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## Internet-based treatment for eating disorders: bridging the treatment gap

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## Chapter 8

### Discussion



## Discussion

The previous chapters can be read separately but are part of an overarching theme: bridging the large treatment gap that currently exists for individuals with eating disorders with eHealth technology. The research regarding effectiveness and cost-effectiveness in the current dissertation aims to inform on whether, why and how to implement internet-based interventions for eating disorders. In order to reach this goal, research regarding the effectiveness of such interventions is important to determine whether individuals benefit from them and experience improvement in eating disorders symptoms or other outcomes. Additionally, cost-effectiveness research builds towards the main aim by looking at the benefits of internet-based interventions on a societal level: do such interventions reduce costs compared to alternative courses of action and are they good value for money? The current chapter summarizes the main findings of the separate chapters, after which implications, limitations and future directions are discussed.

## Summary of main findings

In **chapter 2**, the design of a randomized controlled trial investigating Featback and online expert-patient support for eating disorders was presented. The research aimed at replicating and extending previous findings on Featback (Aardoom, Dingemans, Spinhoven, et al., 2016). Featback is a fully automated internet-based self-help program. After registering, for which only a working email address is necessary, users receive a weekly email over a period of 8 weeks. The email includes a link to a questionnaire with four 4-point questions on eating disorder related symptoms (i.e., weight and shape concern, restrictive food intake, binge eating and compensatory behaviors). After completing the monitoring questionnaire, users receive a supportive feedback message (on average 384 words) that matches the answers, which an algorithm picks from a database with over 1250 handwritten messages. The algorithm also takes the answers of the previous monitoring questionnaire into account, so the feedback messages can contain information on improvement or deterioration. Feedback messages include a summary of self-reported eating problems and changes compared to the previous week, psychoeducation, and guidance on how to counter eating disorder related symptoms. Apart from Featback, expert-patient support was incorporated in the randomized controlled trial design. Expert patients are recovered individuals that have had a lived experience of an eating disorder and may be more approachable by individuals currently suffering from an eating disorder, because of a shared background (Rohrbach et al., 2019). This might make them especially suitable in low-threshold contexts, such as anonymous internet-based interventions. Expert-patient support was offered online in the form of weekly email or chat sessions. Expert patients received training on providing online support and how to use their experiences to help others. The two internet-based interventions, Featback and expert-patient support, and their combination, were hypothesized to have the potential to reduce eating disorder symptoms, but also to reach individuals with eating disorder related problems who currently do not receive appropriate care. To investigate the effectiveness and cost-effectiveness of Featback and expert-patient support, participants aged 16 years or older with at least mild eating disorder symptoms were included. Mild eating disorder symptoms

were defined as a score of 52 or higher on the Weight Concerns Scale (Killen et al., 1993) or, as reported on the Short Evaluation of Eating Disorders (Bauer et al., 2005), a body mass index of 18.5 or lower or at least weekly binge eating episodes or compensatory behaviors in the past four weeks. Participants were randomly assigned to four conditions, being (1) Featback, (2) the combination of Featback and chat or email support from an expert patient, (3) chat or email support from an expert patient, and (4) a waiting list control condition. Participants in all conditions were allowed to make use of other interventions and medication, so the waiting list control condition can be regarded as care as usual for eating disorders. The intervention period was 8 weeks, after which participants were followed for a period of one year. Primarily, the three active interventions were compared to a waiting list in the extent to which they could reduce eating disorder symptoms, as measured by the Eating Disorder Examination Questionnaire (Fairburn & Beglin, 2008). It was also investigated whether the combination condition was superior to Featback and expert-patient support separately, and how Featback and expert-patient support compared to each other. The cost-effectiveness of the three active interventions against the waiting list control condition was also investigated.

