate DSM-5 classifications (American Psychiatric Association, 2013). Subsequently, 103 (29%) participants demonstrated symptoms of anorexia nervosa, being a body mass index of ≤ 18.5 combined with a fear of weight gain or of becoming fat. Ninety-three participants (26%) reported binge eating disorder symptoms: binge eating episodes once a week or more during the past 28 days, without recurrent use of inappropriate compensatory behaviors (i.e., less than once a week over the past 28 days). Seventy-seven (22%) participants reported symptoms of bulimia nervosa, being episodes of binge eating and inappropriate compensatory behaviors both at least once a week or more during the past 28 days. Only 14 participants (4%) demonstrated symptoms of purging disorder, that is, purging behaviors once a week or more during the past 28 days in the absence of binge eating episodes. Finally, 5 participants (14%) reported ED symptoms that may be classified as 'unspecified feeding or ED', or ED problems without a DSM-5 classification. Seventeen participants (5%) could not be classified due to missing data regarding binge eating episodes or body mass index. The four study conditions did not differ with respect to the type of ED (χ^2(15)=19.33, p=.20).

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

	Featback (*n*=87)	Featback +Low-intensity therapist support *n*=88)	Featback +High-intensity therapist support (*n*=89)	Waiting list control condition (*n*=90)	Featback +High-intensity therapist support (*n*=89)	Total sample (*n*=354)	Statistics
Gender							$\chi^2(3)=2.02$, $p=.57$
Male	1 (1.1%)	1 (1.1%)	2 (2.2%)	0 (0.0%)	2 (2.2%)	4 (1.1%)	
Female	86 (98.9%)	87 (98.9%)	87 (97.8%)	90 (100.0%)	87 (97.8%)	350 (98.9%)	
Marital status							$\chi^2(6)=13.22$, $p=.04$
Married/living together	28 (32.2%)^{A,B}	17 (19.3%)^{A,B}	21 (23.6%)^{B}	11 (12.2%)^{A}	21 (23.6%)^{B}	77 (21.8%)	
Single/living alone	58 (66.7%)	71 (80.7%)	67 (75.3%)	79 (78.8%)	67 (75.3%)	275 (77.7%)	
Divorced	1 (1.1%)	0 (0.0%)	1 (1.1%)	0 (0.0%)	1 (1.1%)	2 (0.6%)	
Education level							$\chi^2(6)=7.69$, $p=.26$
Low	4 (4.6%)	4 (4.5%)	7 (7.9%)	10 (11.1%)	7 (7.9%)	25 (7.1%)	
Intermediate	16 (18.4%)	26 (29.5%)	19 (21.3%)	17 (18.9%)	19 (21.3%)	78 (22.0%)	
High	67 (77.0%)	58 (65.9%)	63 (70.8%)	63 (70.0%)	63 (70.8%)	251 (70.9%)	
Use of psychotropic medication							$\chi^2(3)=3.35$, $p=.34$
Yes	21 (24.7%)	17 (19.5%)	16 (18.2%)	25 (28.4%)	16 (18.2%)	79 (22.7%)	
No	64 (75.3%)	70 (80.5%)	72 (81.8%)	63 (71.6%)	72 (81.8%)	269 (77.3%)	
Employment status							$\chi^2(9)=8.96$, $p=.44$
School/study	50 (58.1%)	48 (55.2%)	40 (45.5%)	51 (56.7%)	40 (45.5%)	189 (53.8%)	
Employed	25 (29.1%)	22 (25.3%)	35 (39.8%)	30 (33.3%)	35 (39.8%)	112 (31.9%)	
Unemployed/homemaker	4 (4.7%)	8 (9.2%)	4 (4.5%)	3 (3.3%)	4 (4.5%)	19 (5.4%)	
Sick leave/disabled	7 (8.1%)	9 (10.3%)	9 (10.2%)	6 (6.7%)	9 (10.2%)	31 (8.8%)	
Treatment history ED							$\chi^2(3)=4.43$, $p=.22$
Yes	48 (55.2%)	40 (45.5%)	39 (43.8%)	36 (40.0%)	39 (43.8%)	163 (46.0%)	
No	39 (44.8%)	48 (54.5%)	50 (56.2%)	54 (60.0%)	50 (56.2%)	191 (54.0%)	
Age (years)	24.7 (7.1)^{A,B}	23.0 (7.0)^{A}	26.3 (9.2)^{B}	22.8 (6.6)^{A}	26.3 (9.2)^{B}	24.2 (7.7)	$F(3,350)=4.17$, $p=.01$
Body Mass Index	21.8 (5.0)	21.2 (4.8)	21.4 (5.4)	20.6 (4.6)	21.4 (5.4)	21.2 (5.0)	$F(3,347)=1.03$, $p=.38$
Duration ED problems (years)	8.1 (6.9)^{A,B}	6.5 (5.8)^{A,B}	8.2 (7.7)^{B}	5.7 (5.6)^{A}	8.2 (7.7)^{B}	7.1 (6.6)	$F(3,346)=3.05$, $p=.03$
Global ED psychopathology (EDE-Q)	4.2 (0.8)	4.4 (0.9)	4.0 (0.8)	4.1 (1.1)	4.0 (0.8)	4.2 (0.9)	$F(3,113)=1.54$, $p=.21$
AN psychopathology (SEED-AN)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	$F(3,347)=0.24$, $p=.87$
BN psychopathology (SEED-BN)	1.4 (0.7)	1.5 (0.7)	1.5 (0.6)	1.5 (0.7)	1.5 (0.6)	1.5 (0.7)	$F(3,349)=0.30$, $p=.82$

ED=Eating disorder; AN=Anorexia nervosa; BN=Bulimia nervosa; EDE-Q=Eating Disorder Examination Questionnaire; SEED=Short Evaluation of Eating Disorders

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

Intervention compliance

Participants in the three Featback conditions completed a mean number of 5.6 (*SD*=2.3, range 0-8) out of eight weekly monitoring questionnaires, with no significant difference between the conditions ($F(2,261)=1.36$, $p=.258$). Participants in the two Featback conditions with therapist support received a total of 1407 support sessions, with e-mail being the most popular medium (*n*=937, 67%), followed by chat (*n*=417, 30%), and teleconference (*n*=53, 4%). These proportions of e-mail ($t(1,155)=-1.63$, $p=.11$), chat ($t(1,153)=1.42$, $p=.16$), and teleconference ($t(1,159)=0.53$, $p=.59$) were similar for the two study conditions. The mean number of received therapist support sessions differed significantly between Featback with low- and high-intensity therapist support ($t(175)=8.24$, $p<.001$): participants in the former condition received on average 4.7 (*SD*=2.7, range 0-8) sessions, whereas participants in the latter condition received on average 11.2 (*SD*=6.9, range 0-24) sessions. Thus, we successfully created two different intervention conditions regarding the intensity of therapist support.

Comparison of intervention conditions with waiting list condition

The outcome data for each of the four conditions over time can be found in Supplementary Material 2. Table 2 summarizes the results of the mixed model analyses comparing the three Featback conditions with the WLC (statistical model 1). As shown in Table 2, from baseline to post-intervention, significant time-by-condition effects were found for bulimic psychopathology (*d*=-0.16, 95%CI=-0.31 to -0.01), symptoms of depression and anxiety (*d*=-0.31, 95%CI=-0.54 to -0.09), and perseverative thinking (*d*=-0.28, 95%CI=-0.45 to -0.11). These interaction effects indicated greater reductions in psychopathology for participants in the Featback conditions as compared to the WLC. For global ED psychopathology and ED-related quality of life, only significant time effects were found, indicating improvements over time. From post-intervention to 3-month follow-up, significant time-by-condition effects were found for ED-related quality of life (*d*=-0.22, 95%CI=-0.38 to -0.06) and symptoms of depression and anxiety (*d*=-0.21, 95%CI=-0.33 to -0.09), indicating more improvements in the Featback conditions as compared with the WLC during the 3-month follow-up period (see Table 2). For anorectic and bulimic psychopathology as well as levels of perseverative thinking, no interaction effects were found, but significant time effects were found that indicated improvements over time. Completer analyses confirmed the conclusions of the intent-to-treat analyses and are therefore not reported.

Table 2. Results of linear mixed model analyses comparing the effectiveness of an Internet-based fully automated monitoring- and feedback intervention with a waiting list control condition. Results are based on the pooled results of 100 multiple imputed datasets.

	Time effects			Time x Condition effects		
Measure	***B***	***t (p)***	***95% CI***	***B***	***t (p)***	***95% CI***
Anorectic psychopathology (SEED-AN)						
Baseline to post-intervention	-0.02	-0.42 (.44)	-0.06 to 0.03	0.01	0.35 (.73)	-0.04 to 0.06
Post-intervention to 3-month follow-up	-0.05	-2.21 (.03)	-0.10 to -0.006	0.04	1.41 (.16)	-0.02 to 0.09
Bulimic psychopathology (SEED-BN)						
Baseline to post-intervention	-0.07	-1.50 (.11)	-0.15 to 0.02	-0.11	-2.13 (.03)	-0.21 to -0.009
Post-intervention to 3-month follow-up	-0.12	-2.51 (.01)	-0.22 to -0.03	-0.02	-0.42 (.67)	-0.14 to 0.09
Global ED psychopathology (EDE-Q)						
Baseline to post-intervention	-0.22	-3.07 (.002)	-0.37 to -0.08	-0.09	-1.08 (.28)	-0.26 to 0.08
Post-intervention to 3-month follow-up	-0.18	-2.44 (.02)	-0.32 to -0.03	-0.07	-0.77 (.44)	-0.25 to 0.11
ED-related quality of life (ED-QOL)						
Baseline to post-intervention	-0.13	-3.46 (.001)	-0.20 to -0.06	-0.03	-0.74 (.46)	-0.12 to 0.05
Post-intervention to 3-month follow-up	-0.06	-1.44 (.15)	-0.14 to 0.02	-0.13	-2.70 (.007)	-0.23 to -0.04
Symptoms anxiety & depression (PHQ-4)						
Baseline to post-intervention	-0.37	-1.92 (.06)	-0.74 to 0.007	-0.94	-4.11 (<.001)	-1.39 to -0.49
Post-intervention to 3-month follow-up	-0.29	-1.43 (.15)	-0.69 to 0.11	-0.62	-2.53 (.01)	-1.11 to -0.14
Perseverative thinking (PTQ)						
Baseline to post-intervention	-0.08	-1.48 (.14)	-0.18 to 0.03	-0.20	-3.20 (.001)	-0.32 to -0.07
Post-intervention to 3-month follow-up	-0.16	-2.89 (.004)	-0.26 to -0.05	-0.05	-0.82 (.41)	-0.18 to 0.07

SEED=Short Examination of Eating Disorders; AN=Anorexia Nervosa; BN=Bulimia Nervosa; EDE-Q=Eating Disorder Examination Questionnaire; ED-QOL=Eating Disorder-related Quality Of Life; PHQ-4=Patient Health Questionnaire; PTQ= Perseverative Thinking Questionnaire

Note 1: Values smaller than 0.01 are reported to 3 decimals places.

Note 2: Including the covariates age, marital status, duration of eating disorder psychopathology, and number of received psychological health care appointments (i.e., appointments with a dietitian, social worker, psychologist, psychiatrist, or psychotherapist) did not alter the above mentioned findings.

Comparison of active intervention conditions

In statistical models 2 and 3, we compared the intervention conditions and thus investigated the added value of therapist support, and higher versus lower intensities of therapist support respectively. As shown in Supplementary Material 3 and 4, participants in all Featback conditions improved over time (baseline versus post-intervention, and post-intervention versus 3- and 6-month follow-up respectively) with respect to bulimic psychopathology, global ED psychopathology, ED-related quality of life, symptoms of depression and anxiety, and levels of perseverative thinking (all $p \leq .01$). When comparing Featback without therapist support with the pooled Featback conditions with therapist support (statistical model 2), the results demonstrated no significant differences between the conditions over time (all $p > .05$, see Supplementary Material 3), indicating that participants improved to a similar degree. When comparing Featback with low- versus high-intensity therapist support (statistical model 3), no significant time-by-condition effects were found for the majority of the outcome measures (Supplementary Material 4). Except for ED-related quality of life: participants who received Featback with high-intensity therapist support showed greater improvements in ED-related quality of life from baseline to post-intervention ($p = .001$, $d = 0.15$, 95%CI=0.06 to 0.24) and from post-intervention to 6-month follow-up ($p = .01$, $d = 0.14$, 95% CI 0.03 to 0.25) than participants who received Featback with low-intensity therapist support. This finding should be interpreted with caution, as participants who received Featback without therapist support scored in between and thereby not significantly different than the two Featback conditions with therapist support (Supplementary Material 2). Completer analyses confirmed the conclusions of the intent-to-treat analyses and are therefore not reported.

Participants' experiences

Regarding participants' experiences, significant differences in participants' level of satisfaction with Featback were found ($F(2,184)=38.41$, $p < .001$). Participants who received Featback without therapist support were significantly less satisfied ($M=5.0$, $SD=1.9$, scale 1-10) than participants who received Featback with low- ($M=7.1$, $SD=1.5$) or high-intensity therapist support ($M=7.4$, $SD=1.3$), whereas no differences between the latter two were found. Overall, participants were very satisfied with the therapist support ($M=8.0$, $SD=1.4$, scale 1-10), with no significant differences between the low- and high-intensity therapist support conditions ($t(1,117)=-0.34$, $p=.74$). In addition, no significant differences in satisfaction with the different therapists were found ($F(6,112)=0.36$, $p=.90$).

A total of 158 participants provided negative feedback, and 160 participants provided positive feedback to the open-ended questions regarding their satisfaction with the intervention. Participants' most reported critical comments included statements about

the limitations of the automated feedback (*n*=95, 60.1%), for example it being too general or impersonal, as well as the lack of more personal or individual therapist support. Most of the positive comments (*n*=107, 84.3%) included complementary remarks regarding the individual therapist support, such as participants having received good advice and support, having enjoyed the empathy, warmth, and attention of the therapists, as well as the feeling that someone was looking after them. Approximately one third (*n*=45, 28.1%) of all positive comments included positive feedback on this system, for example experiencing the system as a good check-up supporting moments of reflection. No adverse effects from Featback were reported.

Discussion

To our knowledge, this is the first randomized controlled trial to investigate an Internet-based fully automated self-monitoring and feedback intervention ('Featback') and the added value of two different intensities of therapist support for individuals with ED psychopathology. The results demonstrated Featback to be superior to a WLC in reducing bulimic psychopathology (i.e., a total severity index of binge eating, compensatory behaviors, and overconcern with body shape and weight), perseverative thinking, and symptoms of depression and anxiety. Thus, self-monitoring of ED-related attitudes and behaviors and receiving feedback by means of an automatic system can be effective in reducing psychopathology. No effects were found regarding anorectic psychopathology, hence Featback may be more suitable for individuals with bulimic psychopathology. Interestingly, when comparing Featback with and without therapist support, no added value was found for therapist support in terms of the effectiveness of the intervention, although participants who received Featback with therapist support were significantly more satisfied.

Our findings add to the growing body of literature indicating the potential of E-health interventions for individuals with (ED) psychopathology (Beintner et al., 2011; Aardoom et al., 2013; Bauer et al., 2013; Loucas et al., 2014; Cuijpers, Straten, & Andersson, 2008). Our results are furthermore in line with two studies demonstrating that interventions supplemented with automated support can be equally effective to human support (Kelders et al., 2015; Tate, Jackvony, & Wing, 2006). A fully automated Internet-based intervention such as Featback is a promising, widely disseminable, easily accessible, and potentially effective means of providing care for individuals with ED psychopathology. Such care is particularly important for these individuals, given that many do not seek or receive appropriate mental health care (Hart et al., 2011). Hence, Internet-based self-help interventions might help to bridge the gap between mental disorders and mental health

care services, by improving the help-seeking pathways. Internet-based automated self-monitoring and feedback systems may be of interest to a number of other areas in the field of psychiatry. Indeed, a recent study (Kok et al., 2015) demonstrated an Internet-based intervention including self-monitoring via text-messages to be effective in remitted patients with symptoms of depression.

The finding that Featback was equally effective with and without therapist support is in line with that of several previous studies (Berger et al., 2011; Rheker, Andersson, & Weise, 2015; Mohr et al., 2013), however in contrast to the result of a recent meta-analysis that included Internet-based interventions for a range of mental health problems (Baumeister et al., 2015). This meta-analysis demonstrated guided Internet-based interventions to be significantly superior to unguided interventions. However, the larger effect sizes in the guided interventions may have been biased by significantly higher adherence rates in the guided interventions as compared with unguided interventions (Baumeister et al., 2015), whereas adherence rates in our study were similar for the guided and unguided conditions. A possible explanation for why therapist support did not enhance the effectiveness of Featback, is that the monitoring- and feedback system alone was already a relatively powerful intervention in reducing ED symptoms. Self-monitoring is an important clinical technique that is often used in cognitive behavioral therapy (Cohen et al., 2013). It can help an individual to gain a more comprehensive understanding of one's psychopathology. By self-monitoring one's psychopathology and receiving feedback, an individual is stimulated to think about the frequency, antecedents, and consequences of their problematic behaviors and attitudes (Cohen et al., 2013). Furthermore, through the provided feedback individuals are encouraged to think about possible solutions to achieve positive behavioral changes, and additionally the feedback can help them in applying and developing certain skills to promote such behavioral changes in their daily lives. It could be speculated that the self-monitoring and feedback system of the Featback intervention already provided such a powerful intervention to help reduce eating disorder psychopathology that the therapist support did not add an extra effect. Within this context, the individual therapist support might primarily be appreciated for its empathy, warmth, and attention, as well as the feeling that someone is looking after you and listening to you.

Increasing the frequency of therapist support did not significantly affect outcome, which is in line with the results of a study that experimentally investigated different intensities of therapist support in an Internet-based treatment for panic disorder (Klein et al., 2009b). More frequent therapist support did furthermore not affect the participants' satisfaction with the intervention or their therapist. Thus, increasing the amount of therapist contact may not necessarily result in increased effectiveness or

increased satisfaction with Internet-based interventions. Nevertheless, future dose-response studies should replicate these rather unexpected findings before any firm conclusions can be drawn with respect to the added value of different intensities of therapist support. Also, cost-effectiveness studies comparing different intensities of therapist support would be of great interest. Such studies can facilitate decision-making on how to most optimally deliver therapist support within Internet-based interventions. How much money needs to be invested in terms of additional therapist support in order to realize a particular amount of additional improvement in health outcomes? And does the extra benefit resulting from therapist support justify the extra cost: is adding a certain amount of therapist support good value for money?

Interestingly, our results show a discrepancy between the added value of therapist support in terms of effectiveness (no added value of therapist support) and satisfaction with the intervention (added value of therapist support). The fact that therapist support did increase the satisfaction of participants significantly, might well be due to the empathy, warmth, and attention of the therapists. Individuals with ED are often ashamed about their eating disorder, and can feel isolated and unsupported, as well as misunderstood by their personal environment (Linville, Brown, Sturm, & McDougal, 2012). Although the automated feedback as part of Featback expresses interest in participants' well-being and provides advice on how to possibly counteract certain dysfunctional beliefs or behaviors, it is not interactive. That is, individuals are not able to share their personal story, history, in-depth feelings and emotions, or experiences. In the individual therapist support sessions, they were able to (anonymously) ventilate their problems and emotions, and the majority reported on how nice it was to have someone looking after them, understanding them, and listening to them. Translating these study results to everyday clinical practice is challenging, given the added value of therapist regarding satisfaction, but not effectiveness. The resulting dilemma is about how to implement Featback: with or without therapist support? Adding such support implies more costs while not necessarily resulting in increased effectiveness. That being said, adding therapist support presumably heightens the attractiveness and thus reach of the intervention, eventually leaving more individuals feeling supported. An interesting future research direction would be to investigate the effectiveness of adding personal support by means of an online peer support group. Possibly, the personal interactive support of peers might be sufficient to increase satisfaction rates, while at the same time reducing costs in comparison to trained professionals.

Adding therapist support did not enhance study adherence, as no differences between study dropout rates were found between the three Featback conditions. However, our results showed that at 3-month follow-up, participants in the waiting list

condition dropped out less often than participants who received Featback without or with low-intensity therapist support. Presumably, participants in the waiting list condition were more motivated to complete the study questionnaires given their knowledge that they would receive Featback with low-intensity therapist support after completing this follow-up questionnaire.

It is noteworthy that Featback produced significant reductions in psychopathology over and above usual care. Participants' treatment status (yes/no) or number of received psychological health care appointments during the intervention period did not significantly differ between the study conditions and could furthermore not account for the superiority of Featback in comparison to WLC when entered as a predictor in the model. This suggests minimal self-help interventions such as Featback to be of interest for a broad population of individuals with ED symptoms. The small effect sizes matches our expectations, given the type of intervention (i.e., self-help) and the fact that the majority of participants received psychological health care during the intervention period. Interventions like Featback could be incorporated within regular treatment settings (i.e. blended care), where it would enable accurate monitoring of patients' wellbeing in treatment settings as well as in their everyday lives (Tregarthen, Lock, & Darcy, 2015; Cohen et al., 2013). Also, information about patterns of dysfunctional attitudes and behaviors as gathered by the use of self-monitoring, may aid in clarifying the rationale and goals for treatment, as well as informing therapists and patients about the patient's progress in treatment. It could furthermore be useful to incorporate self-help interventions such as Featback as a first step within a stepped care approach in the treatment of ED, thereby providing low-intensity care to individuals with ED symptoms who might not (yet) need more intense specialist care. Individuals who remain symptomatic after a certain period of time could then 'step up' to a more intense specialist care. Similarly, Featback could also be used as a 'step down' intervention after a more intensive treatment. Individuals can keep track of their ED symptoms and can be supported in their process of recovery. In addition, Featback as a 'step down' intervention could allow for early identification and prevention of relapse. The potential effectiveness and cost-effectiveness of a stepped care approach starting with self-help, as compared with cognitive behavior therapy, has already been demonstrated in a large multi-center trial for individuals with bulimia nervosa (Crow et al., 2013; Mitchell et al., 2011). In sum, investigating the effectiveness of Featback within treatment settings, or as part of stepped-care approaches in the treatment of ED, is an interesting area for future research.

This study has several strengths and limitations. Strengths include the large sample size, randomized controlled design, intent-to-treat analyses, and the use of multiple imputation methods as these have shown improved performance over

alternative approaches such as complete case analysis or single imputation methods (Schafer et al., 2002). Limitations include the lack of a 6-month follow-up for the WLC and the considerable amount of missing data at 3- and 6-month follow-up. The non-significant differences between the three Featback conditions should be interpreted with caution as statistical power might have been reduced due to the missing data at 3- and 6-month follow-up. The use of broad eligibility criteria can be regarded as both a strength and a limitation. The broad inclusion criteria may well have led to a study population that bears close resemblance to reality, thereby enhancing the generalizability of our findings as well as being consistent with the aim of an easily accessible intervention for a broad population of individuals with ED psychopathology. Alternatively, the broad inclusion criteria can be regarded as a limitation given the potential influences of variables such as the presence of comorbid disorders or the use of co-interventions on study outcome measures that were not under study control. Nevertheless, we attempted to reduce the risk of bias by acquiring detailed information on participant characteristics and external influences, so that these influences could be examined and controlled for in the analyses. Finally, the use of online self-report assessments can be considered both a strength and limitation. Advantages include a reduction in research costs and being in line with the aims of the anonymous E-health intervention: being able to remain anonymous which lowers the barriers of seeking help, and maximizing the accessibility, efficiency and availability of health care services. Another advantage includes the minimization of the risk of bias because of the lack of face-to-face contact with participants. However, the latter might have reduced study and/or intervention commitment (Aardoom et al., 2013) and it resulted in the absence of a face-to-face diagnostic interview. Although we did provide a diagnostic impression of the study sample using the EDE-Q (American Psychiatric Association, 2013), it must be emphasized that the resulting classifications provide only an approximation of DSM-5 classifications as there are limitations to the use of the EDE-Q in evaluating the diagnostic criteria of ED (Berg et al., 2012).

In conclusion, an Internet-based fully automated monitoring and feedback intervention was effective in reducing psychopathology and is an interesting means of providing care for individuals with ED symptoms. Supplemental therapist support enhanced satisfaction with the intervention, but did not increase its effectiveness. An interesting next step is to economically evaluate Featback with and without therapist support to determine its cost-effectiveness in comparison to a waiting list. Also, examining potential predictors, moderators, and mediators of intervention response will help to inform the field regarding for whom and how Featback work(s). A final topic for future investigation is a focus on opening the black box of therapeutic support in Internet-based

interventions: what do therapists actually do when providing online support, and can their behavior be linked to the effectiveness of such interventions?

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Conflicts of interest

None.

Supplementary Material 1. Specification of statistical models and contrast coding.

Condition contrasts (CC):

	CC1	CC2	CC3
Featback without therapist support	1	1	0
Featback with low-intensity therapist support	1	-1	1
Featback with high-intensity therapist support	1	-1	-1
Waiting list control	0	0	0

Time contrasts (TC):

	TC1	TC2	TC3
Baseline	-1	0	0
Post-intervention	1	-1	-1
3-month follow-up	0	1	0
6-month follow-up	0	0	1

Statistical model 1:
CC1 (Featback with & without therapist support versus waiting list control)
TC1 (Baseline versus post-intervention)
TC2 (Post-intervention versus 3-month follow-up)
CC1*TC1
CC1*TC2

Statistical model 2:
CC2 (Featback with therapist support versus Featback without therapist support)
TC1 (Baseline versus post-intervention)
TC2 (Post-intervention versus 3-month follow-up)
TC3 (Post-intervention versus 6-month follow-up)
CC2*TC1
CC2*TC2
CC2*TC3

Statistical model 3:
CC3 (Featback with low- intensity versus high-intensity therapist support)
TC1 (Baseline versus post-intervention)
TC2 (Post-intervention versus 3-month follow-up)
TC3 (Post-intervention versus 6-month follow-up)
CC3*TC1
CC3*TC2
CC3*TC3

Supplementary Material 2. Non-imputed outcome data (means and standard deviations) in a trial investigating the effectiveness of Internet-based fully automated monitoring- and feedback intervention *'Featback'* with different intensities of therapist support and a waiting list control condition.

Measure	Featback without therapist support (*n*=87)	Featback + Low-intensity therapist support (*n*=88)	Featback + High-intensity therapist support (*n*=89)	Waiting list control (*n*=90)
Anorectic psychopathology (SEED-AN)				
Baseline	1.07 (0.37)	1.09 (0.42)	1.11 (0.41)	1.11 (0.43)
Post-intervention	1.10 (0.40)	1.14 (0.42)	1.05 (0.40)	1.13 (0.41)
3-Month follow-up	1.12 (0.42)	1.03 (0.44)	1.05 (0.36)	1.03 (0.41)
6-Month follow-up	1.00 (0.39)	1.01 (0.45)	1.05 (0.35)	n/a
Bulimic psychopathology (SEED-BN)				
Baseline	1.41 (0.66)	1.50 (0.72)	1.49 (0.63)	1.47 (0.70)
Post-intervention	1.25 (0.68)	1.27 (0.63)	1.29 (0.71)	1.45 (0.69)
3-Month follow-up	1.02 (0.67)	1.28 (0.76)	1.02 (0.70)	1.27 (0.71)
6-Month follow-up	0.97 (0.74)	1.25 (0.60)	0.94 (0.68)	n/a
Global ED psychopathology (EDE-Q)				
Baseline	4.24 (0.80)	4.43 (0.94)	3.95 (0.79)	4.05 (1.11)
Post-intervention	4.05 (1.00)	3.81 (1.18)	3.58 (1.32)	3.92 (1.14)
3-Month follow-up	3.53 (1.40)	3.57 (1.37)	3.50 (1.58)	3.85 (1.32)
6-Month follow-up	3.43 (1.50)	3.55 (1.56)	3.15 (1.67)	n/a
ED-related quality of life (ED-QOL)				
Baseline	2.75 (0.68)	2.70 (0.53)	2.65 (0.56)	2.73 (0.72)
Post-intervention	2.59 (0.69)	2.55 (0.62)	2.49 (0.69)	2.46 (0.73)
3-Month follow-up	2.14 (0.69)	2.47 (0.61)	2.22 (0.66)	2.35 (0.63)
6-Month follow-up	2.22 (0.79)	2.39 (0.69)	1.88 (0.73)	n/a
Symptoms anxiety & depression (PHQ-4)				
Baseline	8.11 (3.12)	8.48 (2.74)	8.08 (3.06)	8.14 (3.11)
Post-intervention	6.50 (3.38)	6.51 (3.53)	6.79 (3.52)	7.70 (3.39)
3-Month follow-up	5.03 (3.50)	6.07 (3.65)	6.72 (3.77)	7.41 (3.50)
6-Month follow-up	5.00 (3.94)	6.40 (3.65)	6.29 (3.92)	n/a
Perseverative thinking (PTQ)				
Baseline	2.79 (0.73)	2.86 (0.70)	2.78 (0.64)	2.78 (0.76)
Post-intervention	2.58 (0.98)	2.46 (1.04)	2.40 (1.01)	2.78 (0.86)
3-Month follow-up	2.11 (1.02)	2.29 (1.03)	2.39 (1.04)	2.52 (1.00)
6-Month follow-up	2.09 (1.05)	2.33 (1.07)	2.31 (1.18)	n/a

SEED=Short Examination of Eating Disorders; AN=Anorexia Nervosa; BN=Bulimia Nervosa; EDE-Q=Eating Disorder Examination Questionnaire; ED-QOL=Eating Disorder-related Quality Of Life; PHQ-4=Patient Health Questionnaire; PTQ= Perseverative Thinking Questionnaire

Supplementary Material 3. Results of linear mixed model analyses comparing the effectiveness of an Internet-based fully automated monitoring- and feedback intervention with and without therapist support (statistical model 2). Results are based on the pooled results of 100 multiple imputed datasets.

	Time effects			Time x Condition effects		
Measure	***B***	***t (p)***	***95% CI***	***B***	***t (p)***	***95% CI***
Anorectic psychopathology (SEED-AN)						
Baseline to post-intervention	-0.02	-1.49 (.14)	-0.05 to 0.006	0.006	0.44 (.66)	-0.02 to 0.03
Post-intervention to 3-month follow-up	-0.007	-0.45 (.66)	-0.04 to 0.02	0.02	0.99 (.32)	-0.02 to 0.05
Post-intervention to 6-month follow-up	-0.04	-1.93 (.06)	-0.07 to .001	-0.02	-0.86 (.39)	-0.05 to 0.02
Bulimic psychopathology (SEED-BN)						
Baseline to post-intervention	-0.21	-8.07 (<.001)	-0.26 to -0.16	-0.006	-0.23 (.82)	-0.06 to 0.05
Post-intervention to 3-month follow-up	-0.08	-2.81 (.005)	-0.14 to -0.03	-0.01	-0.35 (.73)	-0.08 to 0.06
Post-intervention to 6-month follow-up	-0.19	-4.73(<.001)	-0.27 to -0.11	-0.03	-0.66 (.51)	-0.11 to 0.06
Global ED psychopathology (EDE-Q)						
Baseline to post-intervention	-0.40	-8.45 (<.001)	-0.49 to -0.31	0.05	1.02 (.31)	-0.05 to 0.15
Post-intervention to 3-month follow-up	-0.11	-2.53 (.01)	-0.20 to -0.02	-0.01	-0.23 (.82)	-0.11 to 0.09
Post-intervention to 6-month follow-up	-0.37	-5.76 (<.001)	-0.49 to -0.24	-0.01	-0.23 (.82)	-0.14 to 0.11
ED-related quality of life (ED-QOL)						
Baseline to post-intervention	-0.22	-10.51 (<.001)	-0.27 to -0.18	-0.005	-0.22 (.83)	-0.05 to 0.04
Post-intervention to 3-month follow-up	-0.09	-3.70 (<.001)	-0.14 to -0.04	-0.02	-0.71 (.48)	-0.07 to 0.03
Post-intervention to 6-month follow-up	-0.22	-7.46 (<.001)	-0.27 to -0.16	-0.01	-0.39 (.70)	-0.07 to 0.05
Symptoms anxiety & depression (PHQ-4)						
Baseline to post-intervention	-1.38	-11.76 (<.001)	-1.61 to –1.15	-0.13	-0.94 (.35)	-0.40 to 0.14
Post-intervention to 3-month follow-up	-0.50	-3.67 (<.001)	-0.76 to -0.23	-0.09	-0.58 (.56)	-0.38 to 0.21
Post-intervention to 6-month follow-up	-0.88	-5.33 (<.001)	-1.21 to -0.56	-0.15	-0.94 (.35)	-0.47 to 0.17
Perseverative thinking (PTQ)						
Baseline to post-intervention	-0.30	-8.99 (<.001)	-0.36 to -0.23	0.02	0.60 (.55)	-0.05 to 0.09
Post-intervention to 3-month follow-up	-0.13	-3.49 (.001)	-0.20 to -0.06	-0.03	-0.59 (.55)	-0.11 to 0.06
Post-intervention to 6-month follow-up	-0.23	-4.74 (<.001)	-0.33 to -0.13	-0.005	-0.09 (.93)	-0.10 to 0.09

SEED=Short Examination of Eating Disorders; AN=Anorexia Nervosa; BN=Bulimia Nervosa; EDE-Q=Eating Disorder Examination Questionnaire; ED-QOL=Eating Disorder-related Quality Of Life; PHQ-4=Patient Health Questionnaire; PTQ= Perseverative Thinking Questionnaire

Note 1: Values smaller than 0.01 are reported to 3 decimals places.

Note 2: Including covariates age, marital status, duration of eating disorder psychopathology, and number of received psychological health care appointments did not alter the above mentioned findings.

Supplementary Material 4. Results of linear mixed model analyses comparing the effectiveness of an Internet-based fully automated monitoring- and feedback intervention with low-intensity (once a week) versus high-intensity (three times a week) therapist support (statistical model 3). Results are based on the pooled results of 100 multiple imputed datasets.

	Time effects			Time x Condition effects		
Measure	***B***	***t (p)***	***95% CI***	***B***	***t (p)***	***95% CI***
Anorectic psychopathology (SEED-AN)						
Baseline to post-intervention	-0.02	-1.63 (.10)	-0.05 to 0.004	0.01	0.77 (.44)	-0.02 to 0.05
Post-intervention to 3-month follow-up	-0.01	-0.81 (.42)	-0.04 to 0.02	0.007	0.32 (.75)	-0.04 to 0.05
Post-intervention to 6-month follow-up	-0.03	-1.67 (.10)	-0.70 to .005	-0.03	-1.28 (.20)	-0.07 to 0.02
Bulimic psychopathology (SEED-BN)						
Baseline to post-intervention	-0.21	-8.48 (<.001)	-0.25 to -0.16	0.05	1.54 (.13)	-0.01 to 0.11
Post-intervention to 3-month follow-up	-0.08	-2.89 (.004)	-0.14 to -0.03	0.03	0.69 (.49)	-0.05 to 0.11
Post-intervention to 6-month follow-up	-0.18	-5.04 (<.001)	-0.25 to -0.11	0.07	1.77 (.08)	-0.007 to 0.15
Global ED psychopathology (EDE-Q)						
Baseline to post-intervention	-0.41	-9.21 (<.001)	-0.50 to -0.33	0.06	1.11 (.27)	-0.05 to 0.17
Post-intervention to 3-month follow-up	-0.11	-2.59 (.01)	-0.19 to -0.03	-0.01	-0.19 (.85)	-0.13 to 0.11
Post-intervention to 6-month follow-up	-0.36	-6.09 (<.001)	-0.48 to -0.25	0.10	1.41 (.16)	-0.04 to 0.23
ED-related quality of life (ED-QOL)						
Baseline to post-intervention	-0.22	-11.19 (<.001)	-0.26 to -0.18	0.09	3.25 (.001)	0.03 to 0.14
Post-intervention to 3-month follow-up	-0.09	-3.83 (<.001)	-0.13 to -0.04	0.04	1.44 (.15)	-0.02 to 0.10
Post-intervention to 6-month follow-up	-0.21	-8.13 (<.001)	-0.26 to -0.16	0.08	2.50 (.01)	0.02 to 0.15
Symptoms anxiety & depression (PHQ-4)						
Baseline to post-intervention	-1.34	-12.17 (<.001)	-1.56 to -1.12	-0.20	-1.33 (.18)	-0.51 to 0.10
Post-intervention to 3-month follow-up	-0.49	-3.84 (<.001)	-0.73 to -0.23	-0.23	-1.31 (.19)	-0.57 to 0.11
Post-intervention to 6-month follow-up	-0.83	-5.56 (<.001)	-1.12 to -0.54	0.09	0.52 (.61)	-0.26 to 0.44
Perseverative thinking (PTQ)						
Baseline to post-intervention	-0.30	-9.56 (<.001)	-0.36 to -0.24	0.004	0.84 (.93)	-0.08 to 0.09
Post-intervention to 3-month follow-up	-0.12	-3.56 (<.001)	-0.19 to -0.05	-0.03	-0.56 (.58)	-0.12 to 0.07
Post-intervention to 6-month follow-up	-0.23	-5.06 (<.001)	-0.32 to -0.14	0.01	0.28 (.78)	-0.09 to 0.12

SEED=Short Examination of Eating Disorders; AN=Anorexia Nervosa; BN=Bulimia Nervosa; EDE-Q=Eating Disorder Examination Questionnaire; ED-QOL=Eating Disorder-related Quality Of Life; PHQ-4=Patient Health Questionnaire; PTQ= Perseverative Thinking Questionnaire
Note: Including covariates age, marital status, duration of eating disorder psychopathology, and number of received psychological health care appointments did not alter the above mentioned findings.

Chapter 6

Moderators of change in an Internet-based intervention for eating disorders: What works for whom?

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Abstract

Objective: This study investigated moderators of intervention response in a fully automated Internet-based monitoring and feedback intervention ('Featback') with different levels of therapist support for individuals with eating disorder (ED) symptoms.
Methods: This study was part of a randomized controlled trial comparing four conditions: 1) Featback, 2) Featback with low-intensity (weekly) therapist support, 3) Featback with high-intensity (three times a week) therapist support, and 4) a waiting list. A total of 273 participants completed baseline and post-intervention assessments. The outcome measure was ED psychopathology. Model-based recursive partitioning was applied.
Results: Baseline levels of ED psychopathology were found to moderate intervention response. Specifically, in terms of improvement in symptoms of anorexia nervosa, participants with higher baseline levels of anorectic psychopathology showed better outcomes in the waiting list condition and the Featback conditions with low- and high-intensity therapist support in comparison with Featback without therapist support. In terms of improvement in symptoms of bulimia nervosa, participants with mild to moderate bulimic symptoms had better outcomes in the Featback conditions compared with the waiting list.
Discussion: The fully automated Internet-based intervention may be particularly suitable for individuals with mild to moderate bulimic psychopathology. Further investigating differential intervention responses is important, as this could help to optimize the delivery and dissemination of E-health interventions and therapist support, which in turn could help moving toward personalized (E-)care.

Introduction

Numerous studies have demonstrated that Internet-based interventions can reduce eating disorder (ED) psychopathology (e.g. (Aardoom et al., 2013; Beintner et al., 2011; Melioli et al., 2016)). However, investigating the average impact of Internet-based interventions could mask individual differences in responses to such interventions. Little is known about patient characteristics that may be relevant for predicting who will benefit from such interventions and who will not. It is possible that certain subgroups of participants respond better to particular Internet-based interventions than others. In addition, there may be differences in the way individuals respond to therapist contact. Moderator analyses can be used to investigate such individual differences in intervention response (Baron & Kenny, 1986; Frazier, Tix, & Barron, 2004; Kraemer, Wilson, Fairburn, & Agras, 2002), specifying for whom and under what conditions an intervention is effective. Moderators are baseline variables that are associated with intervention outcome, where the magnitude or direction of the effect differs across interventions (e.g. if women do better in intervention X, whereas men do better in intervention Y). General predictor variables differ from moderator variables in that the association of the predictor with intervention outcome does not differ across interventions (e.g. if women respond better than men to both intervention X and intervention Y).

When comparing a treatment or intervention with a control condition, such as a waiting list or usual care, it is considered more valuable to focus on studying moderators of treatment or intervention response than to examine general predictors. The important question is to investigate who is likely to respond best to the treatment or intervention and not who generally responds best over time, irrespective of receiving an intervention or being on a waiting list or receiving usual care. In other words, predictors do not necessarily provide information identifying the individuals for whom the intervention is likely to work better than being on a waiting list or receiving usual care. Hence, successful identification of moderators could be highly informative for clinical practice. Identifying who will do best with which kind of intervention could optimize the delivery and dissemination of an intervention by tailoring the type and intensity of the intervention to individual patient characteristics. It is a first step toward the development of personalized patient care. Personalized care is becoming increasingly important and is preferable to a 'one-size-fits-all' approach. Indeed, for adults with anorexia nervosa, there is no single superior treatment approach (National Institute for Clinical Excellence, 2004), and for individuals with bulimia nervosa and binge-eating disorder, the treatment of choice (i.e. cognitive behavioral therapy) still fails to help a substantial proportion of patients (Wilson, Grilo, & Vitousek, 2007).

Numerous studies have identified general predictors of outcome for individuals with ED in naturalistic settings, face-to-face treatments, and E-health interventions (Berkman, 2007; Wagner et al., 2015; Grilo, Masheb, & Crosby, 2012; Fichter et al., 2006; Keel et al., 2010). Keel et al. (2010) reviewed the literature with respect to prognostic factors for ED course and outcome. Factors related to the severity and duration of the illness were identified as negative predictors of outcome for individuals with anorexia nervosa. For individuals with bulimia nervosa, greater psychiatric comorbidity was found to predict poorer outcomes, whereas for binge-eating disorder and eating disorder not otherwise specified, few prognostic factors could be reliably identified.

Research into moderators of intervention response within face-to-face or E-health settings is scarce. To date, two studies have compared face-to-face prevention programs for ED with an educational brochure or assessment-only control condition respectively. Stronger intervention effects were found for those with elevated baseline levels of ED symptoms (Stice, Rohde, Shaw, & Marti, 2013; Stice, Rohde, Shaw, & Marti, 2012), and higher levels of body image distress, bulimic symptoms, and thin-ideal internalization (Stice, Marti, Shaw, & O'Neil, 2008). Taylor et al. (2006) investigated moderators of outcome in a randomized controlled trial comparing an Internet-based prevention program with a waiting list control condition. Participants with an elevated baseline BMI of > 25 and a higher baseline frequency of compensatory behaviors achieved significantly better outcomes in the intervention condition compared with the waiting list condition. Finally, a study by Völker et al. (2014) identified several moderators of response in a similar Internet-based prevention program. They found that reductions in binge-eating were stronger for participants with a lower BMI and a higher frequency of purging at baseline. In terms of moderators of outcome as defined by general levels of ED psychopathology, those who restricted their caloric intake and showed lower levels of purging at baseline had a better outcome (Volker, Jacobi, Trockel, & Taylor, 2014). In sum, there is only limited and conflicting evidence regarding moderators of intervention outcomes for individuals with ED symptoms.

The aim of the current study was to examine moderators of outcome in a fully automated Internet-based monitoring and feedback intervention (‘Featback’), supplemented with different intensities of therapist support (i.e. none, once a week, and three times a week) for individuals with ED symptoms. This could help to identify patients who are likely to benefit from Featback and additional therapist support, and patients who are not.

Method

Study design and participants

This study was conducted as part of a randomized controlled trial (Aardoom et al., 2013). This trial involved four conditions: 1) 'Featback', an Internet-based self-help intervention for individuals with ED symptoms, consisting of psychoeducation and a fully automated monitoring and feedback system, 2) Featback supplemented with the possibility of low-intensity (weekly) therapist support by means of e-mail, chat, or Skype, 3) Featback supplemented with the possibility of high-intensity (three times a week) therapist support, and 4) a waiting list control condition. The fully automated monitoring and feedback system comprised a weekly monitoring questionnaire addressing ED psychopathology. After completion of this questionnaire, supportive feedback messages were automatically generated according to a pre-defined algorithm and sent to the participants accordingly (for more details on the study design and the intervention, see Aardoom et al. (2013)).

Participants (*N*=354) were recruited via the Featback website and the website of Proud2Bme, a Dutch pro-recovery focused e-community for young women with ED problems. The eligibility criteria were 1) age ≥ 16, 2) access to the Internet, and 3) self-reported ED symptoms. Ethical approval for the study was obtained from the Leiden University Medical Center ethics committee. The results of this randomized controlled trial demonstrated that Featback was superior in reducing bulimic psychopathology, symptoms of depression and anxiety, and levels of perseverative thinking, in comparison with the waiting list (Aardoom et al., 2016). Contrary to the expectations, no added value of therapist support was found in terms of the effectiveness of Featback.

The current study only included the data of participants who completed both baseline and post-intervention assessments (*n*=273).

Outcome variables

Outcome variables were assessed at baseline and post-intervention, and included anorectic and bulimic psychopathology as measured by the Short Evaluation of Eating Disorders (SEED) (Bauer et al., 2005). The SEED is a brief self-report measure for the assessment of core eating disorder symptoms over the past week. The SEED assesses the main symptoms of anorexia nervosa (underweight, fear of weight gain, distortion of body perception) and bulimia nervosa (binge-eating, compensatory behaviors, over-concern with body shape and weight). Total severity indexes can be calculated for each of these two dimensions (range 0–3), with higher scores reflecting higher severity indexes. The SEED has demonstrated construct, discriminative, and concurrent validity, and has shown that it is sensitive to symptom change (Bauer et al., 2005).

Potential moderator variables

Socio-demographic variables

Socio-demographic variables included as potential moderator variables were age and level of education (low, medium, high).

Eating disorder psychopathology

Potential moderator variables related to eating disorder psychopathology included baseline levels of anorectic and bulimic psychopathology (SEED), treatment history (yes/no), duration of ED problems (years), and BMI (underweight (<18.5), healthy weight (18.5-25), overweight (25-30), and obese (>30)). Finally, ED type (anorexia nervosa, binge-eating disorder, bulimia nervosa, purging disorder, and unspecified feeding or ED or an ED problem) was assessed by the Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn et al., 2008). The EDE-Q is a widely used self-report questionnaire that assesses both the core attitudinal features of ED psychopathology and the frequency of core ED behaviors over the past 28 days. The EDE-Q has demonstrated test-retest and internal consistency reliability, as well as criterion-oriented and construct validity (Berg et al., 2011). On the basis of the EDE-Q, the participants were classified into five ED categories according to the criteria of the DSM-5 (American Psychiatric Association, 2013). Participants who reported a body mass index of ≤ 18.5 combined with a fear of weight gain or of becoming fat were classified as anorexia nervosa. Participants were classified in the binge-eating disorder category if they reported objective binge-eating episodes at least once a week in the past 28 days, without recurrent use of inappropriate compensatory behaviors (i.e. less than once a week over the past 28 days). The category of bulimia nervosa consisted of participants with self-reported episodes of objective binge-eating and inappropriate compensatory behaviors (i.e. self-induced vomiting or misuse of laxatives), both at least once a week or more during the past 28 days. The purging disorder category comprised participants who self-reported purging behaviors once a week or more during the past 28 days in the absence of binge-eating episodes. Finally, if participants did not meet the criteria of any of the categories mentioned above, they were categorized under an unspecified feeding or ED or an ED problem without a DSM-5 classification.

Motivation to change

Three motivation rulers were used to assess participants' motivation to change: their perceived importance of change, their perceived ability/confidence to change, and their perceived readiness to change. Such rulers have been used in previous studies in the field

of eating disorders (Bewell et al., 2008; Genders et al., 2010; Weiss, Mills, Westra, & Carter, 2013), and have demonstrated good psychometric properties in the field of smoking cessation (Boudreaux et al., 2012). Responses were scored on an 11-point Likert scale, ranging from 0 'not at all' to 10 'very much'.

Symptoms of anxiety and depression

The 4-item Patient Health Questionnaire (PHQ-4) (Kroenke et al., 2009) assesses symptoms of anxiety and depression over the past 2 weeks. The PHQ-4 comprises two core anxiety items and two core depression items, all of which can be answered on a 4-point Likert scale, ranging from 0 'not at all' to 3 'nearly every day'. A total score (range 0–12) can be calculated by summing the scores of all four items, with higher scores reflecting higher symptom severity. Factorial and construct validity have been demonstrated by Kroenke et al. (2009).

Levels of perseverative thinking

The 15-item Perseverative Thinking Questionnaire (PTQ) (Ehring et al., 2012) was used as a global measure of repetitive negative thinking in the form of content-independent worry and rumination. The PTQ assesses the repetitiveness, intrusiveness, difficulties with disengagement from, and unproductiveness of repetitive negative thinking. It also assesses the degree to which it captures mental capacity. Items can be answered on a 5-point Likert scale, ranging from 0 'never' to 4 'almost always'. The timeframe was changed from 'in general' to 'in the previous 4 weeks'. The Dutch PTQ has demonstrated good internal consistency and satisfactory stability (Ehring et al., 2012).

Statistical analyses

All data were analyzed in R version 3.2.1 (R Development Core Team, 2014)**.** Potential moderators were investigated using model-based recursive partitioning methods (Hothorn & Zeileis, 2015). Model-based recursive partitioning can be used to detect treatment-subgroup interactions: subgroups of individuals with different (i.e. more or less favorable) responses to one or more treatments, compared with other individuals (Doove, Dusseldorp, van Deun, & van Mechelen, 2014). Translated to the current study, this means investigating which subgroups of individuals respond best to 1) Featback without therapist support, 2) Featback with low-intensity (i.e. weekly) therapist support, 3) Featback with high-intensity (i.e. three times a week) therapist support, or 4) a waiting list control condition (i.e. usual care). Advantages of model-based recursive partitioning methods include the ability to handle many potential moderator variables at once in one model, the modeling of non-linear relationships, and the ability to capture (higher-order) interaction

effects between predictor variables. They also provide specific cut-off ('split') points for the moderator variables, which facilitates the identification of subgroups that are likely to respond or not. In addition, the results of model-based recursive partitioning can be graphically represented as a decision tree. These trees are more easily interpretable than the outcomes of linear models, and can be used directly as a decision-making tool in clinical practice (Fokkema, Smits, Kelderman, & Penninx, 2015; Martignon, Vitouch, Takezawa, & Forster, 2003).

The model-based recursive algorithm is explained in detail in Zeileis et al. (Zeileis, Hothorn, & Hornik, 2008). The algorithm requires the user to specify the outcome variable of interest, the predictor variable for which the effect on the outcome variable is assessed, and potential partitioning variables. In our analyses, change in outcome was used as the outcome variable, calculated as post-intervention scores minus baseline scores, so that a negative score represented a reduction in ED psychopathology. The predictor variable was an indicator for intervention type, and the potential partitioning variables were described above, in the subsection 'Potential moderator variables'. In line with the conducted analyses regarding the effectiveness of Featback (Aardoom et al., 2016), in the model-based recursive partitioning analyses, we first compared the waiting list control condition with the three pooled Featback conditions. After this, the Featback conditions were compared individually, and with the waiting list control condition. Between-group effect sizes were calculated by dividing the sum of the means of both conditions by the pooled standard deviation of the samples at baseline.

Results

Participants

A total of 273 (77.1%, dropout=22.9%) participants provided data at baseline and post-intervention: 60 (60.9%) participants in the Featback condition, 70 (79.5%) and 71 (79.8%) participants in the Featback condition supplemented with low-and high-intensity therapist support respectively, and 72 (80.0%) participants in the waiting list control condition. Study dropout rates did not significantly differ between conditions at post-intervention ($\chi^2(3)=4.35$, $p=.23$). The baseline characteristics of the study population are presented in Table 1. Participants were mainly female ($n=271$, 99.3%) and had a mean age of 24.4 years. Approximately 48.9% of the participants reported to have been diagnosed with an ED. Participants demonstrated severe levels of ED psychopathology as measured by the EDE-Q ($M=4.1$, $SD=0.9$). More specifically, the mean EDE-Q score is comparable to the

Table 1. Baseline characteristics of the study population.

	Waiting list (*n*=72)	Featback (*n*=60)	Featback +Low-intensity therapist support *n*=70)	Featback +High-intensity therapist support (*n*=71)	Total study population (*n*=273)	Statistics
Categorical variables: *n (%)*						
ED subtype						$\chi^2(12)=17.7$, $p=.12$
Anorexia nervosa	25 (36.8)	15 (25.9)	22 (33.3)	18 (26.5)	80 (30.8)	
Binge eating disorders	13 (19.1)	15 (25.9)	19 (28.8)	21 (30.9)	68 (26.2)	
Bulimia nervosa	18 (26.5)	10 (17.2)	16 (24.2)	10 (14.7)	54 (20.8)	
Purging disorders	1 (1.5)	3 (5.2)	5 (7.6)	4 (5.9)	13 (5.0)	
Unspecified ED/ED problems*	11 (16.2)	15 (25.9)	4 (6.1)	15 (22.1)	45 (17.3)	
Education level						$\chi^2(6)=4.00$, $p=.68$
Low	8 (11.1)	3 (5.0)	4 (5.7)	5 (7.0)	20 (7.3)	
Intermediate	12 (16.7)	11 (18.3)	18 (25.7)	15 (28.2)	56 (20.5)	
High	52 (72.2)	46 (76.7)	48 (68.6)	51 (71.8)	197 (72.2)	
Treatment history ED						$\chi^2(3)=6.82$, $p=.08$
Yes	28 (38.9)	35 (58.3)	35 (50.0)	28 (39.4)	126 (26.2)	
No	44 (61.1)	25 (41.7)	35 (50.0)	43 (60.6)	147 (53.8)	
Body Mass Index						$\chi^2(9)=5.16$, $p=.82$
Underweight (<18.5)	25 (34.7)	15 (25.0)	22 (32.4)	18 (25.7)	80 (29.6)	
Healthy weight (18.5-25)	38 (52.8)	32 (53.3)	37 (54.4)	40 (57.1)	147 (54.4)	
Overweight (25-30)	6 (8.3)	6 (10.0)	4 (5.9)	5 (7.1)	21 (7.8)	
Obese (>30)	3 (4.2)	7 (11.7)	5 (7.4)	7 (10.0)	22 (8.1)	
Continuous variables: *m (sd)*						
Age (years)	23.2 (6.6)	25.2 (8.0)	23.4 (7.3)	26.1 (9.4)	24.4 (7.9)	$F(3,269)=2.17$, $p=.09$
Duration ED problems (years)	6.0 (5.8)	8.9 (7.8)	6.8 (6.1)	8.0 (7.7)	7.4 (6.9)	$F(3,267)=2.29$, $p=.08$
SEED-AN	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	1.1 (0.4)	$F(3,266)=0.17$, $p=.91$
SEED-BN	1.4 (0.7)	1.4 (0.7)	1.5 (0.7)	1.5 (0.6)	1.4 (0.7)	$F(3,268)=0.47$, $p=.70$
Motivation to change						
Importance to change	8.5 (1.3)	8.2 (1.6)	8.3 (1.4)	8.4 (1.3)	8.3 (1.4)	$F(3,268)=0.37$, $p=.77$
Ability to change	6.3 (1.6)	6.1 (2.1)	6.1 (2.2)	6.4 (2.1)	6.2 (2.0)	$F(3,268)=0.43$, $p=.74$
Readiness to change	6.6 (1.9)	6.7 (1.7)	6.8 (2.0)	7.0 (1.8)	6.8 (1.9)	$F(3,268)=0.51$, $p=.68$
PHQ-4	8.2 (3.2)	8.0 (3.2)	8.4 (2.8)	8.0 (3.1)	8.2 (3.0)	$F(3,268)=0.23$, $p=.88$
PTQ	2.8 (0.7)	2.8 (0.8)	2.8 (0.7)	2.7 (0.6)	2.8 (0.7)	$F(3,268)=0.25$, $p=.86$

ED=Eating disorder; SEED=Short Evaluation of Eating Disorders; AN=Anorexia nervosa; BN=Bulimia nervosa; PHQ-4=Patient Health Questionnaire; PTQ= Perseverative Thinking Questionnaire

* Participants were classified as having ED problems when experiencing ED symptoms but not meeting the diagnostic criteria for any of the other ED subtypes

overall norm for treatment-seeking patients with an ED in our specialized ED program (Aardoom et al., 2012), and approximately 97.6% of the study participants scored above the clinical significance cut-off point of 2.2 (Dingemans et al., 2016). No significant differences were found between the four study conditions on any of the potential moderator and outcome variables at baseline (all $p>0.5$).

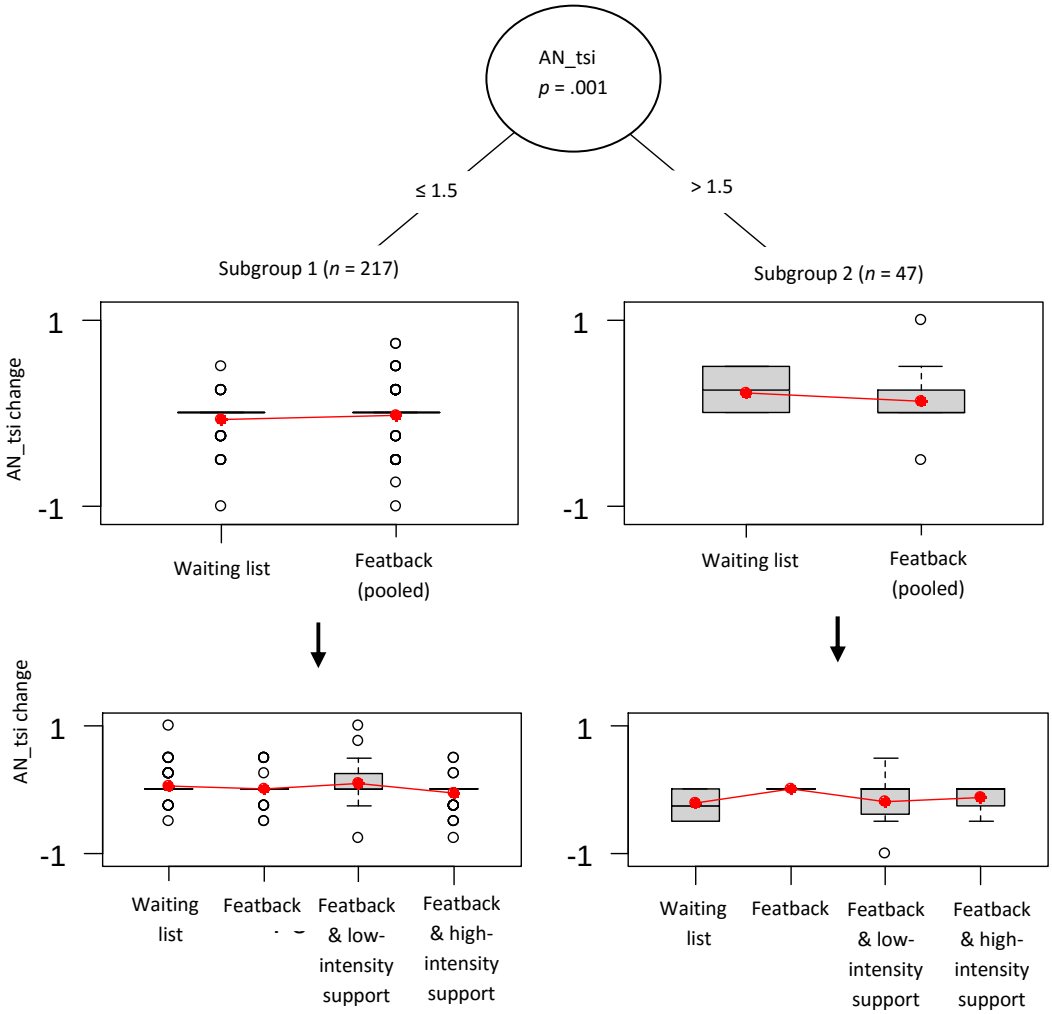
Moderators

Anorectic psychopathology

Figure 1 shows the results of the model-based recursive partitioning analysis with change in anorectic psychopathology as outcome measure. Of all entered potential moderator variables, only baseline symptoms of anorexia nervosa were found to significantly moderate intervention response. More specifically, as can be seen at the upper end of Figure 1, the variable was split at values equal to or lower than 1.5 (subgroup 1, $n=217$) and higher than 1.5 (subgroup 2, $n=47$). These subgroups consisted of participants with relatively low and high baseline levels of anorectic psychopathology respectively. For participants with relatively low levels of baseline anorectic psychopathology, the effects of both Featback and the waiting list were very small or negligible. More specifically, neither the Featback nor the waiting list appeared to be effective in reducing anorectic psychopathology. At the end of the 8-week intervention, a small increase of 0.06 in anorectic psychopathology as measured by the SEED was found for the waiting list and an increase of 0.02 for the pooled Featback conditions (Cohens' $d=0.10$, *95%CI*=-0.01 to 0.16). At the bottom of Figure 1, the results are further specified for the individual Featback conditions with different levels of therapist support. For individuals with low baseline levels of anorectic psychopathology, there was a small increase in symptoms for participants who received Featback without therapist support (0.02) and Featback with low-intensity therapist support (0.10), while there was a small reduction in symptoms in the Featback condition with high-intensity therapist support (-.05).

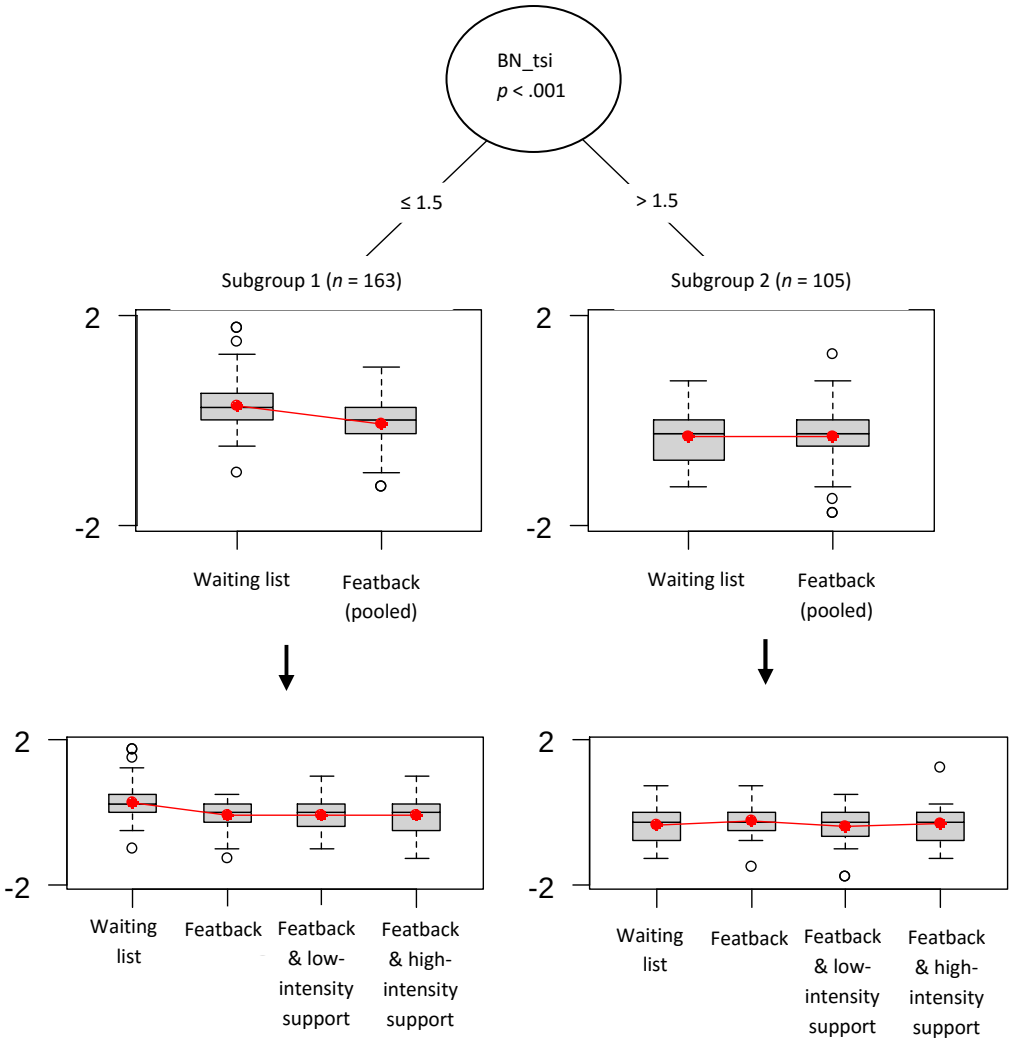
For participants with relatively high levels of baseline anorectic psychopathology (subgroup 2), small differences between the waiting list and the Featback conditions (Cohens' $d=-0.25$, *95%CI*=-0.48 to -0.12) were found regarding change in anorectic psychopathology. More specifically, the decrease in anorectic psychopathology was slightly higher in the waiting list condition (-0.22) than in the Featback conditions (-0.12). Further comparison of the three Featback conditions revealed reductions in anorectic psychopathology in the Featback conditions with low- (-0.18) and high-intensity therapist support (-0.13), whereas no change was found for participants who received Featback without therapist support (0.00). The differences between Featback without therapist

Figure 1. The results of a model-based recursive partitioning analysis with change in anorectic psychopathology (post-intervention minus baseline) as outcome measure.



AN_tsi = Anorectic psychopathology as assessed by the Short Evaluation of Eating Disorders; Featback = an Internet-based intervention that was provided with three different levels of therapist support: none, low-intensity (once a week), and high-intensity (three times a week).
Note: AN_tsi negative change scores represent reductions anorectic psychopathology

Figure 2. The results of a model-based recursive partitioning analysis with change in bulimic psychopathology (post-intervention minus baseline) as outcome measure.



BN_tsi = Bulimic psychopathology as assessed by the Short Evaluation of Eating Disorders; Featback = an Internet-based intervention that was provided with three different levels of therapist support: none, low-intensity (once a week), and high-intensity (three times a week).
Note: BN_tsi negative change scores represent reductions bulimic psychopathology

support and Featback with low-intensity (Cohens' *d*=0.46, *95%CI*=0.23 to 0.69) and high-intensity therapist support (Cohens' *d*=0.31, *95%CI*=0.07 to 0.54) were small. Finally, the difference between Featback with low- and high-intensity therapist support was negligible (Cohens' *d*=-0.15, *95%CI*=-0.38 to -0.08).

Bulimic psychopathology

Only baseline symptoms of bulimia nervosa were found to significantly moderate intervention response in terms of reduction in bulimic psychopathology (see Figure 2). For participants with relatively low levels of bulimic psychopathology (i.e. subgroup 1 (*n*=163), SEED-BN ≤ 1.5), a significant difference of moderate strength (Cohens' *d*=0.51, *95%CI*=0.30 to 0.63) was found regarding change over time in bulimic psychopathology. As shown in Figure 2, participants in the Featback conditions displayed a reduction in bulimic psychopathology (-0.06) whereas participants in the waiting list control condition displayed an increase in symptoms (0.28). The results for the individual Featback conditions are presented at the bottom of Figure 2, and show that for individuals with relatively low levels of bulimic psychopathology, the decrease in symptoms is roughly similar: -0.06 for individuals who received Featback without therapist support, and -0.04 and -0.07 for participants who received Featback with low- and high-intensity therapist support respectively.

The results of participants with relatively high bulimic psychopathology (i.e. subgroup 2 (*n*=105), SEED-BN > 1.5) are shown on the right-hand side of Figure 2. The decrease in bulimic symptoms was very similar between the waiting list and the pooled Featback conditions: -0.32 and -0.31 respectively (Cohens' *d*=-0.02; *95%CI*=-0.27 to 0.13). In addition, the decrease in bulimic psychopathology was somewhat lower for individuals who received Featback without therapist support (-0.23), and somewhat higher for participants who received Featback with low- (-0.38) and high-intensity (-0.31) therapist support respectively.

Discussion

The current study aimed to investigate moderators of response in a fully automated Internet-based monitoring and feedback intervention ('Featback') with different levels of therapist support (i.e. none, once a week, three times a week) as compared with a waiting list for individuals with ED symptoms. The results suggested that offering a fully automated monitoring and feedback system and/or therapist support to individuals who experience mild to moderate anorectic psychopathology seems to have no added value in terms of improvement in symptoms of anorexia nervosa. For those with relatively severe

anorectic psychopathology, Featback with supplemental therapist support resulted in symptom reductions similar to those of usual care, while Featback without therapist support is perhaps inadvisable. With regard to bulimic psychopathology, participants with relatively high bulimic symptoms showed similar reductions across all four conditions, whereas participants with relatively less severe bulimic symptoms had a better outcome in the Featback conditions as compared with usual care in terms of improvement in symptoms of bulimia nervosa. The results therefore suggest that Featback is particularly useful for individuals with mild to moderate bulimic psychopathology.

Featback was superior to usual care for individuals with mild to moderate bulimic psychopathology in reducing symptoms of bulimia nervosa, but not for individuals with mild to moderate anorectic psychopathology in reducing symptoms of anorexia nervosa. A possible explanation might be that binge-eating behaviors and compensatory behaviors are somewhat less difficult to target and change than core anorectic psychopathological beliefs and underweight. In other words, the binge-eating and compensatory behaviors can be more ego-dystonic in nature than, for example, the more ego-syntonic restrictive symptoms of anorexia nervosa (Schmidt & Treasure, 2006). Binge-eating and compensatory behaviors are often accompanied by shame and perceived as problematic and incongruent with the self, hence individuals may have more motivation to change these behaviors.

An automated monitoring and feedback system without therapist support appears to be less suitable for individuals with high levels of anorectic psychopathology. Presumably, the automated feedback messages are insufficient to help them in dealing with their symptoms. It is possible that in this case, it is de-motivating for participants to keep getting feedback messages with concerns about their wellbeing, without sufficient counseling in dealing with these concerns. Although adding supplemental therapist support did increase the effectiveness of the intervention, Featback with therapist support was not found to be more effective than usual care.

The results suggest that a fully automated monitoring and feedback system may be particularly suitable for individuals with mild to moderate bulimic psychopathology, however adding supplemental therapist support did not increase the effectiveness of the intervention for these individuals. This is in line with the findings of Kelders et al. (2015), who demonstrated that a web-based intervention for individuals with mild to moderate depressive symptoms resulted in similar effectiveness at 6-month follow-up when provided with human support or automated support. Although the potential of automated support should be further investigated, preliminary results suggest that automated support can be an effective way of supporting individuals with mild to moderate bulimic psychopathology in the context of an Internet-based intervention.

Hence, providing automated support might reduce the need for human therapist support, at least to some extent. If so, this could have important implications for the implementation of such interventions, potentially increasing the availability of health care services and making it possible to reach more individuals.

Numerous variables other than baseline ED psychopathology were found not to moderate intervention response. This suggests that Featback can be effective for a broad population of individuals experiencing symptoms of bulimia nervosa, irrespective of socio-demographic variables, comorbid symptoms, level of motivation to change, duration of ED symptoms, and whether the individual has received treatment or is currently receiving treatment. These last findings are particularly interesting, as they could imply that a fully automated Internet-based intervention can provide effective care for individuals with ED symptoms during various stages of their disorder, either as a stand-alone health care service, as an adjunct to usual care, or possibly as part of a stepped-care program for the treatment of ED.

This study has several strengths and limitations. One limitation was that only moderators of short-term intervention response from baseline to post-intervention were investigated. It is not known whether the results will generalize to longer periods of follow-up. In addition, the analyses were restricted to completers of both baseline and post-intervention assessments. Although we identified significant moderator effects, the results should be interpreted with caution. In the field of ED, our study is the first to use recursive partitioning methods, which are a promising approach for detecting moderators of intervention response. The results can easily be translated into clinical practice, since relevant patient characteristics and cut-off scores are identified. However, model-based recursive partitioning is an exploratory approach and confirmatory studies would be of great interest. Moreover, the subgroup of participants with high anorectic psychopathology was relatively small. Further studies are therefore needed before the results of this study can be generalized to other eating disordered populations. Finally, the decision tree resulting from the moderator analyses should first be validated before being used in clinical practice to guide the selection of tailored interventions and therapist support. Ideally, our results should be tested in a randomized controlled trial with stratification based on severity levels of anorectic and bulimic psychopathology, as relevant. It would also be interesting to investigate potential moderator effects in different contexts. For example, Featback as an add-on to usual care as compared with usual care alone, or Featback as part of a first step in a stepped-care treatment for eating disorders as compared with treatment in the usual way.

In sum, our preliminary results suggest that a fully automated Internet-based monitoring and feedback system may be particularly suitable for individuals with mild to

moderate bulimic psychopathology. The detection of subgroups of patients showing differential intervention responses is an important direction for future research, as it could help to optimize the delivery and dissemination of E-health interventions and therapist support, which in turn could help moving toward personalized (E-)care.