The results on the effectiveness of the investigated internet-based interventions in this randomized controlled trial were presented in **chapter 3**. In total, 355 participants enrolled in the study, 43% of which indicated never to have received treatment for their eating disorder, while the average duration of the eating disorder across the sample was more than 10 years. Study dropout rates were acceptable, with the respective number of participants completing assessments at baseline, post intervention, and 3, 6, 9 and 12 month follow up being 355 (100%; T0), 280 (79%; T1), 252 (71%; T2), 244 (69%; T3), 233 (66%; T4) en 242 (68%; T5). Featback only, Featback plus online expert-patient support and online expert-patient support only were effective in reducing eating disorder symptoms after eight weeks compared to a waiting list control condition. On the long term, the difference between the participants allocated to the waiting list control condition and the other conditions disappeared, indicating no long-term differences between the conditions regarding eating disorder symptoms. Surprisingly, the three active interventions were all found to be equally effective. Email and chat sessions of expert patients were compared with psychologist sessions from the previous trial (Aardoom, Dingemans, Spinhoven, et al., 2016). The sessions could reliably be distinguished by blinded master level psychology students, indicating that expert-patient and psychologist support are distinct interventions. Differences concerned expert patients sharing personal experiences, which psychologists never did, and psychologists using a broader pallet of interventions (e.g., stimulating reflection, confrontation, challenging cognitions, etc.) compared to expert patients. In the current study, participants who had the option to receive weekly expert-patient support were more satisfied with the intervention, compared to participants who only had access to the automated Featback intervention. Specifically, participants graded (on a scale from 1 'not at all satisfied' to 10 'extremely satisfied') Featback, expert-patient support and their combination with a 5.8, 7.4 and 7.1 respectively. This indicates that receiving guidance is rated as more satisfying by users, but this does not necessarily lead to increases in effectiveness. Interestingly, despite lower satisfaction ratings, participants tended to complete more Featback monitoring sessions compared to expert-patient support sessions. Participants used an average of 6.5 ( $SD = 2.1$ ) monitoring sessions in the Featback only condition and 5.6 ( $SD = 2.7$ ) monitoring sessions in the com-

bination condition, whereas on average 4.4 ( $SD = 3.1$ ) and 3.6 ( $SD = 2.9$ ) support sessions were used in the expert-patient support only and combination condition. The amount of completed sessions was not associated with the effectiveness of the intervention. Secondary outcome measures that were investigated, including symptoms of anxiety and depression, self-efficacy and experienced social support, yielded no differences between the four conditions. Regarding help-seeking behaviors, 33 participants indicated that the intervention they received stimulated them to get professional help. However, no statistically significant differences between conditions were found in the number of participants that initiated professional help (i.e., had never received eating disorder treatment before the study and did receive such treatment at some point during the study). Taking all the results together, it seems that a low-threshold internet-based intervention like Featback and expert-patient support can help to reduce eating disorder symptoms, at least on the short term. Since 43% of the sample had never received eating disorder related treatment, it appears that this intervention can reach individuals who are not reached by other forms of treatment and foresees in a currently unmet need.

**Chapter 4** described a systematic review and meta-analysis of studies investigating the cost-effectiveness of internet-based interventions for mental disorders compared to usual care in society. It provided an overview on cost-effectiveness research in the area of internet interventions for mental disorders and informed on whether such innovative interventions might help to treat individuals with a mental disorder in an efficient way. Specifically, scientific literature databases were searched to find studies describing (1) randomized controlled trials that (2) included participants with symptoms of mental disorders, (3) investigated a telephone or internet-based intervention, (4) included a control condition in the form of treatment as usual, psychological placebo, waiting list control or bibliotherapy, (5) reported outcomes on both quality of life and costs and (6) were published in English. The search also covered unpublished data by including trial registries and contacting authors of published study protocols. Data on risk of bias, quality of the economic evaluation, quality-of-life adjusted life years (QALYs) and costs were extracted from included studies and the incremental net benefit (INB) was calculated and pooled. The INB combines the differences between an internet intervention and a control condition in terms of both the effectiveness (i.e., improvements in quality of life) and their costs into one single monetary value. A positive INB, then, indicates a balance between effects and costs in favor of the internet intervention rather than the control condition and vice versa. The search led to the inclusion of 37 studies with a total of 14,946 participants. The studies investigated depression ( $N = 16$ ), anxiety ( $N = 7$ ), alcohol or substance abuse ( $N = 5$ ), depression and anxiety simultaneously ( $N = 5$ ), obsessive compulsive disorder ( $N = 2$ ), post-traumatic stress disorder ( $N = 1$ ), and eating disorders ( $N = 1$ ). The evaluated internet interventions mostly consisted of online modules based on principles of cognitive-behavioral therapy, but could also be text messaging, web-based games or telephone support. Some form of human support, such as written feedback on exercises or telephone calls, was available for most interventions ( $N = 27$ ), but a minority was fully automated ( $N = 10$ ). A very small, but statistically significant difference, was found between internet-based interventions and control conditions regarding the extent to which they improved quality of life, in favor of the internet-based interventions. Internet interventions and control conditions were found to be equally costly.