Acknowledgements

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Chapter 7

Mediators of change in an Internet-based intervention for eating disorders

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Abstract

Objective: Internet-based interventions have demonstrated promising results in reducing eating disorder psychopathology. However, no research is available investigating mediators of change in the context of E-health for eating disorders. The current study aimed to investigate mediators of intervention response in an Internet-based fully automated monitoring- and feedback intervention ('Featback') provided with different levels of therapist support, developed for individuals with self-reported eating disorder symptoms.

Method: The analyses were conducted as part of a randomized controlled trial comparing the effectiveness of Featback with different levels of therapist support (i.e. none, once a week, three times a week) to a waiting list control condition. The study sample consisted of 75 participants who completed the assessments at baseline (week 0), mid-intervention (week 4), and post-intervention (week 8). Cross-lagged panel analyses were conducted to investigate potential mediators (i.e. levels of perseverative thinking and symptoms of anxiety and depression) of eating disorder psychopathology.

Results: The results demonstrated that early changes (week 0-4) in symptoms of anxiety and depression were found to predict later changes (week 4-8) in both anorectic and bulimic psychopathology, but not vice versa. Perseverative thinking was not found to mediate changes in eating disorder psychopathology.

Conclusions: These preliminary results suggest that it is important to focus on strategies that aim to reduce symptoms of anxiety and depression during (online) eating disorder treatment and interventions, as these might stimulate more rapid and larger change in eating disorder symptoms.

Introduction

Research on Internet-based interventions for EDs is still at an early stage, yet numerous studies have shown promising results regarding the prevention, intervention, and treatment of ED psychopathology (Aardoom et al., 2013; Beintner et al., 2011; Melioli et al., 2016). However, little is known about how these intervention exert their effects, also referred to as mediators of change (Kraemer et al., 2002). What is the psychological mechanism that is (partly) responsible for participants' change? Successful identification of mediators of intervention response could highly inform clinical practice, as the effectiveness of the intervention could be enhanced and maximized accordingly.

Studies investigating mechanisms of change in the treatment of ED symptoms are scarce. A study by Bewell et al. (2008) demonstrated that readiness to change mediated the effects of inpatient treatment for individuals with anorexia nervosa. Wilson et al. (2002) found dietary restraint to mediate changes in treatment outcomes for individuals with bulimia nervosa. To our knowledge, only one study (Volker et al., 2014) investigated mediators of change in the field of E-health interventions for EDs. Increased knowledge about EDs, healthy eating, and corresponding attitudes, were found to mediate reductions in binge eating in an Internet-based prevention program.

A potential interesting mediator of change in ED psychopathology is perseverative thinking, as Nolen-Hoeksema et al. (2007) demonstrated reciprocal relations between rumination, symptoms of bulimia nervosa, and depressive symptoms. Another potential mediator pertains to negative affect, as this has been found to precipitate binge eating and purging behaviors, as well as to predict ED psychopathology maintenance (Fairburn et al., 2003; Goldschmidt et al., 2014; Haedt-Matt & Keel, 2015; Smyth et al., 2007; Stice, 2002).

The current study aimed to examine mediators (i.e. levels of perseverative thinking and symptoms of anxiety and depression) of change in ED psychopathology in an Internet-based fully automated monitoring and feedback intervention supplemented with different intensities of therapist support: none, once a week, and three times a week.

Methods

Study design and participants

This study was conducted as part of a randomized controlled trial (Aardoom et al., 2013) comparing four conditions: 1) 'Featback', an Internet-based intervention for individuals with ED symptoms consisting of psychoeducation and a fully automated monitoring and

feedback system, 2) Featback supplemented with low-intensity (weekly) therapist support by means of e-mail, chat, or Skype, 3) Featback supplemented with high-intensity (three times a week) therapist support, and 4) a waiting list control condition. The study design consisted of an 8 week active intervention period and a 3- and 6 month follow-up. Assessments during the intervention period were conducted at 0, 4, and 8 weeks. The fully automated monitoring and feedback system of Featback comprised a weekly monitoring questionnaire addressing ED psychopathology. After completion, supportive feedback messages were automatically generated according to a pre-defined algorithm and send to the participants accordingly (for more details, see Aardoom et al. (2013)). The eligibility criteria were 1) age ≥ 16, 2) access to the Internet, and 3) self-reported ED symptoms.

For the current study, we selected the subgroup of participants in the Featback conditions that completed assessments at baseline, week 4, and post-intervention. Waiting list participants were excluded from the mediation analyses, given that they were not assessed during the intervention as symptom monitoring was part of Featback.

Measures

The Short Evaluation of EDs (SEED) (Bauer et al., 2005) was used as outcome variable. This brief self-report measure assesses the main symptoms of anorexia nervosa (underweight, fear of weight gain, distortion of body perception) and bulimia nervosa (binge eating, compensatory behaviors, over concern with body shape and weight). Higher scores on both of these dimensions (range 0-3) reflecting higher severity. The SEED has been validated and was demonstrated sensitive to symptom change (Bauer et al., 2005). The timeframe of the SEED was adapted from four weeks to one week, as we aimed to assess symptoms more frequently in light of studying mediators of intervention response.

The 4-item Patient Health Questionnaire (PHQ-4) (Kroenke et al., 2009) was included as potential mediator variable. It assesses the core symptoms of anxiety and depression over the past 2 weeks. Higher scores (range 0-12) reflect more symptoms. The PHQ has demonstrated good factorial and construct validity (Kroenke et al., 2009).

The 15-item Perseverative Thinking Questionnaire (PTQ) (Ehring et al., 2012) was included as potential mediator variable. It is a global measure of repetitive negative thinking assessing content-independent worry and rumination. Higher scores (range 0-4) reflect higher levels of perseverative thinking. The Dutch PTQ demonstrated good internal consistency and satisfactory stability (Ehring et al., 2012), and recently, its concurrent and convergent validity was demonstrated in a large clinical sample (Spinhoven, Drost, van, & Penninx, 2015). For the current study purpose, the timeframe was adapted from ‘in general’ to ‘in the previous 2 weeks’.

Statistical analyses

All data were analyzed in SPSS version 22. Intervention effects on outcome and mediator variables were examined by conducting univariate analyses of co-variance with the post-intervention score as dependent variable, condition as independent variable, and the baseline score as covariate. Bonferroni post-hoc comparisons were examined in case of a significant condition effect. Cross-lagged panel analyses were conducted to determine potential mediators of change in ED psychopathology. Residualized change scores were calculated for baseline to mid-intervention (week 4), as well as for mid- (week 4) to post-intervention (week 8) for all outcome and mediator variables. Higher residualized change scores represented an increase in symptoms. From here on, these periods of change will be referred to as early change (week 0–week 4) and later change (week 4–week 8). We followed a cross-lagged panel design (Burns, Kubilus, Bruehl, Harden, & Lofland, 2003; Preacher & Hayes, 2008) performing hierarchical regression analyses. In step 1, late change in the outcome variable was entered as dependent variable, and late change in the mediator variable (i.e. controlling for synchronous correlations) as well as early change in the outcome variable (i.e. controlling for autocorrelations) as independent variables. In step 2, early change in the mediator variable was entered into the regression equation. A significant effect of early change in the mediator on the outcome variable in step 2, controlling for the variables in step 1, indicates mediation. Finally, the inverse associations, whether early changes in the outcome variable predict later changes in the mediator variable, were tested for non-significance.

Results

Participants

A total of 75 Featback participants (28.4%) completed assessments at baseline, week 4, and post-intervention: 25 participants in the Featback condition, and 23 and 27 participants in the Featback conditions supplemented with low-and high-intensity therapist support respectively. No significant differences were found between completers and dropouts with respect to any baseline variables (all $p>.05$). All participants were female with a mean age of 25.4 years (SD=7.8) and a mean illness duration of 7.8 years (SD=7.8). A total of 34 participants (45.3%) reported to have been formally diagnosed with an ED. Participants demonstrated severe levels of ED psychopathology as manifested by their high scores on the EDE-Q (M=4.1, SD=1.1) (Aardoom et al., 2012). Moreover, 95.8% of the participants scored above the clinical cut-off of 2.2 (Dingemans et al., 2016). No

significant baseline differences between the study conditions were found regarding any of the socio-demographic, clinical, mediator and outcome variables (all p>0.5).

Intervention effects

Baseline and post-intervention scores of the mediator and outcome variables for the four study conditions are presented in Table 1. The univariate analyses of co-variance demonstrated no significant effect of condition on anorectic psychopathology (F(1,130)=1.39, p=0.25), but significant effects of condition were found regarding bulimic psychopathology (F(3,130)=6.15, p=0.001), symptoms of anxiety and depression (F(3,130)= 5.40, p=0.002), and perseverative thinking (F(3,129)=4.52, p=0.005). Post-hoc comparisons showed differences between the waiting list and Featback without therapist support (p=.01) as well as Featback with low-intensity therapist support (p=.02) for symptoms of anxiety and depression. Also, significant differences were found between the waiting list and Featback with low-intensity therapist support with respect to levels of perseverative thinking (p=.01) and bulimic psychopathology (p=.001). Given the non-significant differences between the three Featback conditions, these conditions were pooled in the subsequent mediation analyses.

Table 1. Outcome data (means and standard deviations) of completers in a randomized controlled trial investigating Internet-based intervention *'Featback'* with different intensities of therapist support

	Waiting list control (n=63)	Featback without therapist support (n=25)	Featback + low-intensity therapist support (n=23)	Featback + high-intensity therapist support (n=27)
Anorectic psychopathology (SEED-AN)				
Baseline	1.11 (0.46)	1.10 (0.38)	1.11 (0.42)	1.09 (0.37)
Post-intervention (week 8)	1.14 (0.42)	1.04 (0.39)	1.11 (0.44)	1.03 (0.36)
Bulimic psychopathology (SEED-BN)				
Baseline	1.46 (0.71)	1.40 (0.70)	1.43 (0.70)	1.54 (0.60)
Post-intervention (week 8)	1.52 (0.61)	1.18 (0.64)	1.08 (0.74)	1.28 (0.52)
Symptoms anxiety & depression (PHQ-4)				
Baseline	8.46 (3.10)	8.84 (2.94)	8.70 (2.51)	7.63 (2.95)
Post-intervention (week 8)	8.13 (3.10)	6.26 (3.28)	6.35 (3.56)	6.15 (3.67)
Perseverative thinking (PTQ)				
Baseline	2.87 (0.70)	2.91 (0.62)	2.92 (0.73)	2.57 (0.53)
Post-intervention (week 8)	2.85 (0.81)	2.56 (1.08)	2.41 (0.95)	2.20 (1.03)

SEED=Short Examination of Eating Disorders; AN=Anorexia Nervosa; BN=Bulimia Nervosa; PHQ-4=Patient Health Questionnaire; PTQ= Perseverative Thinking Questionnaire

Mediators of change

The results of the cross-lagged panel analyses can be found in Table 2 and 3. Early change in symptoms of anxiety and depression significantly predicted later change in both anorectic (p=.02) and bulimic (p=.02) psychopathology, even when controlling for later change in symptoms of anxiety and depression, as well as early change in anorectic or bulimic psychopathology (see Table 2). The inverse regression model was non-significant, showing that early change in anorectic or bulimic psychopathology did not predict later change in symptoms of anxiety and depression. Changes in levels of perseverative thinking were not found to mediate changes in anorectic or bulimic psychopathology (see Table 3).

Discussion

This study investigated potential mediators of intervention response in an Internet-based intervention 'Featback' for individuals with ED symptoms. The results demonstrated that early reduction (week 1-4) in symptoms of anxiety and depression were found to mediate later reductions (week 4-8) in both symptoms of anorexia nervosa and bulimia nervosa. Perseverative thinking was not found to mediate changes in ED psychopathology.

The finding that early changes in symptoms of anxiety and depression predicted later changes in anorectic and bulimic psychopathology and not vice versa, suggests that the reduction of anxiety and depression symptoms is an important mechanism through which Featback exerts its effects. This is in line with the accumulating evidence that negative affect is involved in the onset and maintenance of ED psychopathology. More specifically, difficulties in regulating negative affect and adverse moods states such as anxiety, anger, depression, can predict the onset and maintenance of binge eating and purging behaviors (Engel et al., 2013; Fairburn et al., 2003; Goldschmidt et al., 2014; Haedt-Matt et al., 2015; Hilbert & Tuschen-Caffier, 2007; Smyth et al., 2007). Reducing anxiety and depression symptoms by learning new ways to cope with these symptoms may stimulate a more rapid and larger change in ED psychopathology (Fairburn et al., 2003; O'Brien & Vincent, 2003; Pallister & Waller, 2008). For example, treatment could focus on targeting safety behaviors such as cognitive and behavioral rigidity (e.g., 'forbidden' foods) and body checking (e.g., repeated weighing). Similarly, it could be useful to specifically target the underlying anxieties and cognitions of eating disordered behaviors such as bingeing or self-induced vomiting, as these can be a coping mechanisms in order to reduce awareness of or escape from negative cognitions and corresponding affect (Heatherton & Baumeister, 1991). Individuals could also benefit from modules in which they learn to cope with negative mood states or distress.

Early changes in levels of perseverative thinking were not found to mediate later changes in levels of ED psychopathology. Rumination, which can be characterized as a form of perseverative thinking, has been found to predict future levels of symptoms of

Table 1. Results of hierarchical regression analyses testing whether early change in symptoms of anxiety and depression (PHQ) predicted later change in anorectic- (SEED-AN) and bulimic psychopathology (SEED-BN), and not vice versa.

Regression model		*B (SE)*	R^2	R^2 change	Inverse regression model		*B (SE)*	R^2	R^2 change
Dependent variable = SEED-AN					*Dependent variable = PHQ*				
Step 1	Late change PHQ	0.05 (0.11)	0.07	0.07	Step 1	Late change SEED-AN	0.03 (0.13)	0.001	0.001
	Early change SEED-AN	-0.32 (0.14)*				Early change PHQ	-0.01 (0.12)		
Step 2	Early change PHQ	0.23 (0.10)*	0.14	0.06*	Step 2	Early change SEED-AN	0.13 (0.16)	0.01	0.009
Dependent variable = SEED-BN					*Dependent variable = PHQ*				
Step 1	Late change PHQ	0.29 (0.10)**	0.11	0.11*	Step 1	Late change SEED-BN	0.35 (0.12)**	0.10	0.10*
	Early change SEED-BN	-0.12 (0.10)				Early change PHQ	-0.06 (0.11)		
Step 2	Early change PHQ	0.25 (0.11)*	0.18	0.07*	Step 2	Early change SEED-BN	0.17 (0.12)	0.12	0.03

SEED = Short Evaluation of Eating Disorders; AN = anorexia nervosa; BN = bulimia nervosa; PHQ = Patient Health Questionnaire; Early change = residualized change scores from baseline to mid-intervention (week 4); Late change = residualized change scores from mid-intervention (week 4) to post-intervention (week 8)
* $p < .05$ ** $p < .01$

Table 2. Results of hierarchical regression analyses testing whether early change in levels of perseverative thinking predict later change in anorectic and bulimic psychopathology, and not vice versa.

Regression model		*B (SE)*	R^2	R^2 change	Inverse regression model		*B (SE)*	R^2	R^2 change
Dependent variable = SEED-AN					*Dependent variable = PTQ*				
Step 1	Late change PTQ	-0.08 (0.11)	0.08	0.08	Step 1	Late change SEED-AN	-0.05 (0.13)	0.005	0.005
	Early change SEED-AN	-0.33 (0.14)*				Early change PTQ	-0.05 (0.12)		
Step 2	Early change PTQ	0.09 (0.11)	0.08	0.009	Step 2	Early change SEED-AN	-0.18 (0.16)	0.02	0.017
Dependent variable = SEED-BN					*Dependent variable = PTQ*				
Step 1	Late change PTQ	0.28 (0.11)**	0.10	0.10*	Step 1	Late change SEED-BN	0.32 (0.12)**	0.10	0.10*
	Early change SEED-BN	-0.10 (0.11)				Early change PTQ	-0.08 (0.11)		
Step 2	Early change PTQ	0.13 (0.11)	0.12	0.02	Step 2	Early change SEED-BN	0.07 (0.12)	0.10	0.004

SEED = Short Evaluation of Eating Disorders; AN = anorexia nervosa; BN = bulimia nervosa; PTQ = Perseverative Thinking Questionnaire; Early change = residualized change scores from baseline to mid-intervention (week 4); Late change = residualized change scores from mid-intervention (week 4) to post-intervention (week 8)
* $p < .05$ ** $p < .01$

bulimia nervosa (Nolen-Hoeksema, Stice, Wade, & Bohon, 2007). Nevertheless, this relationship was found to be bidirectional, Similarly, the results of this study showed a significant positive association between mid- to post-intervention changes in bulimic psychopathology and levels of perseverative thinking, demonstrating that these symptoms changed simultaneously. Thus, preliminary results do not seem to point to a mediating role of perseverative thinking on ED psychopathology, although these symptoms seem to co-occur. It might be interesting for future studies to consider including a content-dependent measure of worry or rumination specifically related to preoccupation with eating, weight, and shape (Cowdrey & Park, 2011).

A limitation of the current study was that the analyses were restricted to completers. Still, significant mediator effects were identified despite the fact that statistical power was reduced. Another limitation was that a formal mediation analysis was not possible given the lack of mid-intervention assessment for the waiting list condition. Also, the results of crossed-lagged panel analyses are still correlational and no definitive conclusions can be drawn regarding the causality (Burns et al., 2003). Finally, a selection of potential mediator variables was included, however other potential variables might also have been of interest.

In conclusion, these preliminary results suggest that it is important to focus on strategies to reduce symptoms of anxiety and depression during online ED treatment and interventions, as these may represent an important mechanism to help reduce ED psychopathology.

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

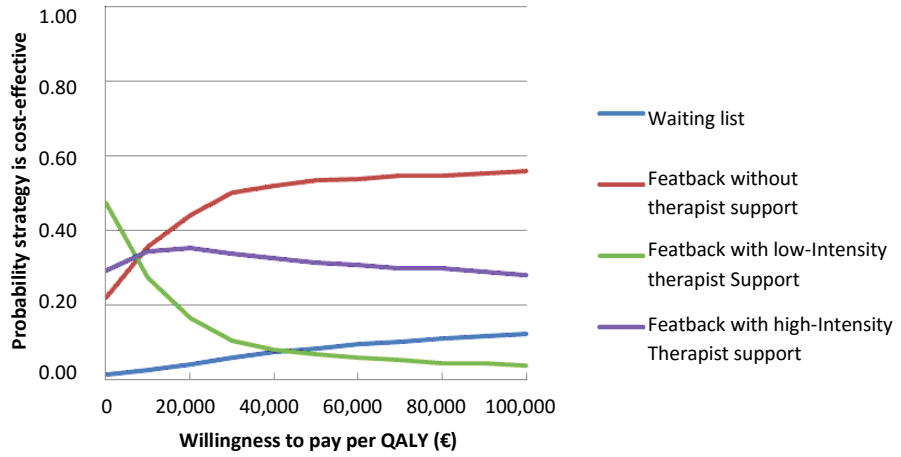
* p≤.05, ** p≤.01, *** p≤.001

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.



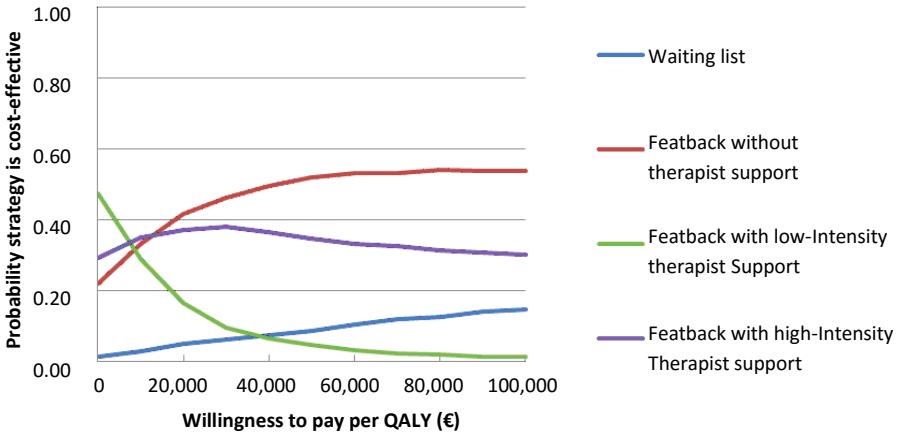
Note: QALY = Quality-Adjusted Life-Year as assessed by the EQ-5D

Discussion

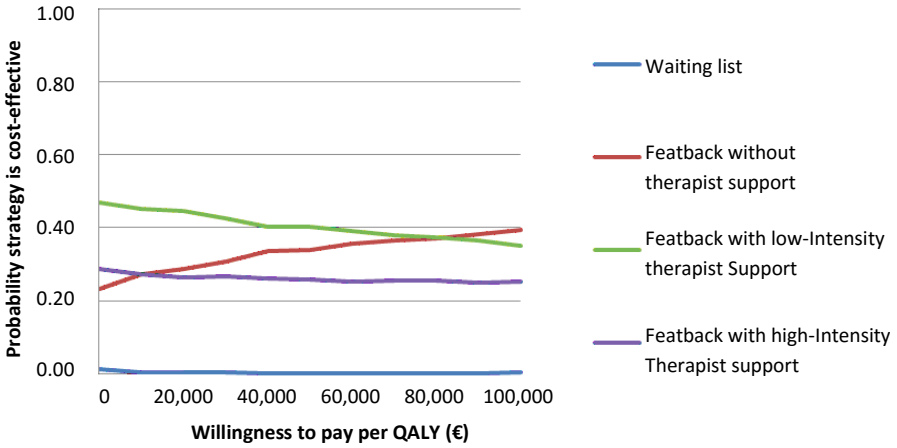
This study investigated the cost-utility of fully-automated Internet-based intervention 'Featback' provided along with different levels of therapist support (i.e. none, once a week, three times a week) in comparison to a WLC for individuals with ED symptoms. The results demonstrated no significant differences 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.

Chapter 9

Opening the black box of therapist support in an Internet-based intervention for eating disorders: Can therapist behaviors predict participants' outcome and satisfaction?

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Abstract

Objective: The current study aimed to 1) explore the types of therapist behaviors that were provided as part of an Internet-based intervention for eating disorder psychopathology, and 2) investigate whether therapist behaviors are associated with participants' outcome and satisfaction.

Method: By means of a Grounded Theory approach, we qualitatively investigated all therapist (*N*=7) communication within 937 e-mails and 417 chats that were sent to 177 participants over the 8-week course of the intervention. Regression analyses were conducted in order to investigate the second aim.

Results: A codebook with 31 identified therapist behaviors was developed, by which 40,216 therapist behaviors were coded. The majority of the behaviors (*n*=19,282, 48%) were related to being supportive and showing interest and empathy, whereas 40% (*n*=16,149) of all therapist behaviors were related to assessment, interventions and counseling, and only a minority (*n*=4785, 12%) pertained formalities and explaining procedures. The type of therapist behaviors did not predict participants' outcome in terms of psychopathology, but significantly predicted participants' satisfaction with their therapist. Specifically, the more therapists behaviors related to assessment and counseling relative to behaviors concerning support and empathy, the higher participants' satisfaction.

Discussion: This study helps in opening the black box of therapeutic support within E-health interventions. Professional therapeutic behaviors related to assessment and interventions may help to enhance participants' satisfaction, but not outcome. The effects of type of therapist behaviors on outcome warrants further investigation, as this could lead to valuable insights on how to most (cost-) effectively implement therapist guidance within E-health interventions.

Introduction

Over the past decade the use of Internet has grown rapidly and has profoundly changed the way we communicate. Individuals increasingly use e-mails, instant messaging, social media, and social networking sites as communication tools (Pew Research Center, 2015b). Many individuals also search for health information on the Internet (Pew Research Center, 2015a). Alongside this development, the use and investigation of new technologies within (mental) healthcare settings has proliferated (Cunningham, Gulliver, Farrer, Bennett, & Carron-Arthur, 2014; Ventola, 2014).

Internet-based interventions have found to be effective for a range of psychological health problems (Aardoom et al., 2013; Gainsbury & Blaszczynski, 2011; Kuester, Niemeyer, & Knaevelsrud, 2016; Riper et al., 2014; Spek et al., 2007). Preliminary evidence suggests that guided Internet-based cognitive behavioral therapy (CBT) might be equally effective as face-to-face CBT (Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014; Olthuis, Watt, Bailey, Hayden, & Stewart, 2015). Despite these promising results, research into factors underlying the effectiveness warrant investigation. The intervention programs come in many different forms (e.g., variation in duration and the number and content of modules), and furthermore include different intensities of therapist contact, ranging from very limited and brief contact to intensive therapeutic involvement (Olthuis et al., 2015; Palmqvist, Carlbring, & Andersson, 2007).

Interestingly, little is known about what types of therapist guidance are offered within Internet-based interventions: what do therapists actually do? Sánchez-Ortiz et al. (2011) investigated the e-mails sent by therapists within an Internet-based treatment for eating disorders (EDs), and found that the e-mails were mainly supportive in content. More specifically, approximately 95% of all sent e-mails contained at least one supportive comment, 15% at least one CBT-based comment, and 14% at least one technical or study-related comment. Two other studies investigated therapist behaviors in an Internet-based CBT for generalized anxiety disorders (Paxling et al., 2012) and depressive symptoms (Holländare et al., 2015). Although both studies identified more categories of therapist behaviors (8 and 9 respectively), supportive behaviors such as encouragement, reinforcement, and affirming were the most frequent therapist behaviors.

The two above-mentioned studies (Holländare et al., 2015; Paxling et al., 2012) subsequently investigated whether the identified therapist behaviors were related to treatment outcome. Indeed, participants with depressive symptoms achieved better outcomes in an Internet-based CBT when therapists more often encouraged participants' behavior, affirmed participants' thoughts, emotions, and actions, and showed more self-disclosures such as mentioning own experiences and examples from one's own life

(Holländare et al., 2015). In the context of generalized anxiety disorders, better treatment outcomes were positively associated with therapist behaviors aimed at reinforcement of assignments (Paxling et al., 2012). Conversely, therapist behaviors related to deadline flexibility, being the allowance of extra time regarding deadlines for homework or treatment modules, were negatively associated with treatment outcome.(Paxling et al., 2012).

Two randomized controlled trials have experimentally investigated the type of guidance within an Internet-based CBT for generalized anxiety disorder (Robinson et al., 2010) and depression (Titov et al., 2010). The guidance was either provided by a licensed therapist, comprising active engagement in participants' goal setting, problem solving, and discussion of strategies to overcome barriers to progress, or a technician with no qualifications in counseling who was instructed to provide support and encouragement. The results of both trials demonstrated no significant differences in outcome between the therapist- and technician-guided condition (Robinson et al., 2010; Titov et al., 2010). Similarly, Alfonsson et al. (2015) experimentally investigated the effects of the frequency (weekly versus everyday) and the type of therapist support (friendly and supportive versus therapeutic with techniques derived from motivational interviewing) on the outcomes of a brief Internet-based relaxation program for individuals with symptoms of stress and worry. Neither the enhancement of the frequency, nor the type of therapist guidance, significantly affected treatment outcome (Alfonsson, Olsson, & Hursti, 2015).

To summarize, the literature provides mixed results regarding the associations between the type of therapist guidance and outcome (Holländare et al., 2015; Paxling et al., 2012). It is important to gain more insight into the type of therapist guidance that is delivered in Internet-based interventions and how this is related to outcome. It could lead to valuable insights into what kind of therapist behaviors need to be focused on in order to enhance outcomes. These insights could in turn inform decision making on how to most (cost-) effectively implement therapist guidance in Internet-based interventions. This study aimed to explore the types of therapist behaviors as provided in the therapist support sessions which were offered in addition to an Internet-based intervention for ED psychopathology. A second aim was to investigate the association between therapist behaviors and participants' outcome and satisfaction with their therapist respectively.

Method

Design

This study was conducted as part of a randomized controlled trial (Aardoom et al., 2013) comparing four conditions: 1) Internet-based intervention 'Featback', consisting of

psychoeducation and a fully automated monitoring and feedback system, 2) Featback with low-intensity (weekly) therapist support by means of e-mail, chat, or Skype, 3) Featback with high-intensity (three times a week) therapist support, and 4) a waiting list control. The automated monitoring and feedback system comprised a weekly monitoring questionnaire addressing ED psychopathology. After completion, supportive feedback messages are automatically generated according to a pre-defined algorithm and send to the participants accordingly (for more details, see Aardoom et al. (2013)). Featback was demonstrated to be superior in reducing bulimic psychopathology, symptoms of depression and anxiety, and levels of perseverative thinking in comparison to the waiting list (Aardoom et al., 2016). No added value of therapist support was found in terms of the effectiveness of Featback, although therapist support did significantly enhance participants' satisfaction with the intervention. Specifically, participants who received Featback without therapist support were significantly less satisfied (*M*=5.0, scale 1-10) than participants who received Featback with low- (*M*=7.1) or high-intensity therapist support (*M*=7.4), while no differences between the latter two were found. Overall, participants were very satisfied with their therapist (*M*=8.0, scale 1-10), with no differences between the low- and high-intensity therapist support conditions (*p*=.74).

Given the current study focus on therapist support, only conditions two and three were included in this study. Skype sessions were not recorded and therefore not included. Chat sessions had a maximum duration of 20 minutes, whereas an e-mail session contained one e-mail reply from the therapist to the participant. Therapist support was provided by seven females who were Master of Science (MSc) students in clinical psychology or individuals with a MSc degree in clinical psychology. All therapists underwent training in the delivery and methodology of online support. The chat methodology was based on a 5-phase model: 1) a warm welcome, 2) clarifying the question, 3) determining the goal of the conversation, 4) concrete elaboration of the goal of the conversation, and 5) closing the circle (Schalken et al., 2010). The e-mail methodology contained three phases: 1) extracting the question, 2) formulating an answer, and 3) checking and re-reading the message, and sending it (Schalken et al., 2010). Regular supervision to the therapists was provided both individually and in group format (for more details, see study protocol (Aardoom et al., 2013)).

Participants

The study sample included 177 participants who received Featback with low- (*n*=88) or high-intensity therapist support (n=89). Participants were primarily female (*n*=174, 98.3%) and had a mean age of 24.7 years (*SD*=8.4). The mean duration of ED problems was 7.1 years (SD=6.6). Seventy-nine participants (44.6%) reported to currently receive, or have

ever received, treatment for their ED. Eighty-five participants (48.0%) reported to have ever been formally diagnosed with an ED. The severity of participants' ED psychopathology was further reflected in their scores on the Eating Disorder Examination Questionnaire (EDE-Q) (*M*=4.2, *SD*=0.9) (Fairburn et al., 2008). This EDE-Q mean score is comparable to the overall norm for treatment-seeking patients with an ED in our specialized clinical program (Aardoom et al., 2012) and is furthermore markedly above the clinical thresholds of >2.2 (Dingemans et al., 2016).

Coding of therapist behaviors

All written therapist communication in e-mails to, or chats with, a participant were extracted from therapists' e-mail inboxes and chat histories and exported to QSR Nvivo for coding. The coding process was guided by a handbook of qualitative research methods (Mortelmans, 2007) and comprised a conventional inductive approach (Hsieh & Shannon, 2005), also commonly referred to as Grounded Theory (Glaser & Strauss, 1967). This approach allows themes and categories to emerge from the data through the researcher's careful examination. Two authors (J.A. and M.N.B) developed a codebook by starting to explore and discuss five randomly selected transcripts of different therapists. The transcripts were extensively read and reviewed, where after the two authors began to create tentative themes (i.e., therapist behaviors) that seemed to emerge from the data. Next, the number of themes was reduced by grouping the themes under categories, resulting in an initial codebook. This initial codebook included names, definitions, descriptions, examples, and inclusion and exclusion criteria for each category of therapist behaviors. Then, the two authors independently coded another randomly selected set of five transcripts. They compared and discussed their coding consecutively, reaching agreement on existing codes, adapting the codebook by refining and elaborating on existing codes, and developing new codes where considered necessary. This process was repeated until the codebook seemed to be functioning well, meaning that no new categories of therapist behaviors were identified in the data.

Saturation of the codebook was reached after eight cycles of coding and discussing five randomly selected transcripts. Then, intercoder reliability was assessed as an objective quantitative measure of the degree to which the two authors assigned the same codes on the same pieces of text, based on another 10 randomly selected transcripts. The intercoder reliability was acceptable (Cohen, 1960): the percent agreement was 98.63 and Cohen's Kappa (*k*) was 0.75. The authors compared and discussed their coding work and reached consensus, so that a golden standard was developed. This golden standard was used in assessing intercoder reliability with three MSc students. Intercoder reliability between the two authors and the students was

acceptable: 98.32% agreement (*k*=0.71), 98.43% agreement (*k*=0.73), and 98.22% agreement (*k*=0.66) respectively. Each student coded a subset of therapist transcripts that were send to 40 randomly selected participants. J.A. and M.N.B. coded the subset of transcripts that were send to the remaining 57 participants.

Outcome measures

This study included the baseline and post-intervention assessments consisting of online self-report questionnaires. The primary outcome measure was ED psychopathology, as assessed by the Short Evaluation of Eating Disorders (SEED) (Bauer et al., 2005) and the EDE-Q (Fairburn et al., 2008). The SEED is a brief self-report questionnaire tapping the main symptoms of anorexia nervosa (underweight, fear of weight gain, distortion of body perception) and bulimia nervosa (binge-eating, compensatory behaviors, over concern with body shape and weight). Total severity indexes (range 0-3) can be calculated for both dimensions. The SEED has demonstrated validity and was shown sensitive to ED symptom change (Bauer et al., 2005). Regarding the EDE-Q, a global score was calculated by summing and averaging 22 seven-point Likert items (range 0-6). The EDE-Q has demonstrated reliability and validity in assessing ED symptoms (Berg et al., 2011) and was also shown sensitive to symptom change (Sysko, Walsh, & Fairburn, 2005). Higher scores on the SEED and the EDE-Q reflect higher levels of ED psychopathology.

Secondary outcomes measures included symptoms of depression and anxiety, as assessed by the 4-item Patient Health Questionnaire (PHQ-4) (Kroenke et al., 2009), a validated and reliable ultra brief screener for anxiety and depression (Kroenke et al., 2009; Löwe et al., 2010). Levels of perseverative thinking were assessed by the Perseverative Thinking Questionnaire (PTQ) (Ehring et al., 2011), which has established reliability and validity in assessing the key characteristics of repetitive negative thinking (Ehring et al., 2011). Finally, ED-related quality of life was measured by the Eating Disorder-related Quality of Life questionnaire (ED-QOL) (Engel et al., 2006), assessing the influence of eating behaviors and body weight in the psychological, physical and cognitive, financial and work/school-related domain. The ED-QOL has demonstrated reliability and validity (Engel et al., 2006). Higher scores on the PHQ-4, PTQ, and ED-QOL reflect higher symptom severity. Finally, participants' satisfaction with their therapist was measured by one self-report question, asking participants to rate the satisfaction with their therapist on a scale of one (very dissatisfied) to ten (very satisfied).

Statistical analyses

The qualitative coding of therapist behaviors was conducted with support of software QSR Nvivo 10. The frequencies of therapist behaviors were exported to SPSS version 22, in

which the quantitative analyses were conducted. Regression analyses were conducted to investigate the relationship between therapist behaviors and participants' outcome and satisfaction with their therapist. Each regression model included the post-intervention score of the outcome measure as dependent variable, and three independent variables: 1) the type of therapist behaviors, operationalized as the relative frequency of A) therapist behaviors related to assessment and interventions, and B) therapist behaviors related to support and empathy (see results section) (A/B), 2) the total frequency of therapist behaviors, and 3) the baseline score of the outcome measure. With respect to the first independent variable, it needs to be noted that the third type of identified therapist behavior (i.e., formalities and procedure (see results section)) was not taken into account as it was considered unlikely that formalities such as greetings would be of influence on the outcome measures. Furthermore, a relative frequency score was calculated in order to deal with issues of multicollinearity, given that the frequency scores of the two types of therapist behaviors (A and B) were highly correlated. The second and third variables were included in each regression model to control for the total amount of therapist behaviors and participants' initial scores on the outcome measure respectively.

Missing data on the outcome measures were imputed using multiple imputation methods in the statistical software program R version 3.02 using predictive mean matching. Interactions were taken into account in the imputation procedure (Doove et al., 2014). For each outcome variable with missing data, the number of predictor variables was determined by the rule of thumb of 15 cases per potential predictor (Stevens, 2009). Variables that correlated the highest with the outcome variable were chosen as predictors for the missing outcome data. One hundred imputed datasets were generated. Results from all imputed datasets were pooled according to Rubin's rules (Rubin, 1987).