This was true for studies that included only costs directly related to the intervention plus costs related to health care service use (i.e., health care perspective), as well as for studies that included these costs plus non-health care costs, such as absence from work and reduced productivity at work because of complaints related to the mental disorder being studied (i.e., societal perspective). Nevertheless, the pooled INB indicating the cost-effectiveness of internet-based interventions compared to control conditions was positive (\$255, 95% CI \$91; \$419). This suggests that internet interventions for mental disorders are likely to be cost-effective compared to a waiting-list or care-as-usual approach. Several explorative moderator analyses were conducted to better understand the results. They indicated that interventions aimed at depression and anxiety, and interventions that incorporate some form of guidance, might have higher probabilities of being efficient compared to ones aimed at other mental disorders or unguided ones. Additionally, the perspective of the economic evaluation (health care or societal) influenced whether internet interventions for mental disorders were found to be cost-effective compared to control conditions. Unlike studies with a health care perspective, pooling studies with a societal perspective resulted in a non-significant difference between the comparators. When interpreting the results, it is important to note that the large heterogeneity between studies regarding type of internet intervention, included costs and targeted mental disorder impede definitive conclusions. Nevertheless, the findings highlight the potential economic benefits of internet-based interventions for mental disorders. The used method of pooling cost-effectiveness data in an aggregate-data meta-analysis is new in the area of psychiatry and might help other researchers in pursuing related research questions.

Surprisingly, in the meta-analysis, internet interventions were found to be significantly more effective than control conditions in terms of quality of life improvements, but the difference was very small. It may be that quality-of-life questionnaires that are often used in economic evaluations (e.g., EQ-5D) are not suitable in contexts outside of (somatic) health, such as psychiatry (Mitchell et al., 2017). The ICECAP-A instrument is increasingly proposed as an alternative, because it might be more sensitive to changes in well-being in such contexts (Keeley et al., 2016; National Institute for Health and Care Excellence, 2016). The ICECAP-A measures five capabilities important to one's quality of life: (1) stability - the extent to which someone can feel settled and secure; (2) attachment - the extent to which someone can feel love, friendship, and support; (3) autonomy - the extent to which someone can feel independent; (4) achievement - the extent to which someone can experience achievement and success; (5) enjoyment - the extent to which someone can experience enjoyment and pleasure. Four levels are available for each of the five capabilities, ranging from 1 (not being able to experience a capability at all) to 4 (fully being able to experience a capability). The ICECAP-A attempts to capture the extent to which someone experiences the ability to do what one wishes. In **chapter 5**, psychometric properties of the Dutch version of the ICECAP-A were investigated to clarify its added value in economic evaluations. Specifically, the test-retest reliability of the ICECAP-A was examined to evaluate the extent to which the instrument is prone to measurement errors. Furthermore, the instrument was related to the EQ-5D-5L and a measure of self-efficacy to better understand the concept the ICECAP-A measures. Lastly, the ability of the ICECAP-A to distinguish groups that were hypothesized to differ in terms of quality of life was studied. Results on test-retest reliability were based

on 252 participants and indicated acceptable measurement error. Other results were based on the answers of 1002 participants. The ICECAP-A correlated moderately to strongly with the EQ-5D-5L, indicating that there is overlap between the two instruments, but they do not seem to measure the same concept. The concept captured by the ICECAP-A correlated strongly with self-efficacy, which encompasses the extent to which individuals believe in their own capability and mastery over life. Additionally, the ICECAP-A was able to differentiate groups based on, among others, happiness ratings, the presence of a chronic illness, self-efficacy ratings and employment status. Being able to distinguish groups with varying levels of quality-of-life status is, arguably, an important feature when measuring changes in people over time or after having received a certain treatment. In summary, the ICECAP-A appears to capture a concept that correlates with health status (as measured by the EQ-5D-5L), but more closely relates to self-efficacy and well-being. Therefore, it can complement other generic health questionnaires in economic evaluations, especially when attempting to capture the benefits of interventions outside hospital contexts, such as elderly care, social care, psychiatry, chronic illness and general living conditions.

In **chapter 6**, a tariff was developed to be able to reliably use the ICECAP-A in economic evaluations in the Netherlands. Specifically, a best-worst scaling task was constructed to be able to compare individual ICECAP-A domains (i.e., stability, attachment, autonomy, achievement and enjoyment) and levels (ranging from 1 to 4) with each other. A sample of 1002 participants representative of the Dutch general population was recruited by a market research agency. Based on the participants' answers on the best-worst scaling task, the relative importance of each of the ICECAP-A items to one's quality of life could be distilled. Results indicated that all five domains are valuable contributors to one's quality of life for the general Dutch population, but that stability, attachment and enjoyment are especially important. Moreover, improving low levels of a domain (e.g., going from level 1 to level 2) is considered more valuable than improving already moderate levels of a domain (e.g., going from level 3 to level 4). This suggests that helping people with low capabilities, rather than those with high capabilities, would result in larger gains in well-being for society. Interestingly, when comparing the ICECAP-A tariff for the Dutch and UK general population, it seems the Dutch population values enjoyment somewhat more and achievement less than their UK counterparts. Consequently, interventions that increase the ability to enjoy life may have a slightly greater impact on well-being in the Netherlands than in the United Kingdom. Now that a tariff for the ICECAP-A for the Dutch general population has been developed, the instrument can be used in economic evaluations in the Netherlands and might complement other instruments such as the EQ-5D.

After looking more broadly at cost-effectiveness research on e-mental health interventions and possible improvements in measuring benefits of interventions by incorporating the ICECAP-A, **chapter 7** returns to internet-based interventions for eating disorders. This chapter extends the findings on Featback, expert-patient support and their combination for eating disorders by looking at their cost-effectiveness compared to usual care (waitlist). Participants in the four conditions were inquired after their quality of life, measured both by the EQ-5D-5L and ICECAP-A. Dutch tariffs for the two instruments were used to calculate quality-of-life adjusted life years (QALYs) and capability values over the 14-month study period. Fur-



thermore, costs related to the intervention (e.g., personnel), health care service use related costs and non-health care costs (e.g., absence from work or reduced efficiency at work) were estimated over the study duration. Finally, to compare the cost-effectiveness of the different conditions, cost-utility acceptability curves were constructed. These curves show the probability of one condition to be cost-effective (i.e., efficient) compared to another, across a range of willingness to pay (WTP) values. WTP values indicate society's willingness to pay for one extra year lived in perfect health (i.e., 1 QALY). The higher the WTP value the more important differences in QALYs between the four conditions become when evaluating cost-effectiveness. To accommodate all relevant WTP values, the study explored values ranging from €0 to €100,000 per QALY. Results on QALYs and capability values showed improvements over time, with only minor and non-significant differences between the four conditions (i.e., Featback, combination of Featback and expert-patient support, expert-patient support and waiting list control). Similarly, no significant, but still noteworthy, differences between the four investigated groups regarding health care expenses and societal costs over a period of 14 months were found. When looking at used health care services during the study duration, almost all participants saw their general practitioner (92%), a majority visited a psychologist, psychotherapist or psychiatrist (85%) and hospitalization in the hospital or a mental health institution was common (31%). Costs related to health care service use were lowest in the Featback only condition, mainly because hospitalization rates tended to be lower in this condition, but differences were not statistically significant. Societal costs, including intervention costs, health care costs and non-health care costs, in the Featback, combination, support and waiting list condition were €16,741, €23,980, €23,620 and €28,479 respectively. Looking at the cost-utility acceptability curves, providing Featback without expert-patient support had the highest chance to be efficient among the alternatives, regardless of how much society was willing to pay per QALY. Comparable results were found when ICECAP-A deduced capability scores were used, suggesting that in the current sample there was no clear preference for using the EQ-5D-5L or the ICECAP-A. Overall, the findings propose that, between the four investigated conditions, Featback is the intervention of choice from a (societal) economic perspective.