Results

Therapist behaviors

The final codebook consisted of 31 codes that defined and described the identified therapist behaviors (see Table 1). Over the 8-week intervention period, participants received a total of 1407 therapist support sessions. Skype sessions (*n*=53) were excluded. A total of 1354 therapist transcripts, stemming from 937 e-mails and 417 chats, were included for coding. In these transcripts, a total frequency of 40,216 therapist behaviors were coded. As shown in Table 1, the most frequent therapist behaviors were to ask questions in order to assess the situation or problem (12.3%), followed by showing empathy or compassion with a participant (12.1%). Helping a participant by providing advice or giving tips were other frequent therapist behaviors (together 11.3%).

Table 1. A list of therapist behaviors derived from an inductive content analysis from therapist support sessions within an Internet-based intervention for individuals with eating disorder symptoms.

Therapist behavior	Description	Example(s)	Total frequency of behavior (% of Total)	Mean (*SD*) frequency of therapist behavior per participant
To assess the situation	Psychologist asks a participant one or more question(s) in order to assess the situation or problem.	"Are you currently on a diet?" "Could you tell me a bit more about your home situation?"	4935 (12.3)	27.9 (26.7)
To show empathy or compassion	Psychologist shows compassion or empathizes with a participant, including whishing someone well or good luck.	"I can well imagine how you must feel right now." "I wish you all the best and really hope that you'll find the strength to fight your eating disorder problems."	4862 (12.1)	27.5 (23.3)
To positively reinforce	Psychologist makes the participant a compliment or positively reinforces the participant.	"Really? Wow, that's so brave of you!" "You did great!"	3810 (9.5)	21.5 (19.6)
To summarize	Psychologist summarizes what a participant has told or how she interprets what a participant has told.	"It sounds like you've been through a lot." "In your last e-mail you wrote that you are using food as a distraction for your emotions, …"	3337 (8.3)	18.9 (20.7)
To advise	Psychologist gives advise or stimulates a participant to take action. This code also includes homework assignments.	"Please try to write a relapse prevention plan. Make a list of high-risk situations and think of healthy ways of coping." "You should really talk to someone!"	2476 (6.2)	14.0 (14.5)
To greet	Psychologist greets a participant.	"Hello there!" "Have a good night, bye."	2429 (6.0)	13.7 (12.3)
To give tips or suggest an idea	Psychologist gives a tip or suggests something to a participant.	"Maybe you can try to take a walk?" "What do you think of writing it down, in order to prepare for the conversation with your GP?"	2056 (5.1)	11.6 (11.0)
To gauge	Psychologist is trying to gauge a participant's thoughts or opinion.	"What do you think of this idea?" "Would that be feasible for you?"	1910 (4.7)	10.8 (11.7)
To psychoeducate	Psychologist provides psychoeducation, including information about treatments, symptoms, service delivery or other mental health-related issues.	"Dieting and restrictive food intake can trigger binge eating episodes, which in turn can elicit feelings of shame, disgust, guilt and depression. Individuals often feel like they are caught up in a vicious cycle of negative mood and binge eating. In order to break this cycle it is important to focus on healthy eating and consuming 3 well-balanced meals and 3 healthy snacks a day."	1591 (4.0)	9.0 (9.8)

Therapist behavior	Description	Example(s)	Total frequency of behavior (% of Total)	Mean (*SD*) frequency of therapist behavior per participant
To confront	Psychologist confronts a participant with certain beliefs or behavior, or explains or reflects on issues that may be difficult to hear.	"Unfortunately, changing your behavior and developing new and healthier habits is difficult and takes time, it is not something that is easily done." "I've noticed that you are very busy, maybe you are demanding too much of yourself."	1363 (3.4)	7.7 (9.7)
To ask for, suggest, or establish the topic of conversation	Psychologist asks for, suggests, or establishes the topic of conversation or (a) certain goal(s) that may or will be addressed during the intervention period.	"What would you like to talk to me about today? How can I help you?" "In this e-mail I will get back to you on your question about how to reduce or stop binge eating successfully."	1274 (3.2)	7.2 (7.4)
To collaborate and being there for someone	Psychologist shows that she is there for a participant and that she is available for help. Or, psychologist emphasizes collaboration between her and the patient.	"I hope we can work together towards a healthier lifestyle in the next few weeks." "I'm here for you and I sincerely hope that I can help you with your problems."	1165 (2.9)	6.6 (6.6)
To listen	Psychologist 'listens' to a participant by letting the participant know that she has read what the participant has 'told'.	"Hmm…." "Oh… Okay."	1143 (2.8)	6.5 (14.3)
To motivate	Psychologist motivates or encourages a participant.	"It will be difficult, but remember that you are working on a life without eating disorder symptoms, in which you will feel more happy and at ease with yourself and your body." "Talking to your friends or family can really help to clear your mind. It may help you to clarify some things and reduce some stress."	1127 (2.8)	6.4 (8.5)
To reassure	Psychologist reassures a participant.	"Let me reassure you that you are not the only one and that it's not crazy at all." "It will be okay, you'll see."	1112 (2.8)	6.3 (6.5)
To show interest or making small talk	Psychologist shows interest in a participant or is making small talk.	"How was your weekend in Berlin? Berlin is a beautiful city with lots to see." "I was wondering how you've been doing in the past few days."	1093 (2.7)	6.2 (6.2)
To stimulate further contact	Psychologist encourages a participant to make a new appointment and stimulates further contact.	"Don't forget to schedule a new appointment for next week. See you then!" "I'm looking forward to your next e-mail."	803 (2.0)	4.5 (4.2)

Therapist behavior	**Description**	**Example(s)**	**Total frequency of behavior (% of Total)**	**Mean (*SD*) frequency of therapist behavior per participant**
To thank	Psychologist thanks a participant.	"Thank you for your reply" "Thank you for being so honest"	654 (1.6)	3.7 (5.1)
To address that there is limited time (left)	Psychologist addresses that time is running out (in chats) or that there is limited time or space to discuss all the issues raised by a participant (in e-mails). This code also includes announcements related to the limited time left with respect to the 8-week intervention period.	"We're running out of time, we only have 1 minute left…" "Time flies: this is already week 8, which means that you still have one last appointment left (to make)?"	487 (1.2)	2.8 (2.9)
To stimulate reflection and insight	Psychologist stimulates self-awareness and self-reflection, aiming for a participant to develop insights.	"How did you manage to eat a healthy diet this week without bingeing, what do you think helped you?" "Do you think there is a connection between the difficult situations at school and your relapse this week? What conclusion can you draw from this?"	399 (1.0)	2.3 (4.0)
To welcome	Psychologist welcomes a participant at the beginning of an e-mail or chat.	"Welcome!" "Good to 'see' you again."	365 (0.9)	2.1 (2.5)
To explain research procedures	Psychologist explains the procedures regarding the research trial or appointments with the psychologist	"You can schedule 3 appointments each week. Each appointment is either one e-mail or a a 20-minute chat or Skype session." "In case you make an e-mail appointment, you will have to e-mail me before the day and time of the appointment."	289 (0.7)	1.6 (2.4)
To correct, clarify, or excuse	Psychologist corrects or excuses herself, or aims to clarify incomprehensible text (e.g., typo or unknown abbreviation).	"I'm sorry I have to cancel our session this afternoon." "What do you mean with *'bck'*?"	274 (0.7)	1.6 (2.3)
To challenge cognitions and beliefs	Psychologist challenges certain dysfunctional cognitions/beliefs of a participant.	"Do you really think so? Could it be another reason? Maybe they're just concerned?" "Do you really believe that you are weak in case you ask your family for help? Would you believe your sister to be weak in case she asks for your help with anything?"	267 (0.7)	1.5 (2.6)

Therapist behavior	Description	Example(s)	Total frequency of behavior (% of Total)	Mean (*SD*) frequency of therapist behavior per participant
To ask for one's experience or feelings	Psychologist asks a participant for one's experience of a situation, or asks about one's feelings/emotions.	"And how does that make you feel?" "How was it for you to write it all down?"	234 (0.6)	1.3 (2.1)
To stimulate thinking about possible solutions	Psychologist stimulates or encourages a participant to think of possibilities of how to solve a particular problem.	"What do you think you need in order to reduce some stress?" "Can you think of ways to reduce the binges somehow?"	232 (0.6)	1.3 (1.8)
To acknowledge the boundaries of one's knowledge	Psychologist acknowledges the limits of one's knowledge or position as a supporter during the 8-week Intervention period.	"Unfortunately I don't know the answer to that question, since I'm not a nutritionist…" "I'm sorry but I can't give you a diagnosis, therefore you would have to go see a doctor or mental health professional."	215 (0.5)	1.2 (1.8)
To express concern	Psychologist expresses worry or concern.	"I am really worried about you, your weight is alarmingly low." "It's very dangerous to keep doing this, it really concerns me."	107 (0.3)	0.6 (1.4)
To concretize aims or goals	Psychologist concretizes particular aims or goals of a participant, or asks a participant to concretize these by asking for example how exactly, when, where and with whom.	"What are you planning to eat exactly? And how much, when and with whom?" "So what do you say, trying not to compensate at least 1 day this week? Or maybe 2 days?"	88 (0.2)	0.5 (1.2)
To communicate regarding technical problems	Psychologist says or asks something about technical problems.	"Are you still there? Having trouble with your Wi-Fi?" "I just sent you a link, but I think you didn't receive it? Let me try again."	72 (0.2)	0.4 (1.0)
To establish a participant's absence or to ask for the reasons of absence	Psychologist establishes a participant's absence or points out that a participant has not scheduled as many appointments as possible. This code also includes the psychologist asking for the reason(s) for the lack of contact.	"I've noticed that you didn't show up at our last appointment. Can I ask why?" "I've noticed that you scheduled one appointment with me for next week, while we can have 3. Why is that?"	47 (0.1)	0.3 (0.7)

The 31 therapist behaviors were grouped under three higher order categories: 1) support and empathy, 2) assessment and interventions, and 3) formalities and procedure (see Table 2 for more details). Forty-eight percent (*n*=19,282) of the therapist behaviors consisted of behaviors related to being supportive and showing interest and empathy, whereas 40.2% (*n*=16,149) of the therapist behaviors included assessment, interventions and counseling. Finally, 11.9% (*n*=4785) of the therapist behaviors was related to formalities and explaining (research) procedures.

Table 2. Broad categories of therapist behaviors derived from an inductive content analysis from therapist support sessions within an Internet-based intervention for individuals with eating disorder symptoms.

Support and Empathy
To collaborate and being there for someone
To show interest or making small talk
To listen
To establish a participant's absence or to ask for the reasons of absence
To stimulate further contact
To show empathy or compassion
To reassure
To gauge
To summarize
To positively reinforce
Assessment and Interventions
To advise
To give tips or suggest an idea
To challenge cognitions and beliefs
To confront
To motivate
To psychoeducate
To concretize aims or goals
To stimulate reflection and insight
To stimulate thinking about possible solutions
To express concern
To ask for, suggest, or establish the topic of conversation
To assess the situation
To ask for one's experience or feelings
Formalities and Procedure
To thank
To welcome
To greet
To communicate regarding technical problems
To correct, clarify, or excuse
To explain research procedures
To address that there is limited time (left)
To acknowledge the boundaries of one's knowledge

Therapist behaviors and outcome

The results of the regression analyses investigating the relationship between the type of therapist behaviors and outcome are presented in Table 3. The type of therapist behavior did not significantly predict any of the post-intervention outcome scores tapping psychopathology (all $p > .05$), nor did the total frequency of therapist behaviors.

Therapist behaviors and participants' satisfaction

The type of therapist behaviors was found to make a significant unique contribution in predicting participants' satisfaction over and above the total frequency of therapist behaviors (see Table 3). The more therapists showed behaviors related to assessment and counseling relative to behaviors concerning support and empathy, the higher participants' satisfaction with their therapist. In addition, higher frequencies of therapist behaviors were shown to predict higher satisfaction rates of participants with their therapist.

Table 3. Results of the regression analyses with therapist behaviors as predictors for multiple outcome measures in the context of an Internet-based self-help intervention with individual therapist support.

Independent variables: Post-intervention scores	Baseline scores	Total amount therapist behaviors	Type of therapist behaviors^
	B (SE), t	*B (SE), t*	*B (SE), t*
EDE-Q	0.95 (0.10), 9.94***	<0.001 (<0.001), -0.84	0.35 (0.35), 1.01
ED-QOL	0.83 (0.07), 11.23***	<0.001 (<0.001), -0.99	0.22 (0.17), 1.32
SEED-AN	0.78 (0.05), 14.28***	<0.001 (<0.001), -0.80	-0.02 (0.10), -0.17
SEED-BN	0.66 (0.07), 9.48***	<0.001 (<0.001), -1.20	-0.01 (0.19), -0.06
PTQ	1.01 (0.09), 11.27***	<0.001 (<0.001), -0.56	0.29 (0.26), 1.11
PHQ	0.76 (0.08), 9.38***	<0.001 (<0.001), 0.30	1.20 (0.98), 1.22
Satisfaction psychologist	n/a	0.003 (0.001), 4.14***	1.23 (0.55), 2.23*

* $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$

EDE-Q = Eating Disorder Examination Questionnaire, ED-QOL = Eating Disorder-related Quality Of Life, SEED = Short Evaluation of Eating Disorders, AN = Anorexia Nervosa, BN = Bulimia Nervosa, PTQ = Perseverative Thinking, PHQ = Patient Health Questionnaire.

^ Relative frequency of therapist behaviors related to assessment and interventions versus therapist behaviors related to support and empathy.

Discussion

This study qualitatively explored therapist behaviors that were provided in the online guidance as part of an Internet-based intervention for ED psychopathology. Also, it was investigated whether certain types of therapist behaviors were associated with participants' outcome and satisfaction with their therapist respectively. A total of 31 therapist behaviors were identified, which were categorized under three higher-order categories. The majority of the therapist behaviors (48%) were related to being supportive

and showing interest and empathy. Approximately 40% of all therapist behaviors were related to assessment, interventions and counseling, whereas only a minority (12%) of behaviors pertained to formalities and explaining procedures. The type of therapist behaviors did not predict participants' outcome in terms of psychopathology, but did significantly predict participants' satisfaction with their therapist. That is, the more therapists had shown behaviors related to assessment and counseling relative to behaviors concerning support and empathy, the higher participants' satisfaction with their therapist.

The finding that most of the therapist behaviors were supportive and empathic is comparable to the findings of previous studies investigating therapist guidance within E-health interventions for bulimia nervosa (Sánchez-Ortiz et al., 2011), generalized anxiety disorder (Paxling et al., 2012), and depressive symptoms (Holländare et al., 2015). However, one apparent difference emerged when comparing our categorizing scheme to that of the two studies investigating an Internet-based CBT for anxiety and depression (Holländare et al., 2015; Paxling et al., 2012). Our most commonly identified individual therapist behavior was asking questions in order to assess participants' situation or problem (12.3%), which was not identified by the other two (Holländare et al., 2015; Paxling et al., 2012). A possible explanation is that the therapist guidance in the current study was based on a methodology where the therapist always had to clarify the needs, problems, or questions of a participant first, before starting to elaborate on these, trying to find ways for the participants to cope with their problems, or answering questions accordingly (Schalken et al., 2010). In contrast, the guidance in the two above-mentioned studies were mainly focused on fostering adherence to the intervention and providing feedback on homework assignments (Holländare et al., 2015; Paxling et al., 2012).

In contrast to two previous studies (Holländare et al., 2015; Paxling et al., 2012), we did not find a significant association between the type of therapist behaviors and participants' symptom improvement. It is difficult to speculate about possible explanations for this discrepancy in findings as the studies differed in many ways. For example, in their categorization schemes and statistical procedures, as well as in the type of E-health interventions on top of which the therapist guidance was provided, and the type of psychological problems being targeted. Our findings are in line with three studies that causally investigated the effect of type of therapist support on outcome by experimentally manipulating the type of therapist support. Two of these studies (Titov et al., 2010; Robinson et al., 2010) were in the field of anxiety and depression, demonstrating no significant differences in outcome between Internet-based CBT guided by a clinician using specific therapeutic techniques, or by a technician being mainly supportive and encouraging. Similarly, Alfonsson et al. (2015) demonstrated that enhancing both the

frequency (weekly versus everyday) and type of therapist support (supportive and friendly versus therapeutic techniques based on motivational interviewing) did not significantly affect treatment outcome in an Internet-based relaxation program for individuals with symptoms of stress and worry (Alfonsson et al., 2015). Regarding the frequency of therapist support, our randomized controlled trial (Aardoom et al., 2016) and one other trial (Klein et al., 2009b) also failed to identify an incremental effect in outcome when enhancing the frequency of therapist support. Thus, preliminary studies seem to suggest that enhancement of the frequency of support and the type of therapist support do not necessarily improve treatment outcomes. However, more experimental studies are needed in order to further examine and establish the effects of the frequency and type of therapist support within E-health interventions.

This is the first study to investigate the association between the type of therapist behaviors and satisfaction of participants within an Internet-based intervention for mental health problems. The fact that participants were more satisfied when therapists showed relatively more behaviors related to assessment and interventions relative to behaviors concerning support and empathy, might suggest that participants need and expect a certain kind of professionalism alongside having someone supporting them and being empathic. This is in line with findings of Traviss et al. (2013), who conducted interviews with participants and therapists as part of a trial investigating guided self-help for disordered eating. Although all participants and therapists stressed the importance of receiving supportive guidance, they also mentioned the therapeutic skills of the therapist as being important, and felt that prior professional training was necessary in order to help and deal with participants' difficulties and problems encountered. Furthermore, the findings are in line with a previous study by Gulliksen et al. (2012), who conducted a qualitative in-depth study of preferred health professional characteristics by patients with anorexia nervosa. Amongst other things, therapists' expertise was found to be associated with treatment satisfaction.

The finding that a higher frequency of therapist behaviors was related to higher satisfaction of participants with their therapist is somewhat in contrast to findings of Klein et al. (Klein et al., 2009b), as well as the main findings of our randomized controlled trial (Aardoom et al., 2016) that both demonstrated no differences in satisfaction between participants who received therapist support once versus three times a week on top of an E-health program. This discrepancy might be explained by the more detailed characterization and assessment of the frequency of therapist support in the current study. By counting the number of therapist behaviors as received by participants within each support session, the variation of the frequency of therapist behaviors within the support sessions is taken into account. The assessment of the frequency of therapist

support in a continuous instead of categorical way, may be a better approximation of the amount of therapist support received.

Participants' satisfaction with their therapist is closely related to the concept of therapeutic alliance (Quirk, Erdberg, Crosier, & Steinfeld, 2007; Conte, Ratto, Clutz, & Karasu, 1995; Kim, Kim, & Boren, 2008). In fact, the therapeutic alliance is an important determinant of individuals' satisfaction with their therapist (Quirk et al., 2007; Kim et al., 2008). Numerous studies have demonstrated that a positive and stable therapeutic alliance can be established within E-health intervention (Knaevelsrud & Maercker, 2006; Andersson et al., 2012; Cook, 2002; Klein et al., 2009a), which also seems to be reflected in the high satisfaction ratings of participants with their therapists in the current study. However, research into factors that may influence the therapeutic alliance in E-health interventions is scarce (Sucala, Schnurr, Constantino, & Miller, 2012). The fact that the type of therapist behaviors in the current study was related to participants' satisfaction but not outcome, is interesting. This might suggest that therapist behaviors related to assessment and interventions, may help to enhance the satisfaction of participants, but not participants' outcome. Interestingly, two studies by Alfonsson et al. (2015) and Andersson et al. (2012) also demonstrated that increased satisfaction with the intervention due to enhancement of therapist support did not carry over in increased effectiveness of the E-health intervention. Notwithstanding the importance of establishing a positive therapeutic alliance (Beck A.T., Rush A.J., Shaw B.F., & Emery G., 1979), the therapeutic alliance may be necessary, yet not sufficient for therapeutic change within guided Internet-based interventions.

This study has several strengths and limitations. Although the current study has established a temporal relationship between therapist behaviors and outcomes, an experimental study would be needed in order to investigate the causal relationship. Another limitation is that conducting qualitative research is inherent to subjective interpretation of the data and there may have been different ways of understanding and making sense of the current data. However, the inductive Grounded Theory approach has allowed categories of therapist behaviors to emerge from the data, instead of being forced through the use of pre-existing categories (Glaser et al., 1967). Furthermore, a good level of intercoder reliability was established in the current study, and by using qualitative methods, this study has provided an in-depth view on what therapists actually do within the therapist support sessions that were offered in addition to an Internet-based self-help intervention for ED psychopathology. This study only focused on therapist behaviors, not participant behaviors, since focusing on therapist behaviors could lead to valuable insights regarding how to effectively and cost-effectively implement therapist guidance in E-health interventions. Exploring participants' behaviors might be interesting

as well (Svartvatten, Segerlund, Dennhag, Andersson, & Carlbring, 2015). Finally, Skype sessions were not included. However, we consider it unlikely that inclusion of the few Skype sessions (*n*=53, 4%) would alter the results.

In order to fully explore and understand the role of therapist guidance within E-health interventions, more studies are needed that specifically investigate the behaviors of therapists in relation to outcome. Furthermore, randomized controlled trials that experimentally investigate the effects of type of therapist support (for example supportive versus CBT techniques) on outcome are needed. Lastly, the type of therapist support needs to be further examined across different populations, as well as in the context of different E-health interventions.

In conclusion, the current study has opened the black box of therapeutic support that was provided in addition to an Internet-based intervention for ED psychopathology. More therapist behaviors related to assessment and interventions relative to behaviors concerning support and empathy were associated with participants' satisfaction with their therapist, but not with participants' outcome in terms of psychopathology. The effects of the type of therapist behaviors on outcomes within E-health interventions warrants further investigation. Such research could lead to valuable insights on how to most effectively and cost-effectively implement therapist guidance in E-health interventions. That is, what a therapist needs to do in order to achieve an additional treatment effect.

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Chapter 10

E-health interventions for eating disorders: Emerging findings, issues, and opportunities

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Abstract

This study aimed to review the emerging findings regarding E-health interventions for eating disorders and to critically discuss emerging issues as well as challenges for future research. Internet-based cognitive behavioral therapy and guided self-help have demonstrated promising results in terms of reducing eating disorder psychopathology. Emerging findings also suggest that E-health interventions reach an underserved population and improve access to care. The use of smartphone applications is becoming increasingly popular and has much potential although their clinical utility and effectiveness is presently unknown and requires investigation. Important challenges include the diagnostic process in E-health interventions, the optimization of E-health within existing health care models, and the investigation and implementation of blended care. More high-quality research is needed to bring the field forward and to determine the place for E-health in our health care service delivery systems.

Introduction

Eating disorders (ED) are severe psychiatric disorders characterized by serious disturbances in attitudes and behaviors around eating, body weight, and body shape (American Psychiatric Association, 2013). Hudson et al. (2007) estimated the lifetime prevalence of anorexia nervosa (AN) among women in the United States to be roughly 0.9%, and estimated 1.5% and 3.5% lifetime rates for bulimia nervosa (BN) and binge eating disorder (BED), respectively. Eating disorders have high rates of comorbidity with other psychiatric disorders (Hudson et al., 2007) and have one of the highest mortality rates of any psychiatric disorder (Arcelus et al., 2011). Patients with an ED (Agh et al., 2015; De Jong et al., 2013) and their relatives (de la Rie, van Furth, de Koning, Noordenbos, & Donker, 2005; Zabala et al., 2009) demonstrate marked impairment in their quality of life. Hence, the economic costs of ED are substantial (Stuhldreher et al., 2012) and they represent a serious public health problem.

Despite their severity, ED are frequently undetected and many individuals do not seek or receive treatment for their ED symptoms (Hart et al., 2011; Hudson et al., 2007; Keski-Rahkonen et al., 2007). Perceived barriers to care include social barriers such as feelings of shame, or fear of stigma and social stereotyping, as well as barriers related to financial constraints and limited availability of specialized care (Becker et al., 2010; Cachelin et al., 2006). A study in the Netherlands (de la Rie et al., 2006) found that it took patients on average 3.6 years to recognize and acknowledge that they were suffering from an ED, and 4.2 to 6.3 years to seek treatment (i.e., patient delay). After seeking treatment, more than half of the community-based sample reported delays (1.1 years) in receiving treatment as well, due to waiting lists or a delay of referral (i.e., doctor/system delay) (de la Rie et al., 2006). These delays in seeking and receiving treatment are unfortunate, as studies have indicated that a shorter duration of the ED symptoms is associated with better outcomes and higher chances of recovery (Berkman, 2007; Fichter et al., 2006; Keel et al., 1997; Reas et al., 2000).

There is a need for interventions for ED that decrease barriers to care, are more widely available, and more easily accessible. Internet-based interventions have the potential to address these challenges and provide promising ways to enhance health care for patients with an ED. The number of studies investigating Internet-based and mobile interventions for ED is rising. In parallel, there is a growing number of reviews available regarding this area of research (Aardoom et al., 2013; Ambwani, Cardi, & Treasure, 2014; Bauer & Moessner, 2013; Dolemeyer, Tietjen, Kersting, & Wagner, 2013; Fairburn & Rothwell, 2015; Juarascio, Manasse, Goldstein, Forman, & Butryn, 2015; Loucas et al., 2014; Schlegl, Burger, Schmidt, Herbst, & Voderholzer, 2015; Shingleton, Richards, &

Thompson-Brenner, 2013). In the current study, we will update our previous review (Aardoom et al., 2013) and critically evaluate published literature over the past 1-3 years (January 2013 – September 2015) with respect to E-health interventions for individuals with ED symptoms. Furthermore, we will critically discuss some emerging issues in this field and several areas for future research in order to bring the field forward.

Methods

We searched four electronic databases (Medline, Embase, PsycInfo, Web of Science) for studies and study protocols published between January 2013 and September 2015. Search terms included 'online', 'web-based', 'Internet-based', 'e-health', 'e-mail', 'technology-based', 'mobile', 'smartphone' combined with 'eating disorders', 'bulimia', 'anorexia', 'binge eating'. The reference lists of retrieved papers were also checked for other relevant studies. Studies were included if they examined an Internet-based or mobile intervention for individuals with ED symptoms, or included at least one internet-based or mobile component. Studies evaluating Internet-based prevention programs were excluded.

Results

E-health for eating disorders: Emerging findings

Treatment and self-help interventions

Three large randomized controlled trials investigated Internet-based cognitive behavioral therapy (CBT) (Ruwaard et al., 2012; ter Huurne et al., 2015a; Wagner et al., 2013). Generally, these trials consist of a structured CBT program including different modules (e.g., monitoring, cognitive restructuring) that individuals have to work through sequentially, accompanied by assignments and homework. Therapist support is provided on at least a weekly basis via email. Ter Huurne et al. (2015a) found that for individuals with BN, BED, and eating disorder not otherwise specified (EDNOS), an Internet-based CBT was more effective than a waiting list control in terms of ED psychopathology, body dissatisfaction, physical health, symptoms of depression, self-esteem, and social functioning (range Cohen's *d*=0.20-1.28). Two other studies investigated Internet-based CBT in individuals with BN (Ruwaard et al., 2012; Wagner et al., 2013). Ruwaard et al. (2012) demonstrated Internet-based CBT to be more effective than both a waiting list control (*d*=1.20) and unguided self-help (*d*=0.90). This may suggest superiority of guided interventions over unguided interventions, which would be in line with emerging findings of E-health studies in the field of mental health (Baumeister et al., 2015). Finally, Wagner

et al. (2013) found Internet-based CBT to be equally effective as conventional guided self-help, in which participants received a self-help book and e-mail support from a therapist.

A pilot study by Hogdahl et al. (2013) supported the findings of Wagner et al. (2013) that a self-help book with e-mail support can significantly improve ED psychopathology (*d*=0.78) over time. Regarding unguided self-help, results of an open trial of an unguided Internet-based self-help program showed that participants experienced improvements in their motivation to change, ED psychopathology, and symptoms of depression and anxiety (Leung, Ma, & Russell, 2013a; Leung, Ma, & Russell, 2013b). However, no comparison condition was used and almost 60% of the study samples reported that they were receiving treatment. Hence, positive results may have been caused by general treatment participation or other factors rather unspecific of the unguided self-help program.

A large (*N*=212) trial conducted by Hötzel et al. (2014) examined guided Internet-based motivational enhancement therapy for individuals with AN or BN. In six online sessions of approximately 45 minutes, participants were asked to complete writing assignments which were based on principles of motivational interviewing. For example, writing about the pros and cons of the ED and change, or writing about the impact that the ED has concerning patients' life goals and quality of life. Individualized feedback was provided after each assignment. Results demonstrated the Internet-based motivational enhancement therapy to be superior to a waiting list in enhancing motivation to change and self-esteem, as well as in reducing restraint (Hotzel et al., 2014). This suggests the Internet to be a potentially useful means to deliver interventions targeting individuals with an ED who are ambivalent towards change, which eventually may help to increase the number of individuals entering treatment for their ED.

Finally, two preliminary studies by Cardi et al. (2013) investigated the use of short video clips ('vodcasts') as a self-help intervention in order to support meal intake for patients with AN and BN. The vodcasts included auditory and visual content including amongst other things music, psychoeducation, and content based on motivational interviewing principles. Participants generally evaluated the vodcasts as being helpful, motivating and practical to use (Mohr et al., 2012). Nevertheless, the effectiveness of the vodcasts in terms of reducing meal distress and increasing meal consumption remains to be evaluated, as no control conditions were included.

Aftercare and maintenance treatment

Two randomized controlled trials reported on an Internet-based maintenance treatment for individuals with ED (Fichter, Quadflieg, & Lindner, 2013; Gulec et al., 2014; Unikel, Sánchez, Trujillo, Bauer, & Moessner, 2015). Fichter et al. (2013) reported on the 9-month

follow-up of an Internet-based CBT relapse prevention program for individuals with AN (*N*=210) after discharge from inpatient treatment. Although participants showed improvements over time regarding measures of ED psychopathology, no significant differences were found between the relapse prevention and the control condition for the majority of outcome measures.

Gulec et al. (2014) investigated the effectiveness of an Internet-based maintenance intervention for individuals with BN or EDNOS (*N*=105). The intervention comprised psychoeducation, weekly group chat sessions, a forum, and a fully automated monitoring and feedback system. The intervention was demonstrated to be feasible and acceptable, but the intervention was not more effective in reducing psychopathology than a waiting list. However, the study had methodological shortcomings and limitations when assessed with the Cochrane risk of bias tool (Higgins et al., 2011). For example, the timing of the intervention could be considered too late as participants were enrolled when they had completed treatment for their ED within the past 12 months, whereas the highest risk for relapse is between four and twelve months after discharge (Carter et al., 2004; Carter et al., 2012; McFarlane, Olmsted, & Trottier, 2008). Furthermore, the 4-month timeframe of the study period may have been too short to detect an effect.

A recent pilot study in Mexico by Unikel et al. (2015) used an adapted version of the above described intervention of Gulec et al. (2014). Preliminary results of 15 participants demonstrated the intervention to be feasible and acceptable, although there were also concerns about data security. Participants furthermore reported on ways to improve the program, for example by using videos and photos in the program, or offering more flexible hours for the group chat sessions. Flexibility is an important factor to consider when developing and implementing E-health interventions, as flexibility may be one of the key reasons for individuals to prefer E-health interventions over face-to-face interventions.

Predictors of outcome and dropout

To our knowledge, only two studies examined predictors of outcome in an Internet-based interventions for ED. Within a guided self-help program for individuals with BN, it was found that higher motivation to change, higher harm-avoidance, higher drive for thinness, lower binge eating, and lower body dissatisfaction at baseline predicted better outcomes (Wagner et al., 2015). Another study (Hogdahl, Birgegard, & Bjorck, 2013) investigating guided self-help for individuals with BN, identified lower baseline body mass index and higher self-esteem as predictors of good outcome.

What about predictors of dropout? Higher baseline levels of depression and ED psychopathology (i.e., shape concerns, self-induced vomiting, and binge eating episodes)

were shown to predict dropout within an Internet-based motivational enhancement therapy (von Brachel et al., 2014). Lower self-directedness was found to predict dropout in a guided self-help program (Wagner et al., 2015).

Smartphone applications in the treatment of eating disorders: emerging findings

In the last few years, there has been an explosive growth in the availability of health-related mobile applications. Recently, two reviews on mobile applications ('apps') for individuals with ED have been published (Fairburn et al., 2015; Juarascio et al., 2015). Both reviews aimed to identify the available apps, and to evaluate their functions and clinical utility. The effectiveness of these apps could not be reviewed as research studies in this field are currently lacking. Juarascio et al. (2015) identified 20 apps. Five apps provided psychoeducation, whereas 9 incorporated a variety of functions such as self-assessment tools, tools for finding referrals, and supportive pro-recovery material. Six apps were aimed at the treatment of patients with an ED or could be used as an adjunct to existing treatments. These 6 apps were reviewed in detail, and the authors concluded that most of these apps only made limited use of evidence-based treatment strategies, such as principles based on CBT, interpersonal therapy, or acceptance and commitment therapy. Moreover, the app functionality and the degree to which the apps utilized recent advances in smartphone technologies (e.g., ecological momentary assessment) appeared to be limited (Juarascio et al., 2015).

A similar conclusion regarding the status of apps for ED was reached by another review (Fairburn et al., 2015). Furthermore, in that review, Fairburn and Rothwell (2015) concluded that the majority of apps included variable or misleading information with respect to the provision of information, advice, treatment, and self-assessment. In addition, 5 apps were identified that were developed for clinicians. Three apps included scientific articles, an e-book, and events sponsored by a recovery center for ED respectively. Another app included diagnostic information on ED, as well as some information on assessment and screening tools. Finally, one app ('Recovery Record') links clinicians to their patients. With the use of this app, clinicians can access monitoring data of their patients and patients and clinicians can communicate directly with each other.

Most recently, Tregarthen et al. (2015) described the development, characteristics, and user- and utilization statistics of Recovery Record. With over 108.000 downloads over a 2-year timeframe, the app has become increasingly popular. The acceptability of the app was demonstrated by high user ratings; approximately 97% of the users rated the app with 4 or 5 stars out of 5. However, the effectiveness of this smartphone app remains to be evaluated. Collectively, the emerging literature suggests that the use of smartphone applications in the treatment of ED has much potential and is

becoming increasingly popular. However, the effectiveness, validity, and clinical utility of these apps have not yet been established and warrants further investigation.

Development and implementation of E-health interventions

Internet-based treatment could be offered instead of face-to-face treatment but the development and implementation of E-health interventions is challenging. Moreover, most E-health interventions have not been developed as a replacement, but rather to use before, after, or as a supplement to existing treatments. Internet-based self-help interventions, for example, may particularly be of interest within a stepped-care approach for the treatment of ED. Such self-help interventions can be used to provide low-intensity care in case of mild ED symptoms and for individuals who have never received treatment. Individuals who do not respond to self-help, can then easily 'step up' to more intensive treatments (Mitchell et al., 2011). Guided or unguided Internet-based self-help could similarly be offered to individuals whose symptoms have improved after receiving treatment, but are still in need of support to work on their recovery and in consolidating and maintaining treatment gains.

Another issue related to the development and implementation of E-health interventions is the combination of face-to-face and online components into a blended care intervention. Unfortunately, well-designed studies investigating blended care for ED are lacking. Blended care is a promising innovation as it could provide the best of both worlds. That is, online components can reduce travel time and stimulate self-management. Face-to-face sessions can in turn be more personal and may enhance the therapeutic relationship. Importantly, patients seem to prefer face-to-face sessions in combination with online sessions in the treatment of mental problems (McClay, Waters, Schmidt, & Williams, 2014; van der Vaart et al., 2014). By blending online and face-to-face components however, one of [illegible] face-to-face sessions, instead of being a substitution of, at least some, face-to-face sessions. The latter has been demonstrated in a study comparing face-to-face treatment with blended treatment for individuals with anxiety and depression (Kenter et al., 2015). Thus, implementation seems to be key; ideally, blended care should improve efficiency (e.g., reduction traveling time, more flexibility) and reduce costs.

Diagnostics in E-health interventions

In daily clinical practice, the "gold standard" for determining a psychiatric diagnosis per classification systems such as the DSM (American Psychiatric Association, 1994; American Psychiatric Association, 2013) is a face-to-face clinical interview. The DSM establishes consistent and reliable diagnoses and furthermore provides a 'common language' to

communicate about these disorders. Importantly, a face-to-face clinical interview allows for clinical intuition and could lead to more detailed information on patients' experiences and symptoms as compared to self-report assessments. Clinicians can furthermore observe and take into account patients' nonverbal behaviors and responses.