## Implications

### Bridging the treatment gap

The findings from this dissertation provide important implications and recommendations for policy, service delivery, and clinical practice. Most importantly, results from the conducted studies confirm the potential of internet-based interventions for eating disorders to reach the large of group individuals in society who suffer from eating disorder related problems but who do not get appropriate care. Even people with long standing and severe eating disorder symptoms can benefit from easy-access brief online interventions and experience a degree of symptom reduction. Reaching individuals who have never received (appropriate) care and guiding them to treatment for their eating disorder will go a long way in improving effectiveness of eating disorder treatment overall (Moessner & Bauer, 2017). Low-threshold and highly scalable internet-based interventions such as Featback and expert-patient support



can be an important tool to bridge the large treatment gap that exists for eating disorders.

From a (societal) economic perspective it would also make sense to implement internet-based interventions. Indeed, both the economic analysis of Featback and expert-patient support and the conducted meta-analysis suggest such interventions to be an efficient use of resources when compared to care as usual. In other words, they provide quality-of-life improvements at a relatively cheap rate. Consequently, widely disseminating internet-interventions for eating disorders will likely be beneficial for individuals with eating disorder symptoms and for society. Policy makers, clinicians and researchers should consider strategies for achieving a more widespread adoption of interventions such as Featback. Furthermore, subsidy providers, policy makers, municipalities, and health insurance companies are encouraged to provide an adequate financial framework, to stimulate implementation of evidence-based internet interventions for eating disorders, as they appear to be worth the investment or even save costs.

## Guidance

There does not appear to be a clear answer on whether and how to include guidance to internet-based interventions. Across mental disorders, adding guidance to eHealth interventions seems to yield an increase in effectiveness (Baumeister et al., 2014). In the meta-analysis by Baumeister et al. (2014), guidance was applied differently in various studies and was mostly provided by psychologists. The evidence for the effectiveness of guidance in internet-based interventions for eating disorders is mixed (Barakat et al., 2019; Yim & Schmidt, 2019b). Accordingly, the trial described in this dissertation (chapter 3) did not find an added effect of guidance to Featback when provided by expert patients. The finding that Featback only, expert-patient support only and their combination were equally effective in reducing eating disorder symptoms might be because they offer a similar intervention. That is, all three interventions help to make users aware of and engage their eating disorder, while the way in which such an intervention is conveyed appears to be of lesser importance. Nevertheless, it is surprising that expert-patient support did not add to the effectiveness of Featback alone. An explanation might be that expert patients are less effective than other health professionals in providing online support. However, this is unlikely given that a previous large trial on Featback also found no added effect of guidance when provided by a psychologist (Aardoom, Dingemans, Spinhoven, et al., 2016). Still, email and chat sessions of expert patients from the current trial (chapter 3) and psychologist support from the previous trial could reliably be distinguished, suggesting that they are distinctly different interventions. The most apparent differences were that expert patients shared their own experiences during the sessions and psychologists used a broader pallet of interventions. It was thought that the shared background of participants and expert patients would result in a greater perceived similarity (i.e., the extent to which participants felt similar to their supporter), stimulating bonding and improving self-efficacy. No proof for this was found. In fact, perceived similarity ratings were surprisingly low. The questionnaire to assess perceived similarity was sent out in week three of the intervention. Perhaps three weeks is too short to establish rapport. Another explanation is that participants might focus on differences between themselves and their assigned expert patient to reduce feelings of failure and a negative self-image. For example, acknowledging similarities to recovered individuals while not

being recovered oneself might lead to cognitive dissonance. Such upward comparison has been found to decrease self-evaluation (Collins, 1996; Wayment et al., 2020). Perceiving to be different, then, might make it easier to accept not being recovered. Furthermore, findings indicated lower intervention completion rates for expert-patient support compared to the automated monitoring intervention, suggesting that participants experienced barriers to make appointments with their expert patient. Contrary to the findings in our randomized controlled trial (chapter 3), across mental disorders, intervention adherence seems to be higher when guidance is added (Musiat et al., 2022). The discrepancy may be explained by the operationalization of guidance. Indeed, in many trials guidance comprises providing some form of feedback on an otherwise automated intervention, like completing online modules. In the trial described in this dissertation, expert-patient support involved email or chat sessions as separate intervention. These two conceptualizations of guidance, as part of an automated intervention or as a separate intervention, make it difficult to compare the existing literature and the conducted trial regarding the influence of guidance on adherence. Regardless, the relatively low number of completed expert-patient support sessions is surprising given that participants were more satisfied with the intervention when they had the option to receive expert-patient support compared to when they could only access the automated monitoring system. Previous research has also indicated that guidance accompanying eHealth interventions is highly valued (Linardon et al., 2021; Yim & Schmidt, 2019a), though it does not necessarily result in other benefits (Berger et al., 2011; Ciuca et al., 2018).