Yet, a face-to-face interview may be at odds with the aims or clinical evaluation of anonymous E-health interventions or applications. If so, is the lack of a face-to-face diagnostic classification problematic? Should we always aim to include a face-to-face clinical interview? A DSM-based psychiatric diagnosis (American Psychiatric Association, 2013) is essential if the treatment is to be reimbursed by a health insurance company. However, the incorporation of a face-to-face diagnostic interview can be in conflict with the goals and advantages of using new technologies as delivery mode of interventions. These goals often pertain to lowering the threshold of seeking help, improving health outcomes, and/or improving the efficiency, accessibility and availability of health care services. Potentially, E-health interventions improve our reach to underserved populations; individuals who would otherwise not have been reached. Face-to-face appointments could limit or eliminate the above-mentioned advantages that often serve as one of the main goals of choosing E-health over more traditional delivery modes. In both research and everyday clinical practice, this is an undesirable situation especially because the majority of individuals with an ED does not seek or receive mental health care (Keski-Rahkonen et al., 2007; Hart et al., 2011; Hudson et al., 2007) due to perceived barriers including a fear of stigma, feelings of shame, and limited availability of specialized care (Becker et al., 2010; Cachelin et al., 2006).

In order to preserve the potential advantages that come with the Internet as delivery mode of the intervention, a valid and reliable online self-report questionnaire for diagnostic classification would be of great value. Keel et al. (2002) investigated the diagnostic agreement between face-to-face or telephone clinical interviews and self-report paper-based questionnaire data. Although the different assessment methods produced somewhat different results (i.e., higher rates of ED with questionnaire data), the authors concluded that the results challenge the use of a structured clinical interview as golden standard for the assessment of ED classifications. Both of the assessment methods have drawbacks, but possibly, the anonymity of self-report questionnaires leads to increased candor (Keel, Crow, Davis, & Mitchell, 2002).

This line of assessment research has been pursued by other researchers as well. Moessner et al. (2015) developed a self-report questionnaire for the online assessment of ED: the Clinical and Research Inventory for Eating Disorders (CR-EAT). The questionnaire showed good internal consistency and test-retest reliability, and showed promising results regarding construct and discriminant validity. The clinical utility of the CR-EAT requires

further investigation. Ter Huurne et al. (2015b) investigated the clinical utility and validity of an online self-report questionnaire (Eating Disorder Questionnaire-Online; EDQ-O) in diagnosing DSM-IV-TR (American Psychiatric Association, 1994) ED, in comparison to a face-to-face clinical interview. The degree to which these two assessment methods led to similar diagnoses ranged from acceptable to high, although the EDQ-O appeared to have low sensitivity in correctly classifying AN (0.44) and BED (0.66). The sensitivity rates for BN and EDNOS were moderate to high: 0.78 and 0.87 respectively. Thus, in E-health studies where a face-to-face clinical interview is in conflict with the primary goals of delivering the intervention by means of the Internet, the EDQ-O seems to be an acceptable instrument to provide a diagnostic impression of study samples. Nevertheless, it would be valuable to further assess and improve the diagnostic validity of the EDQ-O or comparable online self-report questionnaires, also in light of some revisions of the diagnostic criteria with the appearance of the fifth edition of the DSM (American Psychiatric Association, 2013).

Reaching an underserved population and improving access to care?

Reaching an underserved population is often a goal or presumed potential advantage of E-health interventions. Is there evidence that E-health interventions actually reach underserved populations, or improve access to care? Several studies suggest that this is indeed the case. McClay et al. (2014) qualitatively examined the attitudes towards online self-help in a community sample of individual with symptoms of BN. They found that individuals often possessed negative attitudes towards accessing traditional treatments, due to fear, shame, embarrassment, long waiting lists and negative past experiences with such treatments. These difficulties may be solved by seeking help online, with reported advantages such as privacy, anonymity, convenience, and easy access (McClay et al., 2014).

In the three studies investigating an Internet-based CBT reviewed above (Wagner et al., 2013; ter Huurne et al., 2015a; Ruwaard et al., 2012), approximately 33% to 56% of the participants reported not having received any previous treatment for their ED. Similarly, Tregarthen et al. (2015) found that 46% of the users of an ED self-monitoring smartphone app reported that they were currently not receiving any treatment for their ED. A cross-sectional study (Aardoom, Dingemans, Boogaard, & van Furth, 2014) of the pro-recovery focused website and E-community 'Proud2Bme' showed that approximately one third of the study sample had never received treatment. In addition, results suggested that the E-community stimulated help-seeking behaviors. Of the visitors who received treatment at the time of the study, half reported having sought help as a result of visiting the website. Finally, a study by Wagner et al. (2013) further supported the idea that E-

health interventions improve access to traditional face to face care, as participants reported to be motivated to seek further treatment after receiving Internet-based CBT.

Challenges, research gaps and future directions

There appears to be a research gap in comparing face-to-face and E-health interventions although three trials (Bulik et al., 2012; de Zwaan et al., 2012; Jenkins, Luck, Burrows, & Boughton, 2014) are ongoing. One trial is comparing the efficacy of Internet-based guided self-help with CBT for individuals with BED (de Zwaan et al., 2012), whereas another trial (Bulik et al., 2012) is comparing Internet-based group CBT with face-to-face group CBT for individuals with BN. In addition, Jenkins et al. (2014) are investigating the effectiveness of guided self-help delivered either face-to-face or via e-mail.

E-health research on the effectiveness of aftercare and relapse prevention of ED is still at an early stage. It is highly relevant to develop and study this area of research further, as relapse rates following treatment of AN and BN generally range between 35% and 50% (McFarlane et al., 2008), even after successful treatment. New technologies have potential for delivering easily accessible services that might help individuals to maintain and consolidate treatment gains, as well as prevent relapse. Online or mobile aftercare interventions may help to assist with the transition from treatment to daily life, as well as assist in the continuous process of recovery and early relapse detection (e.g., by monitoring ED behaviors and cognitions).

Currently, little is known about how and for whom E-health interventions work or who drop out from such interventions. A better understanding of predictors of dropout and outcome in E-health interventions could help to better implement and utilize such interventions. For example, the intensity, speed, and different components of an intervention might be tailored to the different needs of individual participants, thus moving towards personalized E-care. Similarly, individuals may vary in the extent to which they need and prefer therapist support in guided E-health interventions. Experimentally investigating the amount of therapist support within E-health interventions may lead to important insights on the duration and frequency of therapist support that is needed in order to improve participants' outcomes.

Previous reviews have concluded that the methodological quality and the level of evidence of conducted studies are both limited (Aardoom et al., 2013; Loucas et al., 2014; Schlegl et al., 2015). In the past 3 years, only six randomized controlled studies have been published on the effectiveness of an E-health intervention, of which four in 2013 (Fichter et al., 2013; Hotzel et al., 2014; Ruwaard et al., 2012; Wagner et al., 2013), only one in 2014 (Gulec et al.) and one in 2015 (ter Huurne et al.). More trials with good methodological quality and low risk of bias are needed in order to bring the field forward

and to establish a potential evidence-base of E-health interventions for individuals with ED. Risks of bias (Higgins et al., 2011) can be caused by different sources, one example being substantial amounts of missing data and methods in handling these. The studies included in this review had study dropout rates between approximately 4% and 43% (Gulec et al., 2014; Hotzel et al., 2014; Leung et al., 2013b; Ruwaard et al., 2012; ter Huurne et al., 2015a; Wagner et al., 2013). When facing substantial amounts of missing data, it is important to choose statistical techniques that handle missing data appropriately, for example multiple imputation approaches (Blankers, Koeter, & Schippers, 2010; Graham, 2009; Schafer et al., 2002).

Although it is often assumed that Internet-based interventions for ED are cost-effective in comparison to waiting lists or usual care, no studies have been published to substantiate this assumption. Fortunately, we identified several ongoing trials investigating the cost-effectiveness of Internet-based interventions for ED with a face-to-face alternative (Bulik et al., 2012; Jenkins et al., 2014). Furthermore, the cost-effectiveness of an Internet-based self-help intervention with or without therapist support in comparison to a waiting list is currently being investigated (Aardoom et al., 2013). Crow et al. (2013) investigated a stepped-care approach for individuals with BN, starting with offline self-help from which patients could 'step up' to more intensive treatment approaches. This stepped-care approach was more effective and less expensive, hence cost-effective when compared to CBT. Stepped care approaches in which low-intensity interventions are provided first, may well be delivered online. Possibly, effectiveness and efficiency will thus be increased and lead to even greater reductions in costs.

Furthermore, as described in previous sections of this paper, it would be relevant to develop and examine online diagnostic instruments focusing on the DSM-V (American Psychiatric Association, 2013) criteria for ED. Another future research direction includes focusing on the potential of E-health interventions within a stepped-care approach, as these may heighten the availability, accessibility and quality of health care for individuals with ED symptoms. Also, the potential of blended care, in which face-to-face sessions can be substituted by online modules and online therapist support, requires further investigation. Finally, there is a need to investigate the effectiveness, validity, and clinical utility of smartphone apps for individuals with ED and ED professionals.

Conclusions

Emerging research suggests that Internet-based CBT and self-help interventions can be effective and have potential to help address various gaps in ED treatment although much more research is needed to address important uncertainties. The (cost-) effectiveness of aftercare and relapse prevention programs, as well as smartphone applications requires

investigation. E-health interventions seem to reach underserved populations and may improve access to care but important challenges remain regarding the diagnostic process, the optimization of E-health within existing health care models, and the investigation and implementation of blended care. E-health could help to enhance health care for patients with ED, potentially making it possible to treat more individuals, with an increased effectiveness, less intensive professional guidance, while reducing overall costs. E-health is here to stay, but more high quality research is needed to determine the place for E-health in our service delivery systems and to reach the full potential of E-health.

Chapter 11

Summary and general discussion

In the introductory chapter (Chapter 1) we highlighted that ED are severe psychiatric disorders that represent a significant public mental health concern. Unfortunately, many ED go undetected and the majority of individuals experiencing ED symptoms does not seek and receive health care. Amongst those who do, the current health care services appear only moderately effective. We concluded that there is a need to improve the quality, availability and accessibility of the current health care services. E-health has potential in addressing these challenges and in increasing the efficiency of health care services, thereby potentially lowering the costs of these services as well. Therefore, the focus of this dissertation was on the question of whether and how E-health can help to improve health care for individuals with eating disorder (ED) symptoms. This question was explored by 1) systematically investigating the literature regarding E-health for ED, 2) investigating the potential empowering effects of the e-community 'Proud2Bme', and 3) investigating the fully automated Internet-based intervention 'Featback' with different intensities of therapist support from a clinical, an economical and a qualitative perspective. In this final chapter, the main findings of the studies included in this dissertation are summarized and discussed. The recommendations and clinical implications that follow from the findings in this dissertation are presented. We furthermore consider the strengths and limitations of the research, and finally, we discuss the opportunities and directions for future research.

Summary and discussion

In **Chapter 2**, the literature with respect to Internet-based treatment of ED was systematically reviewed. Most of the included studies investigated an Internet-based cognitive behavioral therapy (CBT), whereas several others investigated CBT delivered by e-mail, the use of e-mail as an adjunct to face-to-face therapy, self-help programs with Internet-based therapist support, or Internet-based unguided self-help. The Internet appeared a promising and acceptable vehicle for delivering ED treatment. Internet-based treatments were found to be superior to waiting lists in reducing ED psychopathology, frequency of binge eating and purging, and improving quality of life. However, the methodological quality of the studies varied and the results of randomized controlled trials were often not reported in accordance with the CONSORT criteria (Schulz et al., 2010; Eysenbach et al., 2011). Several important research gaps and directions for future research were identified. There appeared a lack of economic evaluations and a lack of investigations of predictors, moderators, and mediators of outcome: what works for whom and what is the psychological mechanism that is responsible for participants' change? Also, a lack of knowledge on the role of therapist support within Internet-based

interventions was identified: are Internet-based treatment without therapist support as effective as those without? Does a higher frequency of therapist contact enhance patient outcome?

Chapter 3 reports on a study related to the website and e-community 'Proud2Bme'. Proud2Bme provides a pro-recovery focused, healthy, and positive alternative to potentially harmful pro-ED websites that encourage eating disordered behaviors. Proud2Bme offers a wide variation of information and blogs on diverse topics, as well as a forum and a chat to interact with peers or health care professionals. The e-community aims to increase empowerment by raising awareness and to enhance self-management and promote and facilitate help seeking behaviors. This Chapter includes a cross-sectional investigation of 311 visitors of Proud2Bme who self-reported to have ED problems. We investigated whether, and to what extent, empowerment processes and outcomes were experienced by visitors of Proud2Bme, as well as to explore potential correlates of these processes and outcomes. Results demonstrated that individuals visit Proud2Bme for a variety of reasons, the most popular one wanting to read about personal stories and the experiences of others, but also to enjoy oneself, find information on ED, and finding help. The most frequently experienced empowerment processes were exchanging information, finding recognition, and sharing experiences. Regarding empowerment outcomes, participants reported to feel better informed as a results of visiting Proud2Bme. Furthermore, to a smaller degree, visitors indicated that visiting Proud2Bme increased help-seeking behavior and optimism and control over the future, as well as increased confidence in treatment and the relationship with their therapist. Individuals with generally low levels of empowerment, younger age, and more interactive usage patterns experienced more empowerment as a results of Proud2Bme. In sum, these preliminary results suggest Proud2Bme to be an empowering e-community, helping individuals to take control over their lives and the management of their ED problems, as well as assisting them in their process of recovery.

In **Chapter 4**, the design of a randomized controlled trial (RCT) investigating the second E-health intervention of this dissertation, called 'Featback', was presented. Featback consisted of psychoeducation and a fully automated monitoring and feedback system. This latter comprised a weekly online monitoring questionnaire tapping the four most important areas of ED psychopathology: body dissatisfaction, excessive concern with body weight and shape, unbalanced nutrition and dieting, and binge eating and compensatory behaviors. After completion, supportive feedback messages were automatically generated according to a pre-defined algorithm and sent by e-mail to the participants. The tailored

messages contained social support and advice on how to counteract reported ED symptoms. Eligible participants were aged 16 years of older with self-reported ED symptoms. The trial included four conditions: 1) Featback, 2) Featback supplemented with the possibility of low-intensity (weekly) therapist support by means of e-mail, chat, or Skype, 3) Featback supplemented with the possibility of high-intensity (three times a week) therapist support, and 4) a waiting list control condition. Online self-report assessments were scheduled at baseline, post-intervention (after eight weeks), and 3-and 6-month follow-up. The latter except for the waiting list control condition, who were offered Featback with low-intensity therapist support after the 3-month follow-up. In Chapter 5 to 9, the results of different research questions regarding this randomized controlled trial are reported on.

The effectiveness of Featback and the added value of therapist support was evaluated in **Chapter 5**. Three hundred and forty-five participants with self-reported ED symptoms were recruited via the e-community Proud2Bme and the website of Featback for the RCT as described above. From baseline to post-intervention, the three Featback conditions were found to be superior to the waiting list in reducing bulimic psychopathology, symptoms of depression and anxiety, and levels of perseverative thinking. From post-intervention to 3-month follow-up, more improvements in the Featback conditions as compared to the waiting list were found regarding symptoms of anxiety and depression, as well as ED-related quality of life. No improvements over time were found for symptoms of anorexia nervosa. Contrary to the expectations, supplemental therapist support enhanced satisfaction with the intervention, but did not increase its effectiveness.

In **Chapter 6** we have investigated moderators of intervention response, in order to help identify which individuals may benefit most from Featback and additional therapist support, and which individuals may benefit least. We analyzed a subgroup (*n* = 273) of RCT participants who completed baseline and post-intervention assessments. Both baseline levels of symptoms of anorexia nervosa and bulimia nervosa were found to moderate intervention response. For individuals with relatively severe anorectic psychopathology, Featback without therapist support was found to be inferior to the waiting list and Featback with low- and high-intensity therapist support. For the subgroup with mild to moderate anorectic psychopathology, Featback with and without therapist support was not found to be more effective than the waiting list. For participants with relatively severe symptoms of bulimia nervosa, similar reductions in bulimic psychopathology were found across all four study conditions, whereas participants with relatively less severe bulimic symptoms demonstrated better outcomes in the Featback conditions as compared to the

waiting list in terms of improvements in symptoms of bulimia nervosa. To summarize, the findings in this chapter suggest Featback to be particularly useful for individuals with mild to moderate bulimic psychopathology.

In **Chapter 7** we aimed to investigate mediators of intervention response. In other words: what is the psychological mechanism that is (partly) responsible for participants' change? Identifying critical mechanisms of change could highly inform clinical practice, as the effectiveness of the mental health interventions could be enhanced and maximized accordingly. We analyzed a subgroup of 75 RCT participants who completed the baseline (week 0), mid-intervention (week 4), and post-intervention (week 8) assessment. The results of the conducted cross-lagged panel analyses demonstrated that early changes (week 0-4) in symptoms of anxiety and depression were found to predict later changes (week 4-8) in both anorectic and bulimic psychopathology. However, levels of perseverative thinking were not found to mediate subsequent changes in ED psychopathology. These findings suggest that the reduction of anxiety and depression symptoms is an important mechanism through which Featback exerts its effects. Hence, it might be important to focus on targeting negative affect during interventions or treatments for individuals with ED symptoms. For example, by focusing on learning new ways to cope with negative affect.

The cost-utility of Featback with and without therapist support in comparison to the waiting list was examined in **Chapter 8**. Data from baseline, post-intervention, and 3-month follow-up were included in the analyses (*N* = 354). A societal perspective was adopted including both healthcare and non-healthcare costs. The outcome was measured in term of health-related quality of life: quality-adjusted life years. The results demonstrated no significant differences in costs and outcome between the four study conditions, although the mean societal costs per participant were highest in the waiting list control condition (€2582), followed by Featback without therapist support (€2102), high-intensity therapist support (€2032), and low-intensity therapist support (€1951). Overall, the results of the cost-utility acceptability curves demonstrated that all three Featback strategies (i.e. Featback with no, low-intensity, or high-intensity therapist support) were cost-effective as compared to the waiting list, with no clear preference for one of the three Featback strategies.

Little is known about the type of support that is offered by the therapists (i.e. what do therapists actually do?) and whether certain therapist behaviors are related to specific participant outcomes. These issues were therefore explored in **Chapter 9**. Although all

therapists underwent training in the delivery and methodology of online support and followed a 5- or 3-phase model for delivering chat or e-mail support respectively, there can be variation in the kind of behaviors therapists' show. All therapist communication from e-mails to, and chats with, the participants in the Featback conditions with supplemental therapist support (*n* = 177) were qualitatively explored. Thirty-one therapist behaviors were identified, all defined and explained in a codebook. Subsequently, therapist behaviors were counted in all e-mail and chat communication to the participants. Most frequently, therapists asked questions in order to asses the situation or problem (12.3%), showed empathy or compassion with a participant (12.1%), or provided the participant with advice or tips (11.3%). Next, all 31 therapist behaviors were grouped under higher order categories: 1) support and empathy (*n* = 19,282: 48.0%), 2) assessment and interventions (*n* = 16,149: 40.2%), and 3) formalities and procedure (*n* = 4785: 11.9%). The type or frequency of therapist behaviors was not associated with participant outcomes in terms of effectiveness (i.e. level of ED psychopathology). However, more therapists behaviors related to assessment and counseling relative to behaviors concerning support and empathy, were associated with higher participant satisfaction with their therapist. Also, more therapist behaviors in general were shown to predict higher satisfaction of participants.

Chapter 10 can be regarded as an extension to, and follow-up of, our previous review (Chapter 2). This chapter can furthermore be considered as the foundation for the general discussion (Chapter 11), as it covers the emerging findings, issues, and opportunities regarding E-health interventions for ED in the past few years (2013-2015). Internet-based cognitive behavioral therapy and guided self-help were found to be effective in reducing ED symptoms and comorbid problems. The literature was scarce regarding the use of E-health in the aftercare or maintenance treatment of ED. Regarding the explosive growth in the availability of smartphone applications ('apps') in the treatment of ED, it was alarming to find that the majority of these apps appear to make only limited use of evidence-based treatment principles. Also, many apps appeared to contain variable or misleading information. We furthermore reviewed the literature regarding the question of whether E-health can reach an underserved population and improve access to care. Indeed, emerging evidence suggested that through E-health an underserved population is reached and that there is improved access to care. Nevertheless, important challenges remain. The most important one being the implementation and integration of E-health within the existing health care models. For example, self-help interventions could be incorporated within stepped-care models to provide an early intervention or aftercare. Also, the use of blended care, in which face-to-face and online components are combined, holds promise

in increasing the efficiency of health care services and reducing corresponding costs. The review concluded that E-health is here to stay, but that much more high-quality research is needed to determine the place for E-health in our service delivery systems and to reach the full potential of E-health.

Recommendations and clinical implications

E-health services should never be provided as a goal in itself, but always as a means to improve one or more aspects of the current health care system. In the current dissertation, we have focused on E-health interventions as a means to improve the accessibility, quality, and efficiency of health care services for individuals with an ED. In this section, we aim to translate the current dissertation findings to everyday clinical practice, discussing the clinical implications and recommendations.

Overall, we recommend investing in the development, improvement, implementation, and embedding of E-health services for individuals with ED symptoms in the Dutch health care system for numerous reasons. To begin with, in line with previous literature, findings from the current dissertation show that E-health interventions can reach underserved populations. That is, 28.5% and 54.0% of the Proud2Bme and Featback study sample respectively, reported to have never received treatment. This implicates that E-health interventions could help to decrease the alarmingly high unmet need for health care for individuals with ED symptoms (Hart et al., 2011), and to improve early detection and intervention of symptoms.

E-health interventions could furthermore serve as a means to fast-track individuals to appropriate care. Although not explicitly reported on in any of the individual study reports of this dissertation, approximately 42% of the Proud2Bme study sample reported to have sought professional help as a result of visiting Proud2Bme. Within the subgroup of Featback participants that reported planning on seeking professional help directly after the intervention period, approximately 23% reported that Featback had stimulated them to seek help, and 28% reported that they would presumably not have had this intention without participating in Featback. This suggests that the e-community Proud2Bme and the Internet-based intervention Featback can serve as a means to fast-track individuals to more intensive, tailored care. In turn, early detection of ED symptoms and quicker access to tailored care could enhance ED outcomes, as shorter symptom duration has been found to predict better outcomes (Keel et al., 2010; Le Grange et al., 2014; Steinhausen, 2002).

We found preliminary evidence that Featback is effective in reducing ED symptoms, particularly symptoms of bulimia nervosa, as well as comorbid psychopathology in comparison to a waiting list. In addition, Featback with no-, low-intensity-, or high-intensity therapist support all demonstrated to be cost-effective in comparison to a waiting list, with no clear preference for Featback with and without therapist support. Together with our finding that therapist support clearly enhanced participants' satisfaction and perceived quality and effectiveness of the intervention, our recommendation for implementation would be to provide Featback with at least some sort of therapist guidance. Therapist support is especially recommended for individuals who report relatively high levels of anorexia nervosa, as Featback without therapist support did not appear to be effective in reducing symptoms of anorexia nervosa. As part of the Featback intervention, the therapist can fulfill several important roles. For example, enhancing the adherence to the monitoring- and feedback system by motivating the participant to keep monitoring their ED symptoms. Intervention compliance was only moderate in our randomized controlled setting, in which we aimed to maximize compliance by sending motivational reminders repeatedly and by including a lottery for participants who completed all monitoring- and study assessments. Compliance might be reduced in a real-world setting without any motivational reminders to keep filling in the monitoring questionnaires. Furthermore, therapists could enhance participants' satisfaction with the intervention and thereby improving the perceived quality of care, as demonstrated in the current dissertation. Finally, therapists have to take appropriate action when the monitoring data of participants show severe deteriorations of ED symptoms. An important role of therapists is to direct participants to more intensive tailored care, or to provide one or more low-intensity counseling (online) sessions. In these support sessions, it might be useful not only to focus on dealing with ED symptoms but also on the management of comorbid symptoms of anxiety, as our results suggested that these may represent an important mechanism by which ED psychopathology can be reduced.

Strengths and limitations

The results of the research in this dissertation should be considered in light of several strengths and limitations.

Use of different perspectives

One of the major strengths is the evaluation of Featback from different points of view:

from a patient perspective (i.e. what are the experiences with Featback?), from a clinical perspective (i.e. is Featback effective in reducing psychopathology? What is the added value of therapist support? Is Featback and the supplemental therapist support more effective for particular subgroups of individuals? What are possible underlying mechanisms of change?), from an economic perspective (i.e. is Featback cost-effective in comparison to a waiting list control condition?), and finally, a qualitative perspective in which the type of therapist support was extensively explored and examined in relation to outcome.

Anonymity and lack of clinical diagnosis

Individuals who participated in the research trials investigating Proud2Bme and Featback could participate anonymously, hence no face-to-face meetings were included. One advantage of this approach is that it lowers the threshold of seeking care because barriers such as shame and fear of stigmatization are less of an issue. It is therefore expected that anonymous E-health interventions can improve our reach to underserved populations. Besides the reach, the accessibility of health care services can be increased, as geographical barriers such as living in a remote area are no longer a problem.

A limitation that comes with the anonymity and lack of face-to-face meetings however, is that this might have negatively influenced study adherence (Aardoom et al., 2013). Furthermore, no (face-to-face) diagnostic interviews were conducted and consequently DSM-based ED diagnosis (American Psychiatric Association, 2013) were not available. This is unfortunate, as the DSM is known to establish consistent and reliable diagnoses, and furthermore provides a common language for patients and clinicians to describe and communicate about psychiatric disorders. That being said, in anonymous E-health studies, the Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn et al., 2008) can be used to evaluate symptom severity, by comparing the scores to the norms of a clinical and general population. Also, the EDE-Q can be used to help provide a diagnostic impression of the study population by evaluating participants' body mass index, as well as presence and frequency of binge eating and compensatory behaviors. It is furthermore important to note that Featback cannot be considered a treatment, but rather an (early) intervention program that aims to help reduce ED psychopathology, hence a DSM classification was considered to be of less relevance.

Broad eligibility criteria and heterogeneity

In the included studies investigating Proud2Bme and Featback, we have used rather broad eligibility criteria. The only exclusion criteria for participants were not reporting at least mild ED problems (Featback and Proud2Bme trial), or being younger than 16 years old

(Featback trial). One of the strengths of the use of these broad inclusion criteria is that the study participants are likely to resemble the individuals who make use of this E-health intervention in everyday practice, presumably serving a broad population of individuals experiencing mild to severe ED symptoms. Another strength of such broad inclusion criteria is that it enhances the external validity of the findings. The recruited study sample may well bear close resemblance to every practice, including individuals with various subtypes of ED and comorbidities, thereby enhancing the generalizability of the findings. Furthermore, the heterogeneity of the samples allowed for subgroup analyses in which we were able to investigate for whom what worked, and under what conditions.

A limitation of the broad eligibility criteria is that participants could show large variations in variables such as the presence of comorbid symptoms and the use of co-interventions or medication. In the Featback trial, we have taken these potential sources of bias into consideration by controlling for such variables in the analyses of the study data. The fact that we identified superiority of Featback in reducing psychopathology over and above usual care (i.e. medication and other intervention and treatment programs participants were free to undergo), is noteworthy.

Study dropout

Considerable study dropout rates were present in both the Proud2Bme and Featback trial. More specifically, in the cross-sectional study investigating Proud2Bme, 72.7% (*n* = 226) participants out of the 311 who started the questionnaire completed this questionnaire. With respect to the Featback trial, a total of 354 participants (100%) were assessed at baseline, 273 (77%) at post-intervention, 202 (57%) at 3-month follow-up, and 118 participants (45%) of the available three study conditions at 6-month follow-up. In order to deal with these missing data in the Featback trial, we have first of all used an intent-to-treat approach including all participants who were recruited for the studies. Secondly, multiple imputation approaches were used (Rubin, 1987; Schafer et al., 2002) to handle missing data appropriately. Several important papers (Blankers et al., 2010; Graham, 2009; Schafer et al., 2002; Sterne et al., 2009) and books (Rubin, 1987) have been published regarding how to deal with missing data, recommending multiple imputation approaches. Indeed, simulation studies (Blankers et al., 2010; Eekhout et al., 2014) showed that the use of multiple imputation methods improves the validity of the results when analyzing datasets with considerable amounts of missing data as compared to more traditional approaches such as complete case analysis, mean imputation, and last observation carried forward. Nevertheless, considerable dropout rates remain undesirable and are a limitation of the included studies.

Lack of long-term data

A final limitation of the included studies regarding the Featback trial, pertains the lack of a 6-month follow-up assessment for the waiting list control condition. This was due to ethical reasons, as we considered a waiting period of more than 5 months (i.e. intervention period of 8 weeks and 3-months of follow-up) to be too long. Given that the effects of Featback could only be compared to the waiting list at post-intervention and 3-month follow-up, we do not know whether the found effects would be retained over the longer term.

Directions for future research

There are numerous opportunities and challenges for future research in the field of E-health for ED. The most important ones are highlighted and discussed below.

More research is needed to evaluate the effectiveness and cost-effectiveness of E-health interventions for ED in comparison to usual care or the best available alternative intervention. Furthermore, ideally, our study findings should be replicated in future studies. Many (mental) health organizations strive to implement E-health interventions and insurance companies in the Netherlands are now stimulating the uptake of E-health interventions by rewarding mental health organizations with financial bonuses. Although as demonstrated in this dissertation and in the existing research literature, E-mental health holds great promise in providing (cost-) effective health care services, the evidence-base for E-health interventions for ED in the Netherlands is currently scarce. Hence, establishing an evidence-base is an important direction for future research.

Furthermore, we recommend more studies investigating the role of therapist support within E-health interventions. Direct comparisons are needed. For example, is a particular Internet-based intervention with therapist support (cost)-effective in comparison to the same intervention without therapist support? In addition, the most optimal amount of therapist support in terms of duration and frequency is yet unknown. Ideally, future studies should experimentally test the effectiveness of different intensities of therapist support. What frequency and duration of therapist contacts is needed in order to realize an additional improvement in outcome? Also, more (experimental) research is needed on the most optimal type of therapist support and the level of expertise that is needed. Do certain types of therapist behaviors lead to incremental effects in outcome? Is it necessary that support is provided by a health professional, or may it be effectively provided by trained non-professionals or peers as well? And if so, under which circumstances (i.e.,

what types of E-health interventions) and for whom (i.e., which subgroups of patients) is this true? Finally, although beyond the scope of this dissertation, experimental studies investigating the impact of the medium through which therapist support can be provided, such as telephone, Skype, e-mail, and chat, is interesting.

Another direction for future research is the field of personalized healthcare and the investigation of differential responses to E-health interventions. Personalized healthcare encompasses the tailoring of specific health care interventions on the basis of individual patient characteristics, thereby predicting who is likely to respond to which type of intervention. Research investigating what works for whom, can help to improve the quality of health care services and to allocate the scarce healthcare resources more efficiently.

It would furthermore be interesting to conduct further research into the question of how satisfaction with the fully automated support system of Featback might be enhanced. A qualitative study including interviews with individuals who have participated in the fully automated self-monitoring and feedback system could provide important insights into how the system could possibly be improved. Would it help to change the look and feel of the system? Could the functionality and convenience be improved by offering the possibility of receiving the weekly reminders for the monitoring questionnaires by notifications on one's Smartphone as part of an app, instead of by e-mail? With respect to the content of the feedback messages, we already know that most of the participants' negative comments were about the automated feedback being too general and/or impersonal. It might be interesting to investigate whether the use of human pictures or avatars could enhance the experience and satisfaction of participants by creating a feeling of social presence, hence the feeling that someone is looking after them (Gorini, Gaggioli, Vigna, & Riva, 2008). It may furthermore be valuable to investigate the perceived quality of the individual feedback messages, in order to establish what kind of feedback messages including which content, are valued highest. A better understanding of what works best, could help to improve the quality of the feedback messages. Finally, we believe that the tailoring of the feedback messages could be improved by splitting the category 'binge eating and compensatory behaviors' into two separate categories. Currently, these are combined in one category and the feedback messages always include concerns or advice about binge eating and/or compensatory behaviors, which can be confusing for participants when they only report binge eating behaviors and not compensatory behaviors, or vice versa.

A final direction for future research and clinical practice would be to investigate the potential of Featback as an aftercare intervention for individuals after discharge from ED treatment. Relapse is a common problem among individuals with an ED, even after successful treatment (Field et al., 1997; Keel et al., 2005; McFarlane et al., 2008). The Dutch Multidisciplinary Guideline for Eating Disorders (Landelijke stuurgroep multidisciplinaire richtlijnontwikkeling GGZ, 2006) highlights the importance of developing and investigating relapse prevention programs after treatment, possibly by means of self-help interventions. In addition, qualitative studies support the need and importance of aftercare in maintaining treatment gains, helping with the transition from (intensive) treatment to everyday life and coping with difficulties encountered (Federici et al., 2008). Featback might be a useful means for detecting changes in ED symptoms after discharge of treatment, as it allows for the continuous monitoring of ED symptoms in daily life. Specifically, it could be interesting to investigate the implementation of Featback as a relapse prevention program within specialized treatment centers or even at the level of the general practitioner. Regarding the latter, supporting self-management, psycho-education, improving the functioning of patients with psychiatric problems, and relapse prevention, are already standard tasks of the mental health nurse practitioners (in Dutch 'POH-GGZ') (Dutch Healthcare Authority (NZa), 2016). Transfer of patients following discharge from specialized treatment to the general practitioner level could thus likely be improved by the addition of an Internet-based self-help aftercare program, which can be administered with minimum effort from patients and mental health nurse practitioners. It would be interesting to investigate whether the introduction of Featback on the POH-GGZ level could result in earlier detection of relapse, a reduction of patient delay, and easier and quicker access to tailored care if needed.

Conclusions

E-health for ED, which has been the focus of this dissertation, is promising even though it is still in its infancy. E-health can provide easily accessible, efficient, and effective care, and reaches underserved populations. A careful design of both E-health interventions and research studies is required to study effectiveness and to conduct health economic evaluations. Also, studies need to focus on what works for whom. In the long term, combining prevention, early detection and personalized interventions is paramount in establishing future effective and affordable care for this vulnerable population.

Nederlandse samenvatting

Hoofdstuk 1 bevat een algemene inleiding voor dit proefschrift. Eetstoornissen zijn ernstige psychiatrische stoornissen die gepaard gaan met verstoringen in het fysiek, sociaal en emotioneel functioneren. Ondanks de ernst kunnen eetstoornissen vaak onopgemerkt blijven en het merendeel van de patiënten zoekt en ontvangt geen adequate zorg. Patiënten ervaren vaak een hoge drempel om hulp te zoeken, bijvoorbeeld omdat zij zich schamen of bang zijn gestigmatiseerd te worden. Voor de groep patiënten die wel in zorg komt zijn de bestaande behandelingen matig effectief. Daarnaast valt naar schatting een derde tot de helft van de patiënten na behandeling terug in zijn of haar eetstoornisproblemen. Het is daarom van groot belang om de gezondheidszorg voor mensen met eetproblemen te verbeteren en om de toegankelijkheid en de beschikbaarheid van de gezondheidszorg voor deze groep mensen te vergroten. E-health biedt hiertoe mogelijkheden. E-health is het gebruik van informatie- en communicatietechnologie om de gezondheidszorg te ondersteunen en/of te verbeteren. Naast het verbeteren van de kwaliteit, toegankelijkheid en beschikbaarheid van de gezondheidszorg, heeft E-health potentieel om duurzamere en efficiëntere zorg te leveren. Dit zou de houdbaarheid van het Nederlandse zorgstelsel ten goede kunnen komen. Deze staat namelijk onder druk door stijgende zorgkosten, een toenemende vraag aan hulp en een tekort aan zorgverleners.
Het doel van dit proefschrift was om te onderzoeken of en hoe E-health de gezondheidszorg voor mensen met eetstoornissymptomen kan verbeteren. De focus lag daarbij op het evalueren van twee E-health initiatieven van Rivierduinen eetstoornissen Ursula: E-community 'Proud2Bme' en internet interventie 'Featback'.

Allereerst is er een systematisch literatuuronderzoek uitgevoerd naar internetbehandelingen op het gebied van eetstoornissen (**hoofdstuk 2**). Er werden 21 studies meegenomen waarvan de meeste cognitieve gedragstherapie via het internet onderzochten (*n*=14). De overige studies onderzochten het gebruik van e-mail als toevoeging op een face-to-face behandeling (*n*=2), cognitieve gedragstherapie via e-mail (*n*=3), een zelfhulpboek met e-mail begeleiding van een coach (*n*=1) en een onbegeleid zelfhulpprogramma via het internet (*n*=1). Het internet bleek een veelbelovend medium voor de behandeling van eetstoornissen. Internetbehandeling was effectiever dan een wachtlijst in het verminderen van algemene eetstoornispsychopathologie, eetbuien en compensatiegedrag (zoals bijvoorbeeld zelfopgewekt braken of het gebruik van laxeermiddelen) en in het verhogen van de kwaliteit van leven. Tien tot 45% van de patiënten na internetbehandeling vrij van eetbuien en/of compensatiegedrag. De eerste bevindingen leken erop te wijzen dat internetbehandeling mogelijk effectiever is voor mensen met minder comorbide klachten en voor mensen met eetbuien versus restrictieve

symptomen (beperken van de voedselinname). De methodologische kwaliteit van de studies bleek aanzienlijk te variëren. Meer studies met goede methodologische kwaliteit zijn nodig. Verder werden er belangrijke richtingen voor toekomstig onderzoek genoemd. Economische evaluaties bleken schaars en er werd benadrukt dat het belangrijk is om de kosteneffectiviteit van nieuwe, innovatieve interventies ten opzichte van reguliere zorg of een wachtlijst goed te onderzoeken. Daarnaast bleek er weinig bekend over mediatoren en moderatoren van behandeluitkomsten. Wat is het psychologische mechanisme dat ten grondslag ligt aan de verbetering van de symptomen van deelnemers (mediatie)? Wat werkt voor wie; welke patiënten hebben het meeste baat bij de behandeling (moderatie)? Een laatste belangrijke aanbeveling voor toekomstig onderzoek betrof het onderzoeken van de rol van therapeuten in internet interventies: zijn internet interventies zonder therapeutische begeleiding even effectief als interventies zonder deze therapeutische begeleiding? Leidt meer begeleiding van een therapeut tot betere uitkomsten?

Hoofdstuk 3 beschrijft een studie naar de website en E-community 'Proud2Bme'. Proud2Bme is opgericht als tegenhanger en gezond alternatief voor de zogenaamde 'pro-ana' en 'pro-mia' websites die eetgestoord gedrag als een positieve levensstijl aanprijzen. Proud2Bme biedt een positieve en herstelbevorderende omgeving vol informatie, persoonlijke verhalen en blogs over eetstoornissen en een breed aantal andere onderwerpen zoals bijvoorbeeld mode, gezondheid en schoonheid. Daarnaast biedt Proud2Bme de mogelijkheid om met lotgenoten en hulpverleners (diëtisten, ervaringsdeskundigen en psychologen) in contact te komen via een forum en een chat. Met de studie in dit hoofdstuk werd onderzocht of en in welke mate bezoekers *empowerment* ervaren door hun bezoek aan Proud2Bme. Patiënt empowerment heeft alles te maken met het gevoel van controle hebben over je ziekte en behandeling en het kunnen managen van je ziekte. Daarnaast werd onderzocht of bepaalde variabelen samenhingen met de mate waarin empowerment ervaren werd door het bezoeken van Proud2Bme. In dit cross-sectionele onderzoek werd een online vragenlijst ingevuld door 311 bezoekers van Proud2Bme. Er bleken verschillende redenen te zijn waarom mensen Proud2Bme (blijven) bezoeken. De meest populaire reden was om de persoonlijke verhalen en ervaringen van anderen te lezen, gevolgd door ontspanning of ter gezelligheid, voor het vinden van informatie over eetproblemen, om hulp te vinden en om anderen te helpen. Deelnemers gaven aan dat hun mate van empowerment op verschillende manieren vergroot werd door het bezoeken van Proud2Bme. Dit gebeurde met name door het uitwisselen van informatie, het vinden van herkenning en het delen van ervaringen. Daarnaast gaven deelnemers aan zich beter geïnformeerd te voelen en meer optimisme en controle over te toekomst te ervaren. Tevens werd door een deel van

de deelnemers aangegeven dat Proud2Bme stimulerend werkte om hulp te zoeken en te durven vragen. Tot slot rapporteerde een deel van de bezoekers door Proud2Bme meer vertrouwen te hebben gekregen in hun behandeling en de relatie met hun hulpverlener. Weinig algemene empowerment in het leven (voorbeelditems 'Ik heb een doel in mijn leven', 'Ik weet mijn grenzen te trekken' en 'Ik weet wel raad met de problemen die op mijn weg komen'), een jongere leeftijd en interactieve gebruikerspatronen (het plaatsen van berichten op de website en/of het deelnemen aan chats) hingen samen met het ervaren van meer empowerment door het bezoeken van Proud2Bme. Kortom, de resultaten van dit onderzoek suggereren dat Proud2Bme een empowerende en herstelbevorderende E-community is die mensen op verschillende manieren ondersteunt en helpt bij het managen van hun eetproblemen.

In **hoofdstuk 4** wordt de opzet van een gerandomiseerde gecontroleerde studie naar de internet interventie Featback omschreven. Featback bestaat uit psychoeducatie en een volledig geautomatiseerd monitorings- en feedback systeem. Dit laatste houdt in dat deelnemers wekelijks een online monitoringsvragenlijst ontvangen met daarin 8 multiple-choice vragen over de volgende 4 gebieden: 1) lichaamsontevredenheid, 2) piekeren over gewicht en lichaamsvorm, 3) eetpatronen en lijnen en 4) eetbuien en compensatiegedrag. Na het invullen van de vragenlijst ontvangen deelnemers via een geautomatiseerd systeem een feedbackbericht dat passend is bij de klachten die zij rapporteren. Per gebied wordt er gekeken hoe gezond of ongezond de klachten zijn en of de klachten eventueel verbeterd of verslechterd zijn ten opzichte van de week ervoor. De feedback is ondersteunend en biedt tips en handvatten om met eetproblemen om te gaan. Om deel te kunnen nemen aan de studie moest men 16 jaar of ouder zijn en eetstoornissymptomen rapporteren. De deelnemers werden op willekeurige wijze toegewezen aan 1 van de 4 onderzoekscondities: 1) Featback, 2) Featback met de mogelijkheid om laagintensieve (één keer per week) ondersteuning van een psycholoog te ontvangen per e-mail, chat of Skype, 3) Featback met de mogelijkheid om hoogintensieve (drie keer per week) ondersteuning van een psycholoog te ontvangen per e-mail, chat of Skype en 4) een wachtlijst. Deelnemers in alle studiecondities waren vrij om deel te nemen aan interventies of behandelingen anders dan Featback. Zeven psychologen werden getraind in het online hulpverlenen. Online vragenlijsten werden afgenomen bij aanvang van de studie, na de interventieperiode (8 weken) en 3 en 6 maanden na het afronden van de interventieperiode (follow-up). Deelnemers in de wachtlijstconditie werden niet meer gemeten op de 6-maanden follow-up. Zij kregen Featback met laagintensieve psychologische ondersteuning aangeboden na de 3-maanden follow-up.

In de **hoofdstukken 5 tot en met 9** worden de resultaten van de verschillende onderzoeksvragen gepresenteerd. Deze zijn allen gebaseerd op de gerandomiseerde gecontroleerde studie zoals omschreven in hoofdstuk 4.

In **hoofdstuk 5** wordt de effectiviteit van Featback en de toegevoegde waarde van een psycholoog geëvalueerd. In totaal werden er 354 deelnemers gerandomiseerd over de hierboven omschreven 4 studiecondities. Deelnemers die Featback met of zonder psycholoog hadden ontvangen lieten na de interventieperiode een grotere afname zien in symptomen van boulimia nervosa, perseveratief denken (piekeren en rumineren) en de mate van angst en depressie in vergelijking met deelnemers die op de wachtlijst waren geplaatst. In de drie maanden na de interventieperiode lieten de Featback deelnemers tevens een grotere afname zien in symptomen van angst en depressie en eetstoornisgerelateerde kwaliteit van leven. Er werd geen afname in symptomen van anorexia nervosa gevonden. Wat tevredenheid betreft werd er een toegevoegde waarde van extra ondersteuning van een psycholoog gevonden: deelnemers die Featback met laag- of hoogintensieve ondersteuning van een psycholoog hadden ontvangen waren meer tevreden over de interventie dan deelnemers die Featback zonder deze extra ondersteuning hadden ontvangen. Echter, wat symptoomafname betreft bleek Featback zonder extra ondersteuning van een psycholoog even effectief te zijn als Featback met ondersteuning van een psycholoog.

Hoofdstuk 6 presenteert de resultaten van de moderatie analyses: zijn er subgroepen te identificeren voor wie Featback en/of de extra ondersteuning van een psycholoog beter werkt dan voor anderen? We analyseerden een subgroep van de studiedeelnemers (*n*=273) die zowel de vragenlijsten bij aanvang van het onderzoek als de vragenlijsten na de interventieperiode volledig had ingevuld. De ernst van de symptomen van anorexia nervosa en boulimia nervosa bij aanvang van het onderzoek bleek het effect van de interventie te modereren. Voor de subgroep deelnemers met relatief hoge anorectische psychopathologie was Featback zonder extra ondersteuning van een psycholoog niet effectief, terwijl deelnemers in de wachtlijst conditie en Featback met laag- en hoogintensieve psychologische ondersteuning wel een afname in symptomen lieten zien. De subgroep deelnemers met milde tot matige symptomen van anorexia nervosa liet in geen van de onderzoekscondities een vermindering in symptomen zien. Wat betreft symptomen van boulimia nervosa, liet de subgroep deelnemers met relatief ernstige symptomen van boulimia nervosa een vergelijkbare afname zien in de 4 studie condities, terwijl de subgroep deelnemers met relatief milde tot matige symptomen van boulimia nervosa betere uitkomsten liet zien in de drie Featback condities in vergelijking met de

wachtlijst. Kortom, deze bevindingen suggereren dat Featback met en zonder psychologische ondersteuning met name nuttig lijkt te zijn in het verminderen van milde tot matige klachten van boulimia nervosa. Voor ernstige symptomen van anorexia nervosa lijkt Featback zonder psychologische ondersteuning minder geschikt.

De studie in **hoofdstuk 7** onderzocht mediatoren van interventie-uitkomsten. Featback werkt, maar hoe bereikt de interventie zijn effecten? Met andere woorden: wat zijn de psychologische werkingsmechanismen die de verandering in eetstoornispsychopathologie (deels) kunnen verklaren? Het identificeren van werkingsmechanismen kan zeer waardevolle informatie opleveren voor de klinische praktijk. Zo kan er beter begrepen worden hoe en waarom een bepaalde interventie tot goede resultaten leidt en kunnen de werkzame componenten van een interventie versterkt en gerichter ingezet worden. De effectiviteit en efficiëntie van een interventie kunnen op deze manier vergroot worden. We analyseerden een subgroep studiedeelnemers (*n*=75) die de vragenlijsten bij aanvang, halverwege de interventie (week 4) en na de interventie (week 8) had ingevuld. De resultaten van de zogenaamde cross-lagged panel analyses lieten zien dat vroege veranderingen (week 0 – 4) in symptomen van angst en depressie, latere veranderingen (week 4 – 8) in symptomen van anorexia nervosa en boulimia nervosa voorspelden. Omgekeerd was dit niet het geval. Perseveratief denken bleek geen mediator te zijn van veranderingen in eetstoornissymptomen. Samenvattend lijken de bevindingen in dit hoofdstuk erop te wijzen dat het verminderen van symptomen van angst en depressie een belangrijk werkingsmechanisme is van hoe Featback een vermindering in eetstoornispsychopathologie teweeg kan brengen.

Hoofdstuk 8 presenteert de resultaten van een economische evaluatie van Featback. De data van alle 354 deelnemers van de eerste drie meetmomenten (bij aanvang, na de interventie en op 3-maanden follow-up) werden meegenomen. Een kostenutiliteitsanalyse werd uitgevoerd vanuit een maatschappelijk perspectief, waarbij zowel medische kosten als niet-medische kosten werden meegenomen. Onder medische kosten vielen kosten gerelateerd aan de Featback interventie, zorgkosten (kosten gerelateerd aan het bezoeken van een huisarts, psycholoog, ziekenhuis, etc.) en medicatie. Onder niet-medische kosten vielen kosten gerelateerd aan verzuim op werk, productieverliezen op werk en het niet of verminderd uit kunnen voeren van huishoudelijke taken. De uitkomstmaat was voor kwaliteit gecorrigeerde levensjaren. De resultaten lieten zien dat de 4 studie condities niet significant verschilden wat betreft voor kwaliteit gecorrigeerde levensjaren en maatschappelijke kosten. Desalniettemin waren de gemiddelde maatschappelijke kosten per deelnemer over de studieperiode van 5 maanden het

hoogste in de wachtlijstconditie (€ 2582), gevolgd door Featback zonder psychologische ondersteuning (€ 2102) en Featback met hoog- (€ 2032) en laagintensieve psychologische ondersteuning (€ 1951). De resultaten lieten zien dat alle 3 de Featback strategieën (zonder of met laag- of hoogintensieve psychologische ondersteuning) een hogere kans hebben om kosteneffectief te zijn ten opzichte van de wachtlijst. Vanuit een economisch perspectief bleek er geen duidelijke voorkeur voor één van de drie Featback strategieën.

Er is weinig bekend over wat psychologen precies doen tijdens de ondersteuning in online interventies en of en hoe het gedrag van psychologen samenhangt met de uitkomsten van deelnemers. In **hoofdstuk 9** werden daarom de volgende onderzoeksvragen onderzocht: 1) wat doen de psychologen precies in de online ondersteuningssessies van Featback? en 2) is hun gedrag gerelateerd aan de effectiviteit van de interventie en de tevredenheid van deelnemers over hun psycholoog? De studiepopulatie bestond uit deelnemers die Featback met laag- of hoogintensieve ondersteuning van een psycholoog hadden ontvangen (*n*=177). Alle e-mail en chat communicatie van de psychologen naar de deelnemers werd kwalitatief onderzocht. Het gedrag van de psychologen kon worden ondergebracht in 31 categorieën die zijn samengevat in een codeboek. Aan de hand van dit codeboek werd het gedrag van de psychologen in 937 e-mails en 417 chat gesprekken gecodeerd en geteld. In totaal werden er 40,216 gedragingen gecodeerd. Het uitvragen van de situatie of problemen kwam het vaakste voor (*n*=4,935; 12.3%), gevolgd door het tonen van empathie en het meeleven met de deelnemer (*n*=4,862; 12.1%) en het geven van tips of advies (*n*=4,532; 11.3%). Om te onderzoeken of het gedrag van de psychologen samenhing met de uitkomsten van de deelnemers, werden de 31 categorieën ondergebracht in 3 bredere categorieën: 1) ondersteuning en empathie (*n*=19,282; 47.9%), 2) psychologische interventies (*n*=16,149; 40.2%) en 3) formaliteiten en het uitleggen van de (onderzoeks-) procedures (*n*=4,785; 11.9%). De frequentie en het type gedrag van de psychologen bleken niet voorspellend te zijn voor een afname in eetstoornissymptomen of comorbide klachten. Wel bleken de frequentie en het type gedrag voorspellend te zijn voor hoe tevreden deelnemers waren met hun psycholoog. Hoe hoger het percentage psychologische interventies ten opzichte van ondersteuning en empathie, hoe meer tevreden de deelnemers waren met hun psycholoog.

In **hoofdstuk 10** worden de bevindingen op het gebied van E-health voor eetstoornissen in de afgelopen jaren (2013-2015) besproken, evenals de uitdagingen en mogelijkheden op dit gebied. Cognitieve gedragstherapie en begeleide zelfhulp via het internet werden effectief bevonden in het verminderen van eetstoornissymptomen en comorbide klachten. Over de inzet en effectiviteit van E-health in de vorm van terugvalpreventie- of

nazorgprogramma's voor eetstoornissen bleek nog weinig bekend. Een ander aandachtspunt dat werd omschreven betreft de explosieve groei aan smartphone applicaties ('apps') voor de behandeling van eetstoornissen, omdat de effectiviteit en betrouwbaarheid van deze apps (nog) niet is vastgesteld. Het werd zorgelijk bevonden dat de meeste apps slechts beperkt gebruik maken van wetenschappelijk bewezen effectieve behandelstrategieën. Daarnaast bleek dat de informatie die in dergelijke apps wordt gegeven niet altijd even betrouwbaar is. Veel apps bleken zelfs misleidende of incorrecte informatie te verstrekken. In ons literatuuronderzoek werd ook gevonden dat E-health een nieuwe groep mensen met eetproblemen lijkt te bereiken die met de reguliere zorg nog niet of onvoldoende wordt bereikt. De literatuur leek er tevens op te wijzen dat E-health de toegankelijkheid van de zorg voor mensen met eetproblemen vergroot en vergemakkelijkt. Een van de belangrijke uitdagingen die werd geformuleerd betreft het effectief inzetten en inbedden van E-mental health in de dagelijkse zorgpraktijk. Zo zouden zelfhulpinterventies kunnen worden opgenomen in getrapte ('stepped-care') zorgprogramma's, bijvoorbeeld voor de vroege interventie en terugvalpreventie of nazorg van eetproblemen. Daarnaast werd 'blended care', een combinatie van face-to-face contact en online hulp, als veelbelovend omschreven om de efficiëntie van behandelingen te verhogen en daarbij mogelijk kosten te verlagen. Geconcludeerd werd dat E-health de komende jaren zal worden doorontwikkeld en een essentieel onderdeel van de zorg zal vormen, maar dat er meer onderzoek van hoge kwaliteit nodig is om de rol van E-health in het huidige zorgsysteem te kunnen optimaliseren en om het volledige potentieel van E-health te benutten.

In **hoofdstuk 11** worden de resultaten van alle onderzoeken samengevat en bediscussieerd. Ook worden de klinische implicaties en aanbevelingen voor vervolgonderzoek besproken.

Implicaties

E-health moet nooit worden ingezet als doel op zich, maar altijd als een middel om de gezondheidszorg te verbeteren. De resultaten van dit proefschrift pleiten voor het investeren in de ontwikkeling, verbetering, implementatie en het inbedden van E-health programma's voor mensen met eetproblemen in het huidige zorgsysteem. De resultaten suggereren dat E-health onder andere een nieuwe groep mensen lijkt te bereiken die met het reguliere behandelaanbod niet of nog onvoldoende bereikt wordt. E-health interventies zoals Proud2Bme en Featback zouden daarmee de kloof tussen mensen met eetproblemen en de hulpverlening kunnen verkleinen. Ook zouden deze initiatieven de vroegdetectie en -interventie van eetproblemen kunnen stimuleren. De resultaten lijken

erop te wijzen dat zowel Proud2Bme als Featback een goed middel zijn om mensen naar passende, eventueel meer intensieve zorg te begeleiden. Snellere toegang tot passende hulp kan weer leiden tot betere uitkomsten en kortere behandelingen. In dit proefschrift werd bewijs gevonden voor de effectiviteit en kosteneffectiviteit van Featback in vergelijking met een wachtlijst. Ook bleek extra ondersteuning van een psycholoog de tevredenheid van de deelnemers met de interventie te verhogen en bleken de deelnemers de kwaliteit en effectiviteit van de interventie met psychologische ondersteuning hoger in te schatten. Op basis van deze resultaten wordt de aanbeveling gedaan om Featback in de toekomst met tenminste enige vorm van psychologische ondersteuning aan te gaan bieden. Zeker wanneer mensen zich aanmelden met ernstige symptomen van anorexia nervosa, gezien Featback zonder psychologische ondersteuning niet effectief bleek in het verminderen van deze symptomen. Een psycholoog kan verschillende belangrijke rollen vervullen binnen de Featback interventie, zoals het motiveren van deelnemers om hun symptomen te blijven monitoren. Daarnaast kan de psycholoog de tevredenheid van de deelnemers waarschijnlijk vergroten. Tot slot kunnen psychologen ingrijpen wanneer uit de monitoringsdata blijkt dat deelnemers ernstige achteruitgang in hun symptomen laten zien. De rol van de psycholoog kan dan zijn om deelnemers laagintensieve ondersteuning aan te bieden of door te verwijzen naar passende en meer intensieve zorg. Wanneer de psychologen ondersteuning bieden, is het mogelijk belangrijk dat zij niet enkel focussen op het ondersteunen en het geven van psychologische interventies voor hun eetproblemen, maar ook op het omgaan met negatieve stemmingen.

Toekomst

Veel geestelijke gezondheidszorginstellingen zijn bezig met de implementatie van E-health en zorgverzekeraars stimuleren steeds vaker de implementatie van E-health door middel van hogere tarieven of strafkortingen. Ondanks het feit dat E-health veelbelovend is, is er in Nederland nog maar weinig bewijs voor de werkzaamheid van E-health interventies voor eetproblemen. Meer onderzoek is nodig om de effectiviteit en kosteneffectiviteit van E-health inteventies voor eetproblemen te evalueren ten opzichte van de gebruikelijk zorg of de best beschikbare alternatieve interventie.

Tevens is er meer onderzoek nodig naar de rol van psychologen binnen E-health interventies: is een bepaalde interventie met psychologische ondersteuning (kosten-) effectief/effectiever in vergelijking met dezelfde interventie zonder deze ondersteuning? Hoe vaak en hoelang dienen psychologen ingezet te worden om een bepaald effect te bereiken? Dienen de psychologen ten alle tijde professionals te zijn of kunnen het ook getrainde non-professionals zijn?

Een andere belangrijke interessante vraag voor toekomstig onderzoek is: wat (welke

interventies) werkt er nu precies voor wie (subgroepen)? Inzichten uit dergelijk onderzoek kunnen leiden tot meer gepersonaliseerde zorg, waarmee schaarse middelen en personeel in de zorg efficiënter kunnen worden ingezet.
Wat Featback betreft zou het interessant zijn om in de toekomst meer onderzoek te doen naar hoe het automatische monitoring- en feedback systeem verbeterd kan worden. Kwalitatieve studies door middel van interviews zouden hier meer inzicht in kunnen bieden. Ook is het mogelijk interessant om experimenteel te onderzoeken of het toevoegen van bijvoorbeeld 'avatars' (gebruikersafbeelding: een tekening of foto van een psycholoog) de ervaring en tevredenheid met de automatisch gegenereerde feedbackberichten kunnen verhogen. Tevens zou de kwaliteit van de individuele feedbackberichten verder onderzocht kunnen worden om inzicht te krijgen in welke berichten juist wel of niet goed beoordeeld worden door deelnemers. Verder zouden de feedbackberichten nog meer 'op maat' gemaakt kunnen worden door de categorie 'eetbuien en compensatiegedrag' in tweeën te splitsen. In het huidige systeem bevatten de feedbackberichten bijvoorbeeld vaak advies rondom zowel eetbuien als compensatiegedrag, ook wanneer de deelnemer slechts 1 van deze twee gedragingen rapporteerde. Dit wordt als verwarrend ervaren.
Een laatste interessante richting voor toekomstig onderzoek en de klinische praktijk is het onderzoeken van Featback als terugvalpreventie/nazorg programma voor mensen die uit behandeling gaan voor hun eetstoornis. De terugvalpercentages zijn aanzienlijk (30-50%) en de landelijke stuurgroep van de multidisciplinaire richtlijnontwikkeling voor eetstoornissen heeft dan ook gepleit voor ontwikkeling en onderzoek van terugvalpreventieprogramma's. Het monitoringssysteem van Featback biedt de mogelijkheid om via behandelcentra of huisartsen de eetstoornissymptomen van ex-patiënten in het dagelijks leven eenvoudig en nauwkeurig te monitoren. Hierdoor zou terugval eerder gesignaleerd kunnen worden door zowel patiënt als hulpverlener, waardoor er sneller behandeling op maat geboden zou kunnen worden. De verwachting daarbij is dat er minder intensieve en kortere interventies nodig zijn, waardoor de gezondheidszorgkosten uiteindelijk ook lager zullen zijn.

Conclusie

E-health voor eetstoornissen is veelbelovend al staat het op dit moment nog in de kinderschoenen. E-health heeft potentieel om laagdrempelige zorg te bieden, nieuwe groepen mensen te bereiken en (kosten-)effectieve zorg te leveren. Op de lange termijn is het van groot belang dat preventie, vroege interventie en gepersonaliseerde zorg worden gecombineerd. Dit om toekomstige zorg effectief en betaalbaar te maken voor deze kwetsbare groep mensen.

References

References

Aardoom, J. J., Dingemans, A. E., Boogaard, L. H., & van Furth, E. F. (2014). Internet and patient empowerment in individuals with symptoms of an eating disorder: A cross-sectional investigation of a pro-recovery focused e-community. *Eating Behaviors, 15,* 350-356.

Aardoom, J. J., Dingemans, A. E., Slof Op't Landt, M. C., & van Furth, E. F. (2012). Norms and discriminative validity of the Eating Disorder Examination Questionnaire (EDE-Q). *Eating Behaviors, 13,* 305-309.

Aardoom, J. J., Dingemans, A. E., Spinhoven, P., Hakkaart-van Roijen, L., & van Furth, E. F. (2013). An Internet-based intervention for eating disorders consisting of automated computer-tailored feedback with or without supplemented frequent or infrequent support from a coach: Study protocol for a randomized controlled trial. *Trials, 14,* 340.

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.

Aardoom, J., Dingemans, A., Spinhoven, P., van Ginkel, J., de Rooij, M., & van Furth, E. (2016). Internet-based fully automated self-help with different levels of therapist support for individuals with eating disorder symptoms: A randomized controlled trial. *Journal of Medical Internet Research, In press*.

Aardoom, J., Dingemans, A., & van Furth EF (2016). E-health interventions for eating disorders: Emerging findings, issues, and opportunities. *Current Psychiatry Reports, 18,* 42.

Agh, T., Kovacs, G., Pawaskar, M., Supina, D., Inotai, A., & Voko, Z. (2015). Epidemiology, health-related quality of life and economic burden of binge eating disorder: A systematic literature review. *Eating and Weight Disorders, 20,* 1-12.

Agras, W. S., Telch, C. F., Arnow, B., Eldredge, K., & Marnell, M. (1997). One-year follow-up of cognitive-behavioral therapy for obese individuals with binge eating disorder. *Journal of Consulting and Clinical Psychology, 65,* 343-347.

Alfonsson, S., Olsson, E., & Hursti, T. (2015). The effects of therapist support and treatment presentation on the clinical outcomes of an Internet based applied relaxation program. *Internet Interventions, 2,* 289-296.

Allen, K. L., Byrne, S. M., Oddy, W. H., & Crosby, R. D. (2013). DSM-IV-TR and DSM-5 eating disorders in adolescents: Prevalence, stability, and psychosocial correlates in a population-based sample of male and female adolescents. *Journal of Abnormal Psychology, 122,* 720-732.

Ambwani, S., Cardi, V., & Treasure, J. (2014). Mobile self-help interventions for anorexia nervosa: Conceptual, ethical, and methodological considerations for clinicians and researchers. *Professional Psychology: Research and Practice, 45,* 316-323.

American Psychiatric Association (1994). *Diagnostic and Statistical Manual of mental disorders (4th ed.).* Washington DC: American Psychiatric Association.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (5th ed.).* Washington, DC: American Psychiatric Association.

Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., & Hedman, E. (2014). Guided Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: A systematic review and meta-analysis. *World Psychiatry, 13,* 288-295.

Andersson, G., Paxling, B., Wiwe, M., Vernmark, K., Felix, C. B., Lundborg, L., Furmark, T., Cuijpers, P., & Carlbring, P. (2012). Therapeutic alliance in guided internet-delivered cognitive behavioural treatment of depression, generalized anxiety disorder and social anxiety disorder. *Behaviour Research And Therapy, 50,* 544-550.

Andersson, G. & Cuijpers, P. (2009). Internet-based and other computerized psychological treatments for adult depression: A meta-analysis. *Cognitive Behaviour Therapy, 38,* 196-205.

Arcelus, J., Mitchell, A. J., Wales, J., & Nielsen, S. (2011). Mortality rates in patients with anorexia nervosa and other eating disorders. A meta-analysis of 36 studies. *Archives of General Psychiatry, 68,* 724-731.

Baker, T. B., Gustafson, D. H., Shaw, B., Hawkins, R., Pingree, S., Roberts, L., & Strecher, V. (2010). Relevance of CONSORT reporting criteria for research on eHealth interventions. *Patient Education and Counseling, 81,* S77-S86.

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

References

Bartlett, Y. K. & Coulson, N. S. (2011). An investigation into the empowerment effects of using online support groups and how this affects health professional/patient communication. *Patient Education and Counseling, 83,* 113-119.

Bauer, S. & Moessner, M. (2013). Harnessing the power of technology for the treatment and prevention of eating disorders. *International Journal of Eating Disorders, 46,* 508-515.

Bauer, S., Moessner, M., Wolf, M., Haug, S., & Kordy, H. (2009). ES[S]PRIT - an Internet-based programme for the prevention and early intervention of eating disorders in college students. *British Journal of Guidance & Counselling, 37,* 327-336.

Bauer, S., Papezova, H., Chereches, R., Caselli, G., McLoughlin, O., Szumska, I., van Furth, E., Ozer, F., & Moessner, M. (2013). Advances in the prevention and early intervention of eating disorders: The potential of Internet-delivered approaches. *Mental Health & Prevention, 1,* 26-32.

Bauer, S., Winn, S., Schmidt, U., & Kordy, H. (2005). Construction, scoring and validation of the Short Evaluation of Eating Disorders (SEED). *European Eating Disorders Review, 13,* 191-200.

Baumeister, H., Reichler, L., Munzinger, M., & Lin, J. (2015). The impact of guidance on Internet-based mental health interventions: A systematic review. *Internet Interventions, 1,* 205-215.

Beck A.T., Rush A.J., Shaw B.F., & Emery G. (1979). *Cognitive therapy of depression*. New York: Guilford Press.

Becker, A. E., Hadley Arrindell, A., Perloe, A., Fay, K., & Striegel-Moore, R. H. (2010). A qualitative study of perceived social barriers to care for eating disorders: Perspectives from ethnically diverse health care consumers. *International Journal of Eating Disorders, 43,* 633-647.

Beintner, I., Jacobi, C., & Taylor, C. B. (2011). Effects of an internet-based prevention programme for eating disorders in the USA and Germany: A meta-analytic review. *European Eating Disorders Review, 20,* 1-8.

Berg, K. C., Stiles-Shields, E. C., Swanson, S. A., Peterson, C. B., Lebow, J., & Le, G. D. (2012). Diagnostic concordance of the interview and questionnaire versions of the eating disorder examination. *International Journal of Eating Disorders, 45,* 850-855.

Berg, K. C., Peterson, C. B., Frazier, P., & Crow, S. J. (2011). Psychometric evaluation of the Eating Disorder Examination and Eating Disorder Examination-Questionnaire: A systematic review of the literature. *International Journal of Eating Disorders, 45,* 428-438.

Berger, T., Caspar, F., Richardson, R., Kneubühler, B., Sutter, D., & Andersson, G. (2011). Internet-based treatment of social phobia: A randomized controlled trial comparing unguided with two types of guided self-help. *Behaviour Research And Therapy, 49,* 158-169.

Berkman, N. D. L. (2007). Outcomes of eating disorders: A systematic review of the literature. *International Journal of Eating Disorders, 40,* 293-309.

Bewell, C. V. & Carter, J. C. (2008). Readiness to change mediates the impact of eating disorder symptomatology on treatment outcome in anorexia nervosa. *International Journal of Eating Disorders, 41,* 368-371.

Blake, W., Turnbull, S., & Treasure, J. (1997). Stages and processes of change in eating disorders: Implications for therapy. *Clinical Psychology & Psychotherapy, 4,* 186-191.

Blankers, M., Koeter, M. W. J., & Schippers, G. M. (2010). Missing data approaches in eHealth research: Simulation study and a tutorial for nonmathematically inclined researchers. *Journal of Medical Internet Research, 12,* e54.

Blankers, M., Nabitz, U., Smit, F., Koeter, M. W., & Schippers, G. M. (2012). Economic evaluation of internet-based interventions for harmful alcohol use alongside a pragmatic randomized controlled trial. *Journal of Medical Internet Research, 14,* e134.

Boevink, W., Kroon, H., & Giesen, F. (2008a). Gaining control over one's life: A conceptual exploration of the concept of empowerment of individuals with mental disabilities [Controle herwinnen over het eigen leven: Een conceptuele verkenning van het begrip empowerment van mensen met psychische handicaps]. *Tijdschrift voor Rehabilitatie, 17,* 16-26.

Boevink, W., Kroon, H., & Giesen, F. (2008b). Empowerment: Construction and validation of a questionnaire [*Empowerment: Constructie en validatie van een vragenlijst]*. Utrecht: Trimbos-Instituut.

Boudreaux, E. D., Sullivan, A., Abar, B., Bernstein, S. L., Ginde, A. A., & Camargo, C. A., Jr. (2012). Motivation rulers for smoking cessation: A prospective observational examination of construct and predictive validity. *Addict.Sci Clin Pract, 7,* 8.

Bovier, P. A., Chamot, E., & Perneger, T. V. (2002). Brief scales for measurement of functional social support and psychological resources in French-speaking adults. *Sozial- und Präventivmedizin, 47,* 298-306.

Braun, D. L., Sunday, S. R., & Halmi, K. A. (1994). Psychiatric comorbidity in patients with eating disorders. *Psychological Medicine, 24,* 859-867.

Bruning Brown, J., Winzelberg, A. J., Abascal, L. B., & Taylor, C. B. (2004). An evaluation of an Internet-delivered eating disorder prevention program for adolescents and their parents. *Journal of Adolescent Health, 35,* 290-296.

Bulik, C. M., Sullivan, P. F., Tozzi, F., Furberg, H., Lichtenstein, P., & Pedersen, N. L. (2006). Prevalence, heritability, and prospective risk factors for anorexia nervosa. *Archives of General Psychiatry, 63,* 305-312.

Bulik, C. M., Marcus, M. D., Zerwas, S., Levine, M. D., Hofmeier, S., Trace, S. E., Hamer, R. M., Zimmer, B., Moessner, M., & Kordy, H. (2012). CBT4BN versus CBTF2F: Comparison of online versus face-to-face treatment for bulimia nervosa. *Contemporary Clinical Trials, 33,* 1056-1064.

Burns, J. W., Kubilus, A., Bruehl, S., Harden, N., & Lofland, K. (2003). Do changes in cognitive factors influence outcome following multidisciplinary treatment for Chronic pain? A crossed-lagged panel analysis. *Journal of Consulting and Clinical Psychology, 71,* 81-91.

Burns, J. M., Durkin, L. A., & Nicholas, J. (2009). Mental health of young people in the United States: What role can the Internet play in reducing stigma and promoting help seeking? *Journal of Adolescent Health, 45,* 95-97.

Byford, S., Barrett, B., Roberts, C., Clark, A., Edwards, V., Smethurst, N., & Gowers, S. G. (2007). Economic evaluation of a randomised controlled trial for anorexia nervosa in adolescents. *British Journal of Psychiatry, 191,* 436-440.

Cachelin, F. M., Rebeck, R., Veisel, C., & Striegel-Moore, R. H. (2001). Barriers to treatment for eating disorders among ethnically diverse women. *International Journal of Eating Disorders, 30,* 269-278.

Cachelin, F. M. & Striegel-Moore, R. H. (2006). Help seeking and barriers to treatment in a community sample of Mexican American and European American women with eating disorders. *International Journal of Eating Disorders, 39,* 154-161.

Cardi, V., Clarke, A., & Treasure, J. (2013). The use of guided self-help incorporating a mobile component in people with eating disorders: A pilot study. *European Eating Disorders Review, 21,* 315-322.

Cardi, V., Lounes, N., Kan, C., & Treasure, J. (2013). Meal support using mobile technology in anorexia nervosa. Contextual differences between inpatient and outpatient settings. *Appetite, 60,* 33-39.

Carrard, I., Crépin, C., Rouget, P., Lam, T., Golay, A., & Van der Linden, M. (2011a). Randomised controlled trial of a guided self-help treatment on the internet for binge eating disorder. *Behaviour Research And Therapy, 49,* 482-491.

Carrard, I., Crépin, C., Rouget, P., Lam, T., van der Linden, M., & Golay, A. (2011b). Acceptance and efficacy of a guided Internet self-help treatment program for obese patients with binge eating disorder. *Clinical Practice & Epidemiology in mental health, 7,* 8-18.

Carrard, I., Fernández-Aranda, F., Lam, T., Nevonen, L., Liwowsky, I., Volkart, A. C., Rouget, P., Golay, A., Van der Linden, M., & Norring, C. (2011c). Evaluation of a guided Internet self-treatment programme for bulimia nervosa in several European countries. *European Eating Disorders Review, 19,* 138-149.