Taken together, it would make sense to offer Featback without any guidance, as it is highly scalable, requires low maintenance and was found to have the highest probabilities to be cost-effective while being equally effective compared to Featback with expert-patient support and expert-patient support alone for eating disorders. However, determining user preferences and users' ideas about intervention fidelity even before commencement of the interventions and examining how they influence uptake is needed to further substantiate implementation decisions.

## **Dissemination strategies**

Apart from deliberating whether adding guidance helps with the dissemination of internet-based interventions such as Featback, other dissemination strategies should be considered. Indeed, the sample in our randomized controlled trial had a long average duration of illness and high levels of eating disorder symptomatology. Attempts were made to recruit a younger sample with beginning eating disorder problems, for instance by advertising at a health and lifestyle website mostly targeting adolescent girls. Reaching individuals with an eating disorder at an early stage is important, as the chance of recovery appears to be higher for those with a shorter illness duration (Vall & Wade, 2015). However, those expressing interest in participating in the study tended to find the study via the Proud2Bme community and had been struggling with a serious eating disorder for quite some time. Varying dissemination strategies (e.g., via high schools, websites, social media and flyers) might help to reach a large and diverse population (Bauer et al., 2019), increasing the overall impact.

## Cost-effectiveness

Finally, researchers and clinicians working in the field of internet-based interventions for mental disorders are encouraged not to shy away from cost-effectiveness research. Economic evaluation is a useful tool to complement effectiveness research, as it adds to the understanding of potential benefits of an intervention compared to other relevant courses of action. Consequently, more information is available to choose between different treatment strategies, which will ultimately result in effective care at a fair price. Cost-effectiveness research might be especially important in the area of eHealth, because automating certain aspects of an intervention could lead to high scalability and low intervention costs, making it an efficient alternative compared to other courses of action. However, a good understanding of what cost-effectiveness research entails is necessary to critically evaluate its added value and limitations. For example, the often used QALYs might be limited in their extent to capture benefits of an intervention, especially when evaluating an intervention aimed at improving quality of life beyond (physical) health (Pietersma et al., 2013). In such cases, it might be beneficial to complement established health questionnaires that capture QALYs with other instruments, such as the ICECAP. The ICECAP seems to capture a concept that is related to health as captured by the EQ-5D-5L, but approaches well-being more broadly (Afentou & Kinghorn, 2020; Al-Janabi et al., 2013; Rohrbach, Dingemans, Essers, et al., 2022). Interestingly, no noteworthy differences emerged when using the EQ-5D-5L or the ICECAP-A in the economic evaluation concerning Feedback and expert-patient support, suggesting the ICECAP-A was not as sensitive as expected in the recruited sample. This is not in line with previous research suggesting that the ICECAP-A might be more sensitive in capturing quality-of-life changes of individuals with a psychiatric disorder like depression (Mitchell et al., 2017). Results indicated that individuals in the conducted trial described in this dissertation (chapter 7), on average, experienced a reduction in eating disorder symptoms, but no major changes in quality of life as assessed by the EQ-5D-5L, its visual analogue scale and the ICECAP-A. Since three separate measures indicated only minor group differences, perhaps the findings are not attributable to a lack in instrument sensitivity, but rather to the interventions having no substantial effect on quality of life. A second explanation of why the ICECAP-A and the EQ-5D-5L showed similar results might be that eating disorders, in comparison to depression for example, involve a considerable somatic component. For eating disorders specifically, then, the EQ-5D-5L might be a sensitive tool for measuring quality of life, even if this is not the case for other mental disorders. All in all, more investigation is needed to determine which generic preference-based measures are sensitive in eating disorder populations. Nevertheless, using the ICECAP instead of other quality-of-life measures has in some cases been found to lead to different recommendations concerning resource