Carrard, I., Rouget, P., Fernández-Aranda, F., Volkart, A. C., Damoiseau, M., & Lam, T. (2006). Evaluation and deployment of evidence based patient self-management support program for bulimia nervosa. *International Journal of Medical Informatics, 75,* 101-109.

Carter, J. C., Blackmore, E., Sutandar-Pinnock, K., & Woodside, D. B. (2004). Relapse in anorexia nervosa: A survival analysis. *Psychological Medicine, 34,* 671-679.

Carter, J. C., Mercer-Lynn, K. B., Norwood, S. J., Bewell-Weiss, C. V., Crosby, R. D., Woodside, D. B., & Olmsted, M. P. (2012). A prospective study of predictors of relapse in anorexia nervosa: Implications for relapse prevention. *Psychiatry Research, 200,* 518-523.

Celio, A. A., Winzelberg, A. J., Wilfley, D. E., Eppstein-Herald, D., Springer, E. A., Dev, P., & Taylor, C. B. (2000). Reducing risk factors for eating disorders: Comparison of an Internet- and a classroom-delivered psychoeducational program. *Journal of Consulting and Clinical Psychology, 68,* 650-657.

Chesney, E., Goodwin, G. M., & Fazel, S. (2014). Risks of all-cause and suicide mortality in mental disorders: A meta-review. *World Psychiatry, 13,* 153-160.

Clausen, L. (2008). Time to remission for eating disorder patients: A 2(1/2)-year follow-up study of outcome and predictors. *Nordic Journal of Psychiatry, 62,* 151-159.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences (2nd ed.)* Hillsdale, NJ: Lawrence Erlbaum Associates.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and psychological measurement, 20,* 37-46.

Cohen, J. S., Edmunds, J. M., Brodman, D. M., Benjamin, C. L., & Kendall, P. C. (2013). Using self-monitoring: Implementation of collaborative empiricism in cognitive-behavioral therapy. *Cognitive and Behavioral Practice, 20,* 419-428.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155-159.

Conte, H. R., Ratto, R., Clutz, K., & Karasu, T. B. (1995). Determinants of outpatients' satisfaction with therapists: Relation to outcome. *Journal of Psychotherapy Practice and Research, 4,* 43-51.

Cook, J. E. D. C. (2002). Working alliance in online therapy as compared to face-to-face therapy: Preliminary results. *Cyberpsychology & Behavior, 5,* 95-105.

Cooper, Z., Cooper, P., & Fairburn, C. G. (1989). The validity of the Eating Disorder Examination and its subscales. *British Journal of Psychiatry, 154,* 807-812.

Council for Public and Health Care (2006). Sensible and sustainable healthcare [Zinnige en duurzame zorg]. Zoetermeer: RVZ.

Cowdrey, F. A. & Park, R. J. (2011). Assessing rumination in eating disorders: Principal component analysis of a minimally modified ruminative response scale. *Eating Behaviors, 12,* 321-324.

Crow, S. J., Agras, W. S., Halmi, K. A., Fairburn, C. G., Mitchell, J. E., & Nyman, J. A. (2013). A cost effectiveness analysis of stepped care treatment for bulimia nervosa. *International Journal of Eating Disorders, 46,* 302-307.

Csipke, E. & Horne, O. (2007). Pro-eating disorder websites: User's opinions. *European Eating Disorders Review, 15,* 196-206.

Cuijpers, P., Marks, I. M., van Straten, A., Cavanagh, K., Gega, L., & Andersson, G. (2009). Computer-aided psychotherapy for anxiety disorders: A meta-analytic review. *Cognitive Behaviour Therapy, 38,* 66-82.

Cuijpers, P., Straten, A. v., & Andersson, G. (2008). Internet-administered cognitive behavior therapy for health problems: A systematic review. *Journal of Behavioral Medicine, 31,* 169-177.

Cunningham, J. A., Gulliver, A., Farrer, L., Bennett, K., & Carron-Arthur, B. (2014). Internet interventions for mental health and addictions: Current findings and future directions. *Current Psychiatry Reports, 16,* 521.

De Jong, H., Oldershaw, A., Sternheim, L., Samarawickrema, N., Kenyon, M. D., Broadbent, H., Lavender, A., Startup, H., Treasure, J., & Schmidt, U. (2013). Quality of life in anorexia nervosa, bulimia nervosa and eating disorder not-otherwise-specified. *Journal of Eating Disorders, 1,* 43.

de la Rie, S., Noordenbos, G., Donker, M., & van Furth, E. (2006). Evaluating the treatment of eating disorders from the patient's perspective. *International Journal of Eating Disorders, 39,* 667-676.

de la Rie, S.M., van Furth, E.F., de Koning, A., Noordenbos, G., & Donker, M.C.H. (2005). The quality of life of family caregivers of eating disorder patients. *Eating Disorders, 13,* 345-351.

de Zwaan, M., Herpertz, S., Zipfel, S., Tuschen-Caffier, B., Friederich, H. C., Schmidt, F., Gefeller, O., Mayr, A., Lam, T., Schade-Brittinger, C., & Hilbert, A. (2012). INTERBED:

Internet-based guided self-help for overweight and obese patients with full or subsyndromal binge eating disorder. A multicenter randomized controlled trial. *Trials, 13,* 220.

Deloitte (2*015). Global health care outlook: Common goals, competing priorities*. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/gx-lshc-2015-health-care-outlook-global.pdf.

Dickerson, J. F., DeBar, L., Perrin, N. A., Lynch, F., Wilson, G. T., Rosselli, F., Kraemer, H. C., & Striegel-Moore, R. H. (2011). Health-service use in women with binge eating disorders. *International Journal of Eating Disorders, 44,* 524-530.

Dingemans, A., van Son, G., Aardoom, J., Bruidegom, K., Slof-Op 't Landt, M., & van Furth, E. (2016). Predictors of psychological outcome in patients with eating disorders: A routine outcome monitoring study. *International Journal of Eating Disorders, In press*.

Dolemeyer, R., Tietjen, A., Kersting, A., & Wagner, B. (2013). Internet-based interventions for eating disorders in adults: A systematic review. *BioMed Central Psychiatry, 13,* 207.

Donker, T., Blankers, M., Hedman, E., Ljotsson, B., Petrie, K., & Christensen, H. (2015). Economic evaluations of Internet interventions for mental health: A systematic review. *Psychological Medicine, 45,* 3357-3376.

Doove, L. L., Dusseldorp, E., van Deun, K., & van Mechelen, I. (2014). A comparison of five recursive partitioning methods to find person subgroups involved in meaningful treatment–subgroup interactions. *Advances in Data Analysis and Classification, 8,* 403-425.

Doove, L. L., Van Buuren, S., & Dusseldorp, E. (2014). Recursive partitioning for missing data imputation in the presence of interaction effects. *Computational Statistics and Data Analysis, 72,* 92-104.

Duncan, B. L., Miller, S. D., Sparks, J. A., Claud, D. A., Reynolds, L. R., Brown, J., & Johnson, L. D. (2003). The session rating scale: Preliminary psychometric properties of a "working" alliance measure. *Journal of Brief Therapy, 3,* 3-12.

Dutch Healthcare Authority (NZa) (2016). Prices general practitioner and multidisciplinary care [Tariefbeschikking Huisartsenzorg en mulitdisciplinaire zorg]. Retrieved from

https://www.nza.nl/1048076/1048155/Bijlage_bij_TB_CU_7089_01_Tarievenlijst_huisartsenzorg_en_multidisciplinaire_zorg.pdf.

Eekhout, I., de Vet, H. C., Twisk, J. W., Brand, J. P., de Boer, M. R., & Heymans, M. W. (2014). Missing data in a multi-item instrument were best handled by multiple imputation at the item score level. *Journal of Clinical Epidemiology, 67,* 335-342.

Ehring, T., Raes, F., Weidacker, K., & Emmelkamp, P. M. G. (2012). Validation of the Dutch version of the Perseverative Thinking Questionnaire (PTQ-NL). *European Journal of Psychological Assessment, 28,* 102-108.

Ehring, T., Zetsche, U., Weidacker, K., Wahl, K., Schönfeld, S., & Ehlers, A. (2011). The Perseverative Thinking Questionnaire (PTQ): Validation of a content-independent measure of repetitive negative thinking. *Journal of Behavior Therapy and Experimental Psychiatry, 42,* 225-232.

Engel, S. G., Adair, C. E., Las, H. C., & Abraham, S. (2009). Health-related quality of life and eating disorders: A review and update. *International Journal of Eating Disorders, 42,* 179-187.

Engel, S. G. & Wonderlich, S. (2010). *New technologies in treatments for eating disorders.* In C.M.Grilo & S. A. Wonderlich (Eds.), The treatment of eating disorders: A clinical handbook (pp. 500-509). New York: Guilford Press.

Engel, S. G., Wonderlich, S. A., Crosby, R. D., Mitchell, J. E., Crow, S., Peterson, C. B., Le Grange, D., Simonich, H. K., Cao, L., Lavender, J. M., & Gordon, K. H. (2013). The role of affect in the maintenance of anorexia nervosa: Evidence from a naturalistic assessment of momentary behaviors and emotion. *Journal of Abnormal Psychology, 122,* 709-719.

Engel, S. G., Wittrock, D. A., Crosby, R. D., Wonderlich, S. A., Mitchell, J. E., & Kolotkin, R. L. (2006). Development and psychometric validation of an eating disorder-specific health-related quality of life instrument. *International Journal of Eating Disorders, 39,* 62-71.

Escobar-Koch, T., Banker, J. D., Crow, S., Cullis, J., Ringwood, S., Smith, G., van Furth, E., Westin, K., & Schmidt, U. (2010). Service users' views of eating disorder services: An international comparison. *International Journal of Eating Disorders, 43,* 549-559.

EuroQol Group (1990). EuroQol-a new facility for the measurement of health-related quality of life. *Health Policy, 16,* 199-208.

Evans, E. J., Hay, P. J., Mond, J., Paxton, S. J., Quirk, F., Rodgers, B., Jhajj, A. K., & Sawoniewska, M. A. (2011). Barriers to help-seeking in young women with eating disorders: A qualitative exploration in a longitudinal community survey. *Eating Disorders, 19,* 270-285.

Eysenbach, G. (2001). What is e-health? *Journal of Medical Internet Research, 3,* e20.

Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research, 7,* e11.

Eysenbach, G. & CONSORT-EHEALTH Group (2011). CONSORT-EHEALTH: Improving and standardizing evaluation reports of Web-based and mobile health interventions. *Journal of Medical Internet Research, 13,* e126.

Fairburn, C. G., Bailey-Straebler, S., Basden, S., Doll, H. A., Jones, R., Murphy, R., O'Connor, M. E., & Cooper, Z. (2015). A transdiagnostic comparison of enhanced cognitive behaviour therapy (CBT-E) and interpersonal psychotherapy in the treatment of eating disorders. *Behaviour Research And Therapy, 70,* 64-71.

Fairburn, C. G. & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders, 16,* 363-370.

Fairburn, C. G. & Beglin, S. J. (2008). *Eating Disorder Examination Questionnaire (EDE-Q 6.0).* In C.G.Fairburn (Eds.), Cognitive behavior therapy and eating disorders (pp. 309-313). New York: Guilford Press.

Fairburn, C. G., Cooper, Z., Doll, H. A., Norman, P., & O'Connor, M. (2000). The natural course of bulimia nervosa and binge eating disorder in young women. *Archives of General Psychiatry, 57,* 659-665.

Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. *Behaviour Research Therapy, 41,* 509-528.

Fairburn, C. G. & Rothwell, E. R. (2015). Apps and eating disorders: A systematic clinical appraisal. *International Journal of Eating Disorders*.

Featback (2016). http://www.featback.nl/. WebCite Cache ID 6fgI6ha4A.

Federici, A. & Kaplan, A. S. (2008). The patient's account of relapse and recovery in anorexia nervosa: a qualitative study. *European Eating Disorders Review, 16,* 1-10.

Feingold, A. (2015). Confidence interval estimation for standardized effect sizes in multilevel and latent growth modeling. *Journal of Consulting and Clinical Psychology, 83,* 157-168.

Fernández-Aranda, F., Nunez, A., Martinez, C., Krug, I., Cappozzo, M., Carrard, I., Rouget, P., Jimenez-Murcia, S., Granero, R., Penelo, E., Santamaria, J., & Lam, T. (2009). Internet-based cognitive-behavioral therapy for bulimia nervosa: A controlled study. *Cyberpsychology & Behavior, 12,* 37-41.

Fichter, M. M., Quadflieg, N., & Hedlund, S. (2006). Twelve-year course and outcome predictors of anorexia nervosa. *International Journal of Eating Disorders, 39,* 87-100.

Fichter, M. M., Quadflieg, N., & Lindner, S. (2013). Internet-based relapse prevention for anorexia nervosa: Nine- month follow-up. *Journal of Eating Disorders, 1,* 23.

Field, A. E., Herzog, D. B., Keller, M. B., West, J., Nussbaum, K., & Colditz, G. A. (1997). Distinguishing recovery from remission in a cohort of bulimic women: How should asymptomatic periods be described? *Journal of Clinical Epidemiology, 50,* 1339-1345.

Fokkema, M., Smits, N., Kelderman, H., & Penninx, B. W. (2015). Connecting clinical and actuarial prediction with rule-based methods. *Psychological Assessment, 27,* 636-644.

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology, 51,* 115-134.

Gainsbury, S. & Blaszczynski, A. (2011). A systematic review of Internet-based therapy for the treatment of addictions. *Clinical Psychology Review, 31,* 490-498.

Gatt, L., Jan, S., Mondraty, N., Horsfield, S., Hart, S., Russell, J., Laba, T. L., & Essue, B. (2014). The household economic burden of eating disorders and adherence to treatment in Australia. *BioMed Central Psychiatry, 14,* 338.

Genders, R. & Tchanturia, K. (2010). Cognitive remediation therapy (CRT) for anorexia in group format: A pilot study. *Eating and Weight Disorders, 15,* e234-e239.

Gerhards, S. A., de Graaf, L. E., Jacobs, L. E., Severens, J. L., Huibers, M. J., Arntz, A., Riper, H., Widdershoven, G., Metsemakers, J. F., & Evers, S. M. (2010). Economic evaluation of online computerised cognitive-behavioural therapy without support for depression in primary care: Randomised trial. *British Journal of Psychiatry, 196,* 310-318.

Ghaemi, S. N. & Soldani, F. (2003). Meta-analysis of observational studies: the case of rapid-cycling bipolar disorder. *Acta Psychiatrica Scandinavica, 108,* 1-3.

Glaser, B. G. & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine.

Gold M, Siegel J, Russell L, Weinstein M. Cost-effectiveness in health and medicine (1996). New York: Oxford University Press.

Goldschmidt, A. B., Wonderlich, S. A., Crosby, R. D., Engel, S. G., Lavender, J. M., Peterson, C. B., Crow, S. J., Cao, L., & Mitchell, J. E. (2014). Ecological momentary assessment of stressful events and negative affect in bulimia nervosa. *Journal of Consulting and Clinical Psychology, 82,* 30-39.

Goorden, M., Muntingh, A., van Marwijk, H., Spinhoven, P., Adèr, H., van Balkom, A., Feltz-Cornelis, C., & Hakkaart-van Roijen, L. (2014). Cost utility analysis of a collaborative stepped care intervention for panic and generalized anxiety disorders in primary care. *Journal of Psychosomatic Research, 77,* 57-63.

Gorini, A., Gaggioli, A., Vigna, C., & Riva, G. (2008). A second life for eHealth: Prospects for the use of 3-D virtual worlds in clinical psychology. *Journal of Medical Internet Research, 10,* e21.

Graff Low, K., Charanasomboon, S., Lesser, J., Reinhalter, K., Martin, R., Jones, H., Winzelberg, A., Abascal, L., & Taylor, C. B. (2006). Effectiveness of a computer-based interactive eating disorders prevention program at long-term follow-up. *Eating Disorders: The Journal of Treatment and Prevention, 14,* 17-30.

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology, 60,* 549-576.

Grenon, R., Tasca, G. A., Cwinn, E., Coyle, D., Sumner, A., Gick, M., & Bissada, H. (2010). Depressive symptoms are associated with medication use and lower health-related quality

of life in overweight women with binge eating disorder. *Womens Health Issues, 20,* 435-440.

Griffiths, S., Mond, J. M., Murray, S. B., & Touyz, S. (2015). The prevalence and adverse associations of stigmatization in people with eating disorders. *International Journal of Eating Disorders, 48,* 767-774.

Grilo, C. M., Masheb, R. M., & Crosby, R. D. (2012). Predictors and moderators of response to cognitive behavioral therapy and medication for the treatment of binge eating disorder. *Journal of Consulting and Clinical Psychology, 80,* 897-906.

Grilo, C. M., Pagano, M. E., Skodol, A. E., Sanislow, C. A., McGlashan, T. H., Gunderson, J. G., & Stout, R. L. (2007). Natural course of bulimia nervosa and of eating disorder not otherwise specified: 5-year prospective study of remissions, relapses, and the effects of personality disorder psychopathology. *Journal of Clinical Psychiatry, 68,* 738-746.

Gulec, H., Moessner, M., Tury, F., Fiedler, P., Mezei, A., & Bauer, S. (2014). A randomized controlled trial of an internet-based posttreatment care for patients with eating disorders. *Telemedicine Journal and E-Health, 20,* 916-922.

Gulec, H., Moessner, M., Mezei, A., Kohls, E., Túry, F., & Bauer, S. (2011). Internet-based maintenance treatment for patients with eating disorders. *Professional Psychology: Research and Practice, 42,* 479-486.

Gulliksen, K. S., Espeset, E. M., Nordbo, R. H., Skarderud, F., Geller, J., & Holte, A. (2012). Preferred therapist characteristics in treatment of anorexia nervosa: The patient's perspective. *International Journal of Eating Disorders, 45,* 932-941.

Gulliver, A., Griffiths, K., & Christensen, H. (2010). Perceived barriers and facilitators to mental health help-seeking in young people: A systematic review. *BioMed Central Psychiatry, 10,* 113.

Haedt-Matt, A. A. & Keel, P. K. (2015). Affect regulation and purging: An ecological momentary assessment study in purging disorder. *Journal of Abnormal Psychology, 124,* 399-411.

Hakkaart-van Roijen, L., Donker, M., & Tiemens, B. (2002). *Manual trimbos/iMTA questionnaire for costs associated with psychiatric illness (TiC-P)*. Retrieved from

https://www.bmg.eur.nl/fileadmin/ASSETS/bmg/english/iMTA/Publications/Manuals___Questionnaires/Handleiding_TIC_P_Nederlands_september_2010.pdf.

Hakkaart-van Roijen, L., Tan, S. S., & Bouwmans, C. A. M. (2010). *Dutch manual for costing in health economic evaluations [Handleiding voor kostenonderzoek: Methoden en standaard kostprijzen voor economische evaluaties in de gezondheidszorg]*. Diemen: College voor zorgverzekeringen.

Halmi, K. A., Agras, W. S., Mitchell, J., Wilson, G. T., Crow, S., Bryson, S. W., & Kraemer, H. (2002). Relapse predictors of patients with bulimia nervosa who achieved abstinence through cognitive behavioral therapy. *Archives of General Psychiatry, 59,* 1105-1109.

Harris, E. C. & Barraclough, B. (1998). Excess mortality of mental disorder. *British Journal of Psychiatry, 173,* 11-53.

Hart, L. M., Granillo, M. T., Jorm, A. F., & Paxton, S. J. (2011). Unmet need for treatment in the eating disorders: A systematic review of eating disorder specific treatment seeking among community cases. *Clinical Psychology Review, 31,* 727-735.

Heatherton, T. F. & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin, 110,* 86-108.

Hedman, E., Andersson, E., Ljótsson, B., Andersson, G., Rück, C., & Lindefors, N. (2011). Cost-effectiveness of Internet-based cognitive behavior therapy vs. cognitive behavioral group therapy for social anxiety disorder: Results from a randomized controlled trial. *Behaviour Research And Therapy, 49,* 729-736.

Heinicke, B. E., Paxton, S. J., Mclean, S. A., & Wertheim, E. H. (2007). Internet-delivered targeted group intervention for body dissatisfaction and disordered eating in adolescent girls: A randomized controlled trial. *Journal of Abnormal Child Psychology, 35,* 379-391.

Hepworth, N. & Paxton, S. J. (2007). Pathways to help-seeking in bulimia nervosa and binge eating problems: A concept mapping approach. *International Journal of Eating Disorders, 40,* 493-504.

Herzog, D. B., Dorer, D. J., Keel, P. K., Selwyn, S. E., Ekeblad, E. R., Flores, A. T., Greenwood, D. N., Burwell, R. A., & Keller, M. B. (1999). Recovery and relapse in anorexia and bulimia nervosa: A 7.5-year follow-up study. *Journal of the American Academy of Child and Adolescent Psychiatry, 38,* 829-837.

Higgins, J. P. T. & Green, S. (2011). *Cochrane handbook for systematic reviews of interventions (version 5.1.0).* West Sussex, England: The Cochrane Collaboration and John Wiley & Sons Ltd.

Hilbert, A. & Tuschen-Caffier, B. (2007). Maintenance of binge eating through negative mood: a naturalistic comparison of binge eating disorder and bulimia nervosa. *International Journal of Eating Disorders, 40,* 521-530.

Hilbert, A., Bishop, M. E., Stein, R. I., Tanofsky-Kraff, M., Swenson, A. K., Welch, R. R., & Wilfley, D. E. (2012). Long-term efficacy of psychological treatments for binge eating disorder. *The British Journal of Psychiatry, 200,* 232-237.

Hoek, H. W. & van Hoeken, D. (2003). Review of the prevalence and incidence of eating disorders. *International Journal of Eating Disorders, 34,* 383-396.

Hogdahl, L., Birgegard, A., & Bjorck, C. (2013). How effective is bibliotherapy-based self-help cognitive behavioral therapy with Internet support in clinical settings? Results from a pilot study. *Eating and Weight Disorders, 18,* 37-44.

Holländare, F., Gustafsson, S. A., Berglind, M., Grape, F., Carlbring, P., Andersson, G., Hadjistavropoulos, H., & Tillfors, M. (2015). Therapist behaviours in internet-based cognitive behaviour therapy (ICBT) for depressive symptoms. *Internet Interventions, 3,* 1-7.

Hollinghurst, S., Peters, T. J., Kaur, S., Wiles, N., Lewis, G., & Kessler, D. (2010). Cost-effectiveness of therapist-delivered online cognitive behavioural therapy for depression: Randomised controlled trial. *British Journal of Psychiatry, 197,* 297-304.

Hollis, S. & Campbell, F. (1999). What is meant by intention to treat analysis? Survey of published randomised controlled trials. *British Medical Journal, 319,* 670-674.

Hothorn, T. & Zeileis, A. (2015). Partykit: A modular toolkit for recursive partytioning in R. *Journal of Machine Learning Research, 16,* 3905−3909.

Hötzel, K., von Brachel, R., Schmidt, U., Rieger, E., Kosfelder, J., Hechler, T., Schulte, D., & Vocks, S. (2014). An Internet-based program to enhance motivation to change in females with symptoms of an eating disorder: A randomized controlled trial. *Psychological Medicine, 44,* 1947-1963.

Hsieh, H. F. & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15,* 1277-1288.

Hudson, J. I., Hiripi, E., Pope, J., & Kessler, R. C. (2007). The prevalence and correlates of eating disorders in the national comorbidity survey replication. *Biological Psychiatry, 61,* 348-358.

Internet World Stats (2012). *World Internet usage and population statistics.* Retrieved from http://www.internetworldstats.com/stats.htm.

Jacobi, C., Abascal, L., & Taylor, C. B. (2004). Screening for eating disorders and high-risk behavior: Caution. *International Journal of Eating Disorders, 36,* 280-295.

Jacobi, C., Morris, L., Beckers, C., Bronisch-Holtze, J., Winter, J., Winzelberg, A. J., & Taylor, C. B. (2007). Maintenance of Internet-based prevention: A randomized controlled trial. *International Journal of Eating Disorders, 40,* 114-119.

Jacobi, C., Völker, U., Trockel, M. T., & Taylor, C. B. (2011). Effects of an Internet-based intervention for subthreshold eating disorders: A randomized controlled trial. *Behaviour Research And Therapy, 50,* 93-99.

Jenkins, P. E., Hoste, R. R., Meyer, C., & Blissett, J. M. (2011). Eating disorders and quality of life: A review of the literature. *Clinical Psychology Review, 31,* 113-121.

Jenkins, P. E., Luck, A., Burrows, A., & Boughton, N. (2014). Comparison of face-to-face versus email guided self-help for binge eating: Study protocol for a randomised controlled trial. *Trials, 15,* 181.

Johnson, J. G., Cohen, P., Kasen, S., & Brook, J. S. (2002). Eating disorders during adolescence and the risk for physical and mental disorders during early adulthood. *Archives of General Psychiatry, 59,* 545-552.

Jones, M., Luce, K. H., Osborne, M. I., Taylor, K., Cunning, D., Doyle, A. C., Wilfley, D. E., & Taylor, C. B. (2008). Randomized controlled trial of an Internet-facilitated intervention for reducing binge eating and overweight in adolescents. *Pediatrics, 121,* 453-462.

Juarascio, A. S., Manasse, S. M., Goldstein, S. P., Forman, E. M., & Butryn, M. L. (2015). Review of smartphone applications for the treatment of eating disorders. *European Eating Disorders Review, 23,* 1-11.

Kass, A. E., Kolko, R. P., & Wilfley, D. E. (2013). Psychological treatments for eating disorders. *Current Opinions in Psychiatry, 26,* 549-555.

Keel, P. K., Crow, S., Davis, T. L., & Mitchell, J. E. (2002). Assessment of eating disorders: Comparison of interview and questionnaire data from a long-term follow-up study of bulimia nervosa. *Journal of Psychosomatic Research, 53,* 1043-1047.

Keel, P. K., Dorer, D. J., Franko, D. L., Jackson, S. C., & Herzog, D. B. (2005). Postremission predictors of relapse in women with eating disorders. *American Journal of Psychiatry, 162,* 2263-2268.

Keel, P. K. & Mitchell, J. E. (1997). Outcome in bulimia nervosa. *American Journal of Psychiatry, 154,* 313-321.

Keel, P. K. & Brown, T. A. (2010). Update on course and outcome in eating disorders. *International Journal of Eating Disorders, 43,* 195-204.

Kelders, S. M., Bohlmeijer, E. T., Pots, W. T., & van Gemert-Pijnen, J. E. (2015). Comparing human and automated support for depression: Fractional factorial randomized controlled trial. *Behaviour Research And Therapy, 72,* 72-80.

Kenter, R. M. F., van de Ven, P. M., Cuijpers, P., Koole, G., Niamat, S., Gerrits, R. S., Willems, M., & van Straten, A. (2015). Costs and effects of Internet cognitive behavioral treatment blended with face-to-face treatment: Results from a naturalistic study. *Internet Interventions, 2,* 77-83.

Keski-Rahkonen, A., Hoek, H. W., Linna, M. S., Raevuori, A., Sihvola, E., Bulik, C. M., Rissanen, A., & Kaprio, J. (2009). Incidence and outcomes of bulimia nervosa: A nationwide population-based study. *Psychological Medicine, 39,* 823-831.

Keski-Rahkonen, A., Hoek, H. W., Susser, E. S., Linna, M. S., Sihvola, E., Raevuori, A., Bulik.C.M., Kaprio, J., & Rissanen, A. (2007). Epidemiology and course of anorexia nervosa in the community. *American Journal of Psychiatry, 164,* 1259-1265.

Keski-Rahkonen, A. & Tozzi, F. (2005). The process of recovery in eating disorder sufferers' own words: An Internet-based study. *International Journal of Eating Disorders, 37,* s80-s86.

Kessler, R. C., Berglund, P. A., Chiu, W. T., Deitz, A. C., Hudson, J. I., Shahly, V., Aguilar-Gaxiola, S., Alonso, J., Angermeyer, M. C., Benjet, C., Bruffaerts, R., de, G. G., de, G. R., Maria, H. J., Kovess-Masfety, V., O'Neill, S., Posada-Villa, J., Sasu, C., Scott, K., Viana, M. C., & Xavier, M. (2013). The prevalence and correlates of binge eating disorder in the World Health Organization World Mental Health Surveys. *Biological Psychiatry, 73,* 904-914.

Killen, J. D., Taylor, C. B., Hammer, L. D., Litt, I., Wilson, D. M., Rich, T., Hayward, C., Simmonds, B., Kraemer, H., & Varady, A. (1993). An attempt to modify unhealthful eating attitudes and weight regulation practices of young adolescent girls. *International Journal of Eating Disorders, 13,* 369-384.

Killen, J. D., Taylor, C. B., Hayward, C., Wilson, D. M., Haydel, K. F., Hammer, L. D., Simmonds, B., Robinson, T. N., Litt, I., Varady, A., & Kraemer, H. (1994). Pursuit of thinness and onset of eating disorder symptoms in a community sample of adolescent girls: A three-year prospective analysis. *International Journal of Eating Disorders, 16,* 227-238.

Kiluk, B. D., Sugarman, D. E., Nich, C., Gibbons, C. J., Martino, S., Rounsaville, B. J., & Carroll, K. M. (2011). A methodological analysis of randomized clinical trials of computer-assisted therapies for psychiatric disorders: Toward improved standards for an emerging field. *American Journal of Psychiatry, 168,* 790-799.

Kim, S. C., Kim, S., & Boren, D. (2008). The quality of therapeutic alliance between patient and provider predicts general satisfaction. *Military Medicine, 173,* 85-90.

Klein, B., Mitchell, J., Gilson, K., Shandley, K., Austin, D., Kiropoulos, L., Abbott, J., & Cannard, G. (2009a). A therapist-assisted Internet-based CBT intervention for posttraumatic stress disorder: Preliminary results. *Cognitive Behaviour Therapy, 38,* 121-131.

Klein, B., Austin, D., Pier, C., Kiropoulos, L., Shandley, K., Mitchell, J., Gilson, K., & Ciechomski, L. (2009b). Internet-based treatment for panic disorder: Does frequency of therapist contact make a difference? *Cognitive Behaviour Therapy, 38,* 100-113.

Knaevelsrud, C. & Maercker, A. (2006). Does the quality of the working alliance predict treatment outcome in online psychotherapy for traumatized patients? *Journal of Medical Internet Research, 8,* e31.

Knaevelsrud, C. & Maercker, A. (2007). Internet-based treatment for PTSD reduces distress and facilitates the development of a strong therapeutic alliance: a randomized controlled clinical trial. *BioMed Central Psychiatry, 7,* 13.

Kohn, R., Saxena, S., Levav, I., & Saraceno, B. (2004). The treatment gap in mental health care. *Bulletin of the World Health Organization, 82,* 858-866.

Kok, G., Burger, H., Riper, H., Cuijpers, P., Dekker, J., van Marwijk, H., Smit, F., Beck, A., & Bockting, C. L. (2015). The three-month effect of mobile Internet-based cognitive therapy on the course of depressive symptoms in remitted recurrently depressed patients: Results of a randomized controlled trial. *Psychotherapy and Psychosomatics, 84,* 90-99.

Kraemer, H. C., Wilson, G. T., Fairburn, C. G., & Agras, W. S. (2002). Mediators and moderators of treatment effects in randomized clinical trials. *Archives of General Psychiatry, 59,* 877-883.

Krauth, C., Buser, K., & Vogel, H. (2002). How high are the costs of eating disorders - anorexia nervosa and bulimia nervosa - for German society? *European Journal of Health Economics, 3,* 244-250.

Kroenke, K., Spitzer, R. L., Williams, J. B. W., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: The PHQ–4. *Psychosomatics, 50,* 613-621.

Kuester, A., Niemeyer, H., & Knaevelsrud, C. (2016). Internet-based interventions for posttraumatic stress: A meta-analysis of randomized controlled trials. *Clinical Psychology Review, 43,* 1-16.

Kummervold, P. E., Chronaki, C. E., Lausen, B., Prokosch, H. U., Rasmussen, J., Santana, S., Staniszewski, A., & Wangberg, S. C. (2008). eHealth trends in Europe 2005-2007: A population-based survey. *Journal of Medical Internet Research, 10,* e42.

Lamers, L. M., Stalmeier, P. F., McDonnell, J., Krabbe, P. F., van Busschbach, J. J. (2005). Measuring the quality of life in economic evaluations: The Dutch EQ-5D tariff. *Nederlands Tijdschrift voor Geneeskunde, 149,* 1574-1578.

Landelijke stuurgroep multidisciplinaire richtlijnontwikkeling GGZ (2006). Dutch multidisciplinary guideline for eating disorders: Guideline for diagnostics and treatment of eating disorders [*Multidisciplinaire richtlijn eetstoornissen: Richtlijn voor de diagnostiek en behandeling van eetstoornissen].* Utrecht: Trimbos instituut.

Le Grange, D., Fitzsimmons-Craft, E. E., Crosby, R. D., Hay, P., Lacey, H., Bamford, B., Stiles-Shields, C., & Touyz, S. (2014). Predictors and moderators of outcome for severe and enduring anorexia nervosa. *Behaviour Research And Therapy, 56,* 91-98.

Leung, S. F., Ma, J., & Russell, J. (2013a). Enhancing motivation to change in eating disorders with an online self-help program. *International Journal of Mental Health Nursing, 22,* 329-339.

Leung, S. F., Ma, J. L. C., & Russell, J. (2013b). Enhancing quality of life in people with disordered eating using an online self-help programme. *Journal of eating disorders, 1,* 9.

Leung, S. F., Joyce Ma, L. C., & Russell, J. (2013c). An open trial of self-help behaviours of clients with eating disorders in an online programme. *Journal of Advanced Nursing, 69*, 66-76.

Lindenberg, K., Moessner, M., Harney, J., McLaughlin, O., & Bauer, S. (2011). E-Health for individualized prevention of eating disorders. *Clinical Practice & Epidemiology in mental health, 7,* 74-83.

Linville, D., Brown, T., Sturm, K., & McDougal, T. (2012). Eating disorders and social support: Perspectives of recovered individuals. *Eating Disorders: The Journal of Treatment and Prevention, 20,* 216-231.

Ljotsson, B., Lundin, C., Mitsell, K., Carlbring, P., Ramklint, M., & Ghaderi, A. (2007). Remote treatment of bulimia nervosa and binge eating disorder: A randomized trial of Internet-assisted cognitive behavioural therapy. *Behaviour Research And Therapy, 45,* 649-661.

Loucas, C. E., Fairburn, C. G., Whittington, C., Pennant, M. E., Stockton, S., & Kendall, T. (2014). E-therapy in the treatment and prevention of eating disorders: A systematic review and meta-analysis. *Behaviour Research And Therapy, 63C,* 122-131.

Löwe, B., Wahl, I., Rose, M., Spitzer, C., Glaesmer, H., Wingenfeld, K., Schneider, A., & Brähler, A. (2010). A 4-item measure of depression and anxiety: Validation and

standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *Journal Of Affective Disorders, 122,* 86-95.

Lynch, F. L., Striegel-Moore, R. H., Dickerson, J. F., Perrin, N., DeBar, L., Wilson, G. T., & Kraemer, H. C. (2010). Cost-effectiveness of guided self-help treatment for recurrent binge eating. *Journal of Consulting and Clinical Psychology, 78,* 322-333.

Machado, P. P., Martins, C., Vaz, A. R., Conceicao, E., Bastos, A. P., & Goncalves, S. (2014). Eating disorder examination questionnaire: psychometric properties and norms for the Portuguese population. *European Eating Disorders Review, 22,* 448-453.

Martignon, L., Vitouch, O., Takezawa, M., & Forster, M. (2003). *Naive and yet enlightened: From natural frequencies to fast and frugal decision trees.* In Wiley (Eds.), Thinking: Psychological perspective on reasoning, judgement, and decision making (pp. 189-211). West Sussex, England: Wiley.

Martin, D. J., Garske, J. P., & Davis, M. K. (2000). Relation of the therapeutic alliance with outcome and other variables: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 68,* 438-450.

McAllister, M., Dunn, G., Payne, K., Davies, L., & Todd, C. (2012). Patient empowerment: The need to consider it as a measurable patient-reported outcome for chronic conditions. *BioMed Central Health Services Research, 12,* 157.

McClay, A. C., Waters, L., Schmidt, U., & Williams, C. (2014). A survey of attitudes towards computerized self-help for eating disorders within a community-based sample. *Behavioural and Cognitive Psychotherapy, 28,* 1-14.

McCormack, A. (2010). Individuals with eating disorders and the use of online support groups as a form of social support. *Computers, Informatics, Nursing, 28,* 12-19.

McFarlane, T., Olmsted, M. P., & Trottier, K. (2008). Timing and prediction of relapse in a transdiagnostic eating disorder sample. *International Journal of Eating Disorders, 41,* 587-593.

Melioli, T., Bauer, S., Franko, D. L., Moessner, M., Ozer, F., Chabrol, H., & Rodgers, R. F. (2016). Reducing eating disorder symptoms and risk factors using the internet: A meta-analytic review. *International Journal of Eating Disorders, 49,* 19-31.

Melville, K. M., Casey, L. M., & Kavanagh, D. J. (2010). Dropout from Internet-based treatment for psychological disorders. *British Journal of Clinical Psychology, 49,* 455-471.

Menon, S. T. (2002). Toward a model of psychological health empowerment: Implications for health care in multicultural communities. *Nurse Education Today, 22,* 28-39.

Mitchell, J. E. & Crow, S. (2006). Medical complications of anorexia nervosa and bulimia nervosa. *Current Opinions in Psychiatry, 19,* 438-443.

Mitchell, J. E., Myers, T., Crosby, R., O'Neill, G., Carlisle, J., & Gerlach, S. (2009). Health care utilization in patients with eating disorders. *International Journal of Eating Disorders, 42,* 571-574.

Mitchell, J. E., Agras, S., Crow, S., Halmi, K., Fairburn, C. G., Bryson, S., & Kraemer, H. (2011). Stepped care and cognitive-behavioural therapy for bulimia nervosa: Randomised trial. *British Journal of Psychiatry, 198,* 391-397.

Mitchison, D. & Mond, J. (2015). Epidemiology of eating disorders, eating disordered behaviour, and body image disturbance in males: A narrative review. *Journal of eating disorders*, *3,* 20.

Mo, P. K. H. & Coulson, N. S. (2010). Empowering processes in online support groups among people living with HIV/AIDS: A comparative analysis of 'lurkers' and 'posters'. *Computers in Human Behavior, 26,* 1183-1193.

Moessner, M., Fassnacht, D., & Bauer, S. (2015). Online assessment of eating disorders: The Clinical and Research Inventory for Eating Disorders (CR-EAT). *Mental Health & Prevention, 3,* 170-177.

Moessner, M. & Bauer, S. (2012). Online counselling for eating disorders: Reaching an underserved population? *Journal of Mental Health, 21,* 336-345.

Mohr, D. C., Duffecy, J., Ho, J., Kwasny, M., Cai, X., Burns, M. N., & Begale, M. (2013). A randomized controlled trial evaluating a manualized TeleCoaching protocol for improving adherence to a web-based intervention for the treatment of depression. *PLoS one, 8,* e70086.

Mohr, D. C., Ho, J., Duffecy, J., Reifler, D., Sokol, L., Burns, M. N., Jin, L., & Siddique, J. (2012). Effect of telephone-administered vs face-to-face cognitive behavioral therapy on

adherence to therapy and depression outcomes among primary care patients. *Journal of the American Medical Association, 307,* 2278-2285.

Mortelmans, D. (2007). *Handbook of qualitative research methods [Handboek kwalitatieve onderzoeksmethoden].* Leuven, Belgium: Acco.

Myers, T. C., Swan-Kremeier, L., Wonderlich, S., Lancaster, K., & Mitchell, J. E. (2004). The use of alternative delivery systems and new technologies in the treatment of patients with eating disorders. *International Journal of Eating Disorders, 36,* 123-143.

National Healthcare Institute (2015). *Medicine prices [Medicijnkosten].* Retrieved from https://www.medicijnkosten.nl/.

National Institute for Clinical Excellence (2004). *Eating disorders: Core interventions in the treatment and management of anorexia nervosa, bulimia nervosa, and related eating disorders.* London: National Institute for Clinical Excellence.

Nevonen, L., Mark, M., Levin, B., Lindström, M., & Paulson-Karlsson, G. (2006). Evaluation of a new Internet-based self-help guide for patients with bulimic symptoms in Sweden. *Nordic Journal of Psychiatry, 60,* 463-468.

Nolen-Hoeksema, S., Stice, E., Wade, E., & Bohon, C. (2007). Reciprocal relations between rumination and bulimic, substance abuse, and depressive symptoms in female adolescents. *Journal of Abnormal Psychology, 116,* 198-207.

O'Brien, K. M. & Vincent, N. K. (2003). Psychiatric comorbidity in anorexia and bulimia nervosa: Nature, prevalence, and causal relationships. *Clinical Psychology Review, 23,* 57-74.

Olmsted, M. P., Kaplan, A. S., & Rockert, W. (1994). Rate and prediction of relapse in bulimia nervosa. *American Journal of Psychiatry, 151,* 738-743.

Olmsted, M. P., Kaplan, A. S., & Rockert, W. (2005). Defining remission and relapse in bulimia nervosa. *International Journal of Eating Disorders, 38,* 1-6.

Olthuis, J. V., Watt, M. C., Bailey, K., Hayden, J. A., & Stewart, S. H. (2015). Therapist-supported Internet cognitive behavioural therapy for anxiety disorders in adults. *Cochrane Database of Systematic Reviews, 3,* CD011565.

Pallister, E. & Waller, G. (2008). Anxiety in the eating disorders: Understanding the overlap. *Clinical Psychology Review, 28,* 366-386.

Palmqvist, B., Carlbring, P., & Andersson, G. (2007). Internet-delivered treatments with or without therapist input: Does the therapist factor have implications for efficacy and cost? *Expert Reviews of Pharmacoeconomics and Outcomes Research, 7,* 291-297.

Paxling, B., Lundgren, S., Norman, A., Almlov, J., Carlbring, P., Cuijpers, P., & Andersson, G. (2012). Therapist behaviours in Internet-delivered cognitive behaviour therapy: Analyses of e-mail correspondence in the treatment of generalized anxiety disorder. *Behavioural and Cognitive Psychotherapy* 1-10.

Paxton, SJ., McLean, S., Gollings, EK., Faulkner, C., & Wertheim, EH. (2007). Comparison of face-to-face and Internet interventions for body image and eating problems in adult women: An RCT. *International Journal of Eating Disorders, 40,* 692-704.

Percevic, R. (2004). Computer-supported monitoring of patient treatment response. *Journal of Clinical Psychology, 60,* 285-299.

Perkins, S. J., Murphy, R. M., Schmidt, U. S., & Williams, C. (2006). Self-help and guided self-help for eating disorders. *Cochrane Database of Systematic Reviews, 19,* CD004191.

Pew Research Center (2015). *Health online 201*3. Retrieved from http://pewinternet.org/Reports/2013/Health-online.aspx.

Pew Research Center (2015b). *Social media usage: 2005-2015.* Retrieved from http://www.pewinternet.org/2015/10/08/social-networking-usage-2005-2015/.

Preacher, K. J. & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879-891.

Pretorius, N., Arcelus, J., Beecham, J., Dawson, H., Doherty, F., Eisler, I., Gallagher, C., Gowers, S., Isaacs, G., Johnson-Sabine, E., Jones, A., Newell, C., Morris, J., Richards, L., Ringwood, S., Rowlands, L., Simic, M., Treasure, J., Waller, G., Williams, C., Yi, I., Yoshioka, M., & Schmidt, U. (2009). Cognitive-behavioural therapy for adolescents with bulimic symptomatology: The acceptability and effectiveness of Internet-based delivery. *Behaviour Research and Therapy, 47,* 729-736.

Proud2Bme (2016). http://www.proud2bme.nl. WebCite Cache ID 6fgHnixVa.

Quirk, M. P., Erdberg, P., Crosier, M., & Steinfeld, B. (2007). Personality assessment in today's health care environment: Therapeutic alliance and patient satisfaction. *Journal of Personality Assessment, 89,* 95-104.

R Development Core Team (2014). R: A language and environment for statistical computing [Computer software]. Vienna, Austria: R Foundation for Statistical Computing.

Reas, D. L., Williamson, D. A., Martin, C. K., & Zucker, N. L. (2000). Duration of illness predicts outcome for bulimia nervosa: A long-term follow-up study. *International Journal of Eating Disorders, 27,* 428-434.

Rheker, J., Andersson, G., & Weise, C. (2015). The role of "on demand" therapist guidance vs. no support in the treatment of tinnitus via the internet: A randomized controlled trial. *Internet Interventions, 2,* 189-199.

Richard, M., Bauer, S., Kordy, H., & COST Action B6 (2005). Relapse in anorexia and bulimia nervosa-A 2.5-year follow-up study. *European Eating Disorders Review, 13,* 180-190.

Riper, H., Blankers, M., Hadiwijaya, H., Cunningham, J., Clarke, S., Wiers, R., Ebert, D., & Cuijpers, P. (2014). Effectiveness of guided and unguided low-intensity internet interventions for adult alcohol misuse: A meta-analysis. *PLoS one, 9,* e99912.

Riper, H., Smit, F., Zanden, R., van der Conijn, B., Kramer, J., & Mutsaers, K. (2007). *E-mental health. High tech, high touch, high trust.* Utrecht: Trimbos Instituut.

Ro, O., Reas, D. L., & Stedal, K. (2015). Eating Disorder Examination Questionnaire (EDE-Q) in Norwegian adults: Discrimination between female controls and eating disorder patients. *European Eating Disorders Review, 23,* 408-412.

Robinson, E., Titov, N., Andrews, G., McIntyre, K., Schwencke, G., & Solley, K. (2010). Internet treatment for generalized anxiety disorder: A randomized controlled trial comparing clinician vs. technician assistance. *PLoS one, 5,* e10942.

Robinson, P. & Serfaty, M. (2003). Computers, e-mail and therapy in eating disorders. *European Eating Disorders Review, 11,* 210-221.

Robinson, P. & Serfaty, M. (2008). Getting better byte by byte: A pilot randomised controlled trial of email therapy for bulimia nervosa and binge eating disorder. *European Eating Disorders Review, 16,* 84-93.

Robinson, P. H. & Serfaty, M. A. (2001). The use of e-mail in the identification of bulimia nervosa and its treatment. *European Eating Disorders Review, 9,* 182-193.

Rosenvinge, J. H. & Klusmeier, A. K. (2000). Treatment for eating disorders from a patient satisfaction perspective: A Norwegian replication of a British study. *European Eating Disorders Review, 8,* 293-300.

Rosenvinge, J. H., Martinussen, M., & Ostensen, E. (2000). The comorbidity of eating disorders and personality disorders: A meta-analytic review of studies published between 1983 and 1998. *Eating and Weight Disorders, 5,* 52-61.

Rouleau, C. R. & von Ranson, K. M. (2011). Potential risks of pro-eating disorder websites. *Clinical Psychology Review, 31,* 525-531.

Rubin, D. B. (1987). *Multiple Imputation for Nonresponse in Surveys.* New York: Wiley.

Ruwaard, J., Lange, A., Broeksteeg, J., Renteria-Agirre, A., Schrieken, B., Dolan, C. V., & Emmelkamp, P. (2012). Online cognitive behavioural treatment of bulimic symptoms: A randomized controlled trial. *Clinical Psychology & Psychotherapy, 20,* 308-318.

Safer, D. L., Lively, T. J., Telch, C. F., & Agras, W. S. (2002). Predictors of relapse following successful dialectical behavior therapy for binge eating disorder. *International Journal of Eating Disorders, 32,* 155-163.

Sánchez-Ortiz, V. C., House, J., Munro, C., Treasure, J., Startup, H., Williams, C., & Schmidt, U. (2011a). "A computer isn't gonna judge you": A qualitative study of users' views of an internet-based cognitive behavioural guided self-care treatment package for bulimia nervosa and related disorders. *Eating and Weight Disorders, 16,* e93-e101.

Sánchez-Ortiz, V. C., Munro, C., Stahl, D., House, J., Startup, H., Treasure, J., Williams, C., & Schmidt, U. (2011b). A randomized controlled trial of Internet-based cognitive-behavioural therapy for bulimia nervosa or related disorders in a student population. *Psychological Medicine, 41,* 407-417.

Sánchez-Ortiz, V. C., Munro, C., Startup, H., Treasure, J., & Schmidt, U. (2011). The role of email guidance in Internet-based cognitive-behavioural self-care treatment for bulimia nervosa. *European Eating Disorders Review, 19,* 342-348.

Sareen, J., Jagdeo, A., Cox, B. J., Clara, I., ten Have, M., Belik, S. L., de Graaf, R., & Stein, M. B. (2007). Perceived barriers to mental health service utilization in the United States, Ontario, and the Netherlands. *Psychiatric Services, 58,* 357-364.

Schafer, J. L. & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147-177.

Schalken, F., Wolters, W., Tilanus, M., Gemert, M., Hoogenhuyze, C., Meijer, E., Kraefft, E., Brenninkmeijer, M., & Postel, M. (2010). *Handbook of Online Counseling [Handboek online hulpverlening].* Houten: Bohn Stafleu van Loghum.

Schlegl, S., Burger, C., Schmidt, L., Herbst, N., & Voderholzer, U. (2015). The potential of technology-based psychological interventions for anorexia and bulimia nervosa: A systematic review and recommendations for future research. *Journal of Medical Internet Research, 17,* e85.

Schmidt, U., Adan, R., Bohm, I., Campbell, I. C., Dingemans, A., Ehrlich, S., Elzakkers, I., Favaro, A., Giel, K., Harrison, A., Himmerich, H., Hoek, H. W., Herpertz-Dahlmann, B., Kas, M. J., Seitz, J., Smeets, P., Sternheim, L., Tenconi, E., van, E. A., van, F. E., & Zipfel, S. (2016). Eating disorders: The big issue. *Lancet Psychiatry, 3,* 313-315.

Schmidt, U. & Treasure, J. (2006). Anorexia nervosa: Valued and visible. A cognitive-interpersonal maintenance model and its implications for research and practice. *British Journal of Clinical Psychology, 45,* 343-366.

Schulz, K., Altman, D., & Moher, D. (2010). CONSORT 2010 Statement: Updated guidelines for reporting parallel group randomised trials. *Annals of Internal Medicine, 152,* 726-732.

Shapiro, J. R., Berkman, N. D., Brownley, K. A., Sedway, J. A., Lohr, K. N., & Bulik, C. M. (2007). Bulimia nervosa treatment: A systematic review of randomized controlled trials. *International Journal of Eating Disorders, 40,* 321-336.

Shingleton, R. M., Richards, L. K., & Thompson-Brenner, H. (2013). Using technology within the treatment of eating disorders: A clinical practice review. *Psychotherapy (Chic.), 50,* 576-582.

Simon, J., Schmidt, U., & Pilling, S. (2005). The health service use and cost of eating disorders. *Psychological Medicine, 35,* 1543-1551.

Smink, F., van Hoeken, D., Oldehinkel, A., & Hoek, H. (2014). Prevalence and severity of DSM-5 eating disorders in a community cohort of adolescents. *International Journal of Eating Disorders, 47,* 610-619.

Smink, F., van Hoeken, D., & Hoek, H. (2013). Epidemiology, course, and outcome of eating disorders. *Current Opinions in Psychiatry, 26,* 543-548.

Smit, E. S., Evers, S. M., de Vries, H., & Hoving, C. (2013). Cost-effectiveness and cost-utility of Internet-based computer tailoring for smoking cessation. *Journal of Medical Internet Research, 15,* e57.

Smyth, J. M., Wonderlich, S. A., Heron, K. E., Sliwinski, M. J., Crosby, R. D., Mitchell, J. E., & Engel, S. G. (2007). Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting and Clinical Psychology, 75,* 629-638.

Spek, V., Cuijpers, P., Nyklícek, N., Riper, H., Keyzer, J., & Pop, V. (2007). Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: A meta-analysis. *Psychological Medicine, 37,* 319-328.

Spinhoven, P., Drost, J., van, H. B., & Penninx, B. W. (2015). Common rather than unique aspects of repetitive negative thinking are related to depressive and anxiety disorders and symptoms. *Journal of Anxiety Disorders, 33,* 45-52.

Statistics Netherlands (2015). *Netherlands Consumer Price Index [Consumentenprijzen]*. Retrieved from http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=71311ned&D1=0-1,4-5&D2=0&D3=a&HD=080521-1622&HDR=G1,T&STB=G

Steinhausen, H. C. (2002). The outcome of anorexia nervosa in the 20th century. *American Journal of Psychiatry, 159,* 1284-1293.

Steinhausen, H. C. & Weber, S. (2009). The outcome of bulimia nervosa: Findings from one-quarter century of research. *American Journal of Psychiatry, 166,* 1331-1341.

Sterne, J. A., White, I. R., Carlin, J. B., Spratt, M., Royston, P., Kenward, M. G., Wood, A. M., & Carpenter, J. R. (2009). Multiple imputation for missing data in epidemiological and clinical research: Potential and pitfalls. *British Medical Journal, 338,* b2393.

Stevens, J. (2009). *Applied multivariate statistics for the social sciences.* Hillsdale, NJ: Taylor & Francis.

Stewart, W. F., Ricci, J. A., Chee, E., Hahn, S. R., & Morganstein, D. (2003). Cost of lost productive work time among US workers with depression. *Journal of the American Medical Association, 289,* 3135-3144.

Stice, E., Marti, C. N., & Rohde, P. (2013). Prevalence, incidence, impairment, and course of the proposed DSM-5 eating disorder diagnoses in an 8-year prospective community study of young women. *Journal of Abnormal Psychology, 122,* 445-457.

Stice, E., Rohde, P., Shaw, H., & Marti, C. N. (2012). Efficacy trial of a selective prevention program targeting both eating disorder symptoms and unhealthy weight gain among female college students. *Journal of Consulting and Clinical Psychology, 80,* 164-170.

Stice, E., Rohde, P., Shaw, H., & Marti, C. N. (2013). Efficacy trial of a selective prevention program targeting both eating disorders and obesity among female college students: 1- and 2-year follow-up effects. *Journal of Consulting and Clinical Psychology, 81,* 183-189.

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin, 128,* 825-848.

Stice, E., Marti, N., Shaw, H., & O'Neil, K. (2008). General and program-specific moderators of two eating disorder prevention programs. *International Journal of Eating Disorders, 41,* 611-617.

Stice, E., Rohde, P., Durant, S., & Shaw, H. (2012). A preliminary trial of a prototype Internet dissonance-based eating disorder prevention program for young women with body image concerns. *Journal of Consulting and Clinical Psychology, 80,* 907-916.

Striegel-Moore, R. H., Leslie, D., Petrill, S. A., Garvin, V., & Rosenheck, R. A. (2000). One-year use and cost of inpatient and outpatient services among female and male patients with an eating disorder: Evidence from a national database of health insurance claims. *International Journal of Eating Disorders, 27,* 381-389.

Striegel-Moore, R. H., Rosselli, F., Perrin, N., DeBar, L., Wilson, G. T., May, A., & Kraemer, H. C. (2009). Gender difference in the prevalence of eating disorder symptoms. *International Journal of Eating Disorders, 42,* 471-474.

Strober, M., Freeman, R., & Morrell, W. (1997). The long-term course of severe anorexia nervosa in adolescents: Survival analysis of recovery, relapse, and outcome predictors over 10-15 years in a prospective study. *International Journal of Eating Disorders, 22,* 339-360.

Stuhldreher, N., Wild, B., Konig, H. H., Konnopka, A., Zipfel, S., & Herzog, W. (2015). Determinants of direct and indirect costs in anorexia nervosa. *International Journal of Eating Disorders, 48,* 139-146.

Stuhldreher, N., Konnopka, A., Wild, B., Herzog, W., Zipfel, S., Löwe, B., & König, H. H. (2012). Cost-of-illness studies and cost-effectiveness analyses in eating disorders: A systematic review. *International Journal of Eating Disorders, 45,* 476-491.

Sucala, M., Schnurr, J. B., Constantino, M. J., & Miller, S. J., Brackmann, E. H., & Montgomery G. H. (2012). The therapeutic relationship in E-therapy for mental health: A systematic review. *Journal of Medical Internet Research, 14,* e110.

Svartvatten, N., Segerlund, M., Dennhag, I., Andersson, G., & Carlbring, P. (2015). A content analysis of client e-mails in guided internet-based cognitive behavior therapy for depression. *Internet Interventions, 2,* 121-127.

Swanson, S. A., Crow, S. J., Le Grange, D., Swendsen, J., & Merikangas, K. R. (2011). Prevalence and correlates of eating disorders in adolescents. Results from the national comorbidity survey replication adolescent supplement. *Archives of General Psychiatry, 68,* 714-723.

Sysko, R., Walsh, B. T., & Fairburn, C. G. (2005). Eating Disorder Examination-Questionnaire as a measure of change in patients with bulimia nervosa. *International Journal of Eating Disorders, 37,* 100-106.

Sysko, R. & Walsh, B. T. (2008). A critical evaluation of the efficacy of self-help interventions for the treatment of bulimia nervosa and binge-eating disorder. *International Journal of Eating Disorders, 41,* 97-112.

Tate, D. F., Jackvony, E. H., & Wing, R. R. (2006). A randomized trial comparing human e-mail counseling, computer-automated tailored counseling, and no counseling in an Internet weight loss program. *Archives of Internal Medicine, 166,* 1620-1625.

Taylor, C. B., Bryson, S., Luce, K. H., Cunning, D., Doyle, A. C., Abascal, L. B., Rockwell, R., Dev, P., Winzelberg, A. J., & Wilfley, D. E. (2006). Prevention of eating disorders in at-risk college-age women. *Archives of General Psychiatry, 63,* 881-888.

ter Huurne, E. D., de Haan, H. A., Postel, M. G., van der Palen, J., Van der Nagel, J. E., & de Jong, C. A. (2015a). Web-based cognitive behavioral therapy for female patients with eating disorders: Randomized controlled trial. *Journal of Medical Internet Research, 17,* e152.

ter Huurne, E. D., de Haan, H. A., ten Napel-Schutz, M. C., Postel, M. G., Menting, J., van der Palen, J., Vroling, M. S., & de Jong, C. A. (2015b). Is the Eating Disorder Questionnaire-Online (EDQ-O) a valid diagnostic instrument for the DSM-IV-TR classification of eating disorders? *Comprehensive Psychiatry, 57,* 167-176.

Thiels, C., Schmidt, U., Troop, N., Treasure, J., & Garthe, R. (2001). Compliance with a self-care manual in guided self-change for bulimia nervosa. *European Eating Disorders Review, 9,* 255-262.

Titov, N., Andrews, G., Davies, M., McIntyre, K., Robinson, E., & Soley, K. (2010). Internet treatment for depression: A randomized controlled trial comparing clinician vs. technician assistance. *PLoS one, 6,* e10939.

Tolin, D. F., Diefenbach, G. J., & Gilliam, C. M. (2011). Stepped care versus standard cognitive-behavioral therapy for obsessive-compulsive disorder: A preliminary study of efficacy and costs. *Depression and Anxiety, 28,* 314-323.

Tozzi, F., Thornton, L. M., Klump, K. L., Fichter, M. M., Halmi, K. A., Kaplan, A. S., Strober, M., Woodside, D. B., Crow, S., Mitchell, J., Rotondo, A., Mauri, M., Cassano, G., Keel, P., Plotnicov, K. H., Pollice, C., Lilenfeld, L. R., Berrettini, W. H., Bulik, C. M., & Kaye, W. H. (2005). Symptom fluctuation in eating disorders: Correlates of diagnostic crossover. *American Journal of Psychiatry, 162,* 732-740.

Trace, S. E., Thornton, L. M., Root, T. L., Mazzeo, S. E., Lichtenstein, P., Pedersen, N. L., & Bulik, C. M. (2012). Effects of reducing the frequency and duration criteria for binge eating

on lifetime prevalence of bulimia nervosa and binge eating disorder: implications for DSM-5. *International Journal of Eating Disorders, 45,* 531-536.

Traviss, G. D., Heywood-Everett, S., & Hill, A. J. (2013). Understanding the 'guide' in guided self-help for disordered eating: A qualitative process study. *Psychology and Psychotherapy, 86,* 86-104.

Treasure, J., Schmidt, U., Troop, N., Tiller, J., Todd, G., & Turnbull, S. (1996). Sequential treatment for bulimia nervosa incorporating a self-care manual. *British Journal of Psychiatry, 168,* 94-98.

Tregarthen, J., Lock, J., & Darcy, A. (2015). Development of a smartphone application for eating disorder self-monitoring. *International Journal of Eating Disorders, 48,* 972-982.

Troop, N. A., Holbrey, A., & Treasure, J. L. (1998). Stress, coping, and crisis support in eating disorders. *International Journal of Eating Disorders, 24,* 157-166.

Unikel, C., Sánchez, M., Trujillo, E., Bauer, S., & Moessner, M. (2015). Internet-based aftercare program for patients with bulimia nervosa in Mexico: A pilot study. *Revista Mexicana de Trastornos Alimentarios, 6,* 64-69.

van der Vaart, R., Witting, M., Riper, H., Kooistra, L., Bohlmeijer, E. T., & van Gemert-Pijnen, L. (2014). Blending online therapy into regular face-to-face therapy for depression: Content, ratio and preconditions according to patients and therapists using a Delphi study. *BioMed Central Psychiatry* 355.

van Roijen L., Essink-Bot, M. L., Koopmanschap, M. A., Bonsel, G., & Rutten, F. F. (1996). Labor and health status in economic evaluation of health care. The Health and Labor Questionnaire. *International Journal of Technology and Assessment in Health Care, 12,* 405-415.

van Son, G. E., van Hoeken, D., van Furth, E. F., Donker, G. A., & Hoek, H. W. (2010). Course and outcome of eating disorders in a primary care-based cohort. *International Journal of Eating Disorders, 43,* 130-138.

van Spijker, B. A., Majo, m. C., Smit, F., van, S. A., & Kerkhof, A. J. (2012). Reducing suicidal ideation: Cost-effectiveness analysis of a randomized controlled trial of unguided web-based self-help. *Journal of Medical Internet Research, 14,* e141.

van Uden-Kraan, C. F., Drossaert, C. H. C., Taal, E., Seydel, E. R., & Van de Laar, M. A. F. J. (2009). Participation in online patient support groups endorses patients' empowerment. *Patient Education and Counseling, 74,* 61-69.

van Uden-Kraan, C. F., Drosseart, C. H. C., Taal, E., Seydel, E. R., & Van de Laar, M. A. F. J. (2008). Self-reported differences in empowerment between lurkers and posters in online patient support groups. *Journal of Medical Internet Research, 10,* e18.

van Uden-Kraan, C. F., Drossaert, C. H. C., Taal, E., Shaw, B. R., Seydel, E. R., & van de Laar, M. A. F. J. (2008). Empowering processes and outcomes of participation in online support groups for patients with breast cancer, arthritis, or fibromyalgia. *Qualitative Health Research, 18,* 405-417.

Veer-Tazelaar, P., Smit, F., van, H. H., van, O. P., van der Horst, H., Beekman, A., & van, M. H. (2010). Cost-effectiveness of a stepped care intervention to prevent depression and anxiety in late life: Randomised trial. *British Journal of Psychiatry, 196,* 319-325.

Ventola, C. L. (2014). Mobile devices and apps for health care professionals: Uses and benefits. *Pharmacy & Therapeutics, 39,* 356-364.

Vogel, D. L., Wade, N. G., & Haake, S. (2006). Measuring the self-stigma associated with seeking psychological help. *Journal of Counseling Psychology, 53,* 325-337.

Völker, U., Jacobi, C., Trockel, M. T., & Taylor, C. B. (2014). Moderators and mediators of outcome in Internet-based indicated prevention for eating disorders. *Behaviour Research And Therapy, 63C,* 114-121.

von Brachel, R., Hötzel, K., Hirschfeld, G., Rieger, E., Schmidt, U., Kosfelder, J., Hechler, T., Schulte, D., & Vocks, S. (2014). Internet-based motivation program for women with eating disorders: Eating disorder pathology and depressive mood predict dropout. *Journal of Medical Internet Research, 16,* e92.

Wagner, G., Penelo, E., Nobis, G., Mayrhofer, A., Wanner, C., Schau, J., Spitzer, M., Gwinner, P., Trofaier, M. L., Imgart, H., Fernandez-Aranda, F., & Karwautz, A. (2015). Predictors for good therapeutic outcome and drop-out in technology assisted guided self-help in the treatment of bulimia nervosa and bulimia like phenotype. *European Eating Disorders Review, 23,* 163-169.

Wagner, G., Penelo, E., Wanner, C., Gwinner, P., Trofaier, M. L., Imgart, H., Waldherr, K., Wober-Bingol, C., & Karwautz, A. F. (2012). Internet-delivered cognitive-behavioural therapy v. conventional guided self-help for bulimia nervosa: Long-term evaluation of a randomised controlled trial. *British Journal of Psychiatry*, *202,* 135-141.

Wallerstein, N. (2006). *What is the evidence on effectiveness of empowerment to improve health?* Copenhagen. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0010/74656/E88086.pdf.

Warmerdam, L., Smit, F., van Straten, A., Riper, H., & Cuijpers, P. (2010). Cost-utility and cost-effectiveness of Internet-based treatment for adults with depressive symptoms: Randomized trial. *Journal of Medical Internet Research, 12,* e35.

Watson, H. J. & Bulik, C. M. (2013). Update on the treatment of anorexia nervosa: review of clinical trials, practice guidelines and emerging interventions. *Psychological Medicine, 43,* 2477-2500.

Weiss, C. V., Mills, J. S., Westra, H. A., & Carter, J. C. (2013). A preliminary study of motivational interviewing as a prelude to intensive treatment for an eating disorder. *Journal of Eating Disorders, 1,* 34.

Wilson, G. T. (2005). Psychological treatment of eating disorders. *Annual Review of Clinical Psychology, 1,* 439-465.

Wilson, G. T., Grilo, C. M., & Vitousek, K. M. (2007). Psychological treatment of eating disorders. *American Psychologist, 62,* 199-216.

Wilson, G. T., Walsh, B. T., Kraemer, H., Fairburn, C. C., & Agras, W. S. (2002). Cognitive-behavioral therapy for bulimia nervosa: Time course and mechanisms of change. *Journal of Consulting and Clinical Psychology, 70,* 267-274.

Wilson, J. L., Peebles, R., Hardy, K. K., & Litt, I. F. (2006). Surfing for thinness: A pilot study of pro-eating disorder website usage in adolescents with eating disorders. *Pediatrics, 118,* e1635-e1643.

Winzelberg, A. J., Eppstein, D., Eldredge, K. L., Wilfley, D., Dasmahapatra, R., Dev, P., & Taylor, C. B. (2000). Effectiveness of an Internet-based program for reducing risk factors for eating disorders. *Journal of Consulting and Clinical Psychology, 68,* 346-350.

Winzelberg, A. J. & Taylor, C. B. (1998). Evaluation of a computer-mediated eating disorder intervention program. *International Journal of Eating Disorders, 24,* 339-349.

Wonderlich, S. A., Peterson, C. B., Crosby, R. D., Smith, T. L., Klein, M. H., Mitchell, J. E., & Crow, S. J. (2014). A randomized controlled comparison of integrative cognitive-affective therapy (ICAT) and enhanced cognitive-behavioral therapy (CBT-E) for bulimia nervosa. *Psychological Medicine, 44,* 543-553.

Yager, J. (2003). E-mail therapy for anorexia nervosa: Prospects and limitations. *European Eating Disorders Review, 11,* 198-209.

Yager, J. (2001). E-mail as a therapeutic adjunct in the outpatient treatment of anorexia nervosa: Illustrative case material and discussion of the issues. *International Journal of Eating Disorders, 29,* 125-138.

Zabala, M. J., Macdonald, P., & Treasure, J. (2009). Appraisal of caregiving burden, expressed emotion and psychological distress in families of people with eating disorders: A systematic review. *European Eating Disorders Review, 17,* 338-349.

Zabinski, M. F., Pung, M. A., Wilfley, D. E., Eppstein, D. L., Winzelberg, A. J., Celio, A., & Taylor, C. B. (2001). Reducing risk factors for eating disorders: Targeting at-risk women with a computerized psychoeducational program. *International Journal of Eating Disorders, 29,* 401-408.

Zeileis, A., Hothorn, T., & Hornik, K. (2008). Model-based recursive partitioning. *Journal of Computational and GraphicalStatistics, 17,* 492-514.

Zipfel, S., Giel, K. E., Bulik, C. M., Hay, P., & Schmidt, U. (2015). Anorexia nervosa: Aetiology, assessment, and treatment. *Lancet Psychiatry, 2,* 1099-1111.

Zipfel, S., Lowe, B., Reas, D. L., Deter, H. C., & Herzog, W. (2000). Long-term prognosis in anorexia nervosa: Lessons from a 21-year follow-up study. *Lancet, 355,* 721-722.

Zipfel, S., Wild, B., Gross, G., Friederich, H. C., Teufel, M., Schellberg, D., Giel, K. E., de, Z. M., Dinkel, A., Herpertz, S., Burgmer, M., Lowe, B., Tagay, S., von, W. J., Zeeck, A., Schade-Brittinger, C., Schauenburg, H., & Herzog, W. (2014). Focal psychodynamic therapy, cognitive behaviour therapy, and optimised treatment as usual in outpatients with anorexia nervosa (ANTOP study): Randomised controlled trial. *Lancet, 383,* 127-137.

Publications

Aardoom J.J., Dingemans A.E., Slof-Op 't Landt M.C.T., & van Furth E.F. (2012). Norms and discriminative validity of the Eating Disorder Examination Questionnaire (EDE-Q). *Eating Behaviors, 13,* 305-309.

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.

Aardoom J.J., Dingemans A.E., Spinhoven P., Hakkaart-van Roijen, L., & van Furth E.F. (2013). An Internet-based intervention for eating disorders consisting of automated computer-tailored feedback with or without supplemented frequent or infrequent support from a coach: study protocol for a randomized controlled trial. *Trials, 14*, 340.

Dingemans A.E., Danner U.N., Donker J.M., Aardoom J.J., van Meer F., Tobias K., van Elburg A.A., & van Furth E.F. (2014). The effectiveness of cognitive remediation therapy in patients with a severe or enduring eating disorder: A randomized controlled trial. *Psychotherapy and Psychosomatics, 83,* 29-36.

Aardoom J.J., Dingemans A.E., Boogaard L., & van Furth E.F. (2014). Internet and patient empowerment in individuals with symptoms of an eating disorder: A cross-sectional investigation of a pro-recovery focused e-community. *Eating Behaviors, 15,* 350-356.

Aardoom J.J., Dingemans A.E., & van Furth E.F. (2016). E-Health interventions for eating disorders: Emerging findings, issues, and opportunities. *Current Psychiatry Reports, 18,* 42.

Aardoom, J.J., Dingemans, A.E., Spinhoven, P., van Ginkel, J.R., de Rooij, M., & van Furth, E.F. (2016). Web-based fully automated self-help with different levels of therapist support for individuals with eating disorder symptoms: A randomized controlled trial. *Journal of Medical Internet Research, 18,* e159.

Dingemans, A.E., van Son, G.E., Aardoom, J.J., Bruidegom, K., Slof-Op't Landt, M.C.T., & van Furth, E.F. (2016). Predictors of psychological outcome in patients with eating disorders: A routine outcome monitoring study. *International Journal of Eating Disorders, 49,* 863-873.

Aardoom, J.J., Dingemans, A.E., van Ginkel, J.R., Spinhoven, P., van Furth, E.F., & van den Akker-van Marle, M.E. (in press). Cost-utility of an Internet-based intervention with or

without therapist support in comparison with a waiting list for individuals with eating disorder symptoms: A randomized controlled trial. *International Journal of Eating Disorders.*

Curriculum Vitae

Jiska Joëlle Aardoom was born in ’s-Gravendeel in the Netherlands on January 15, 1987. She attended secondary education (atheneum) at Rijnlands Lyceum, Sassenheim (1991-2002), and later at Melanchton College, Rotterdam (2001-2005). After graduation Jiska started studying Psychology at the University of Leiden. After finishing her bachelor thesis in Psychology (2008) and taking a sabbatical year to travel, she started a 2-years Research Master program in Psychology at the University of Amsterdam in 2009. In 2011, Jiska received her MSc degree cum laude, after writing her thesis on a study investigating predictors of response in cognitive remediation therapy for patients with an eating disorder at GGZ Rivierduinen eating disorders Ursula. At this clinical center, Jiska started her PhD project on ‘E-mental health for eating disorders’ in collaboration with the University of Leiden. The research studies that were performed during Jiska’s PhD project are described and discussed in this doctoral dissertation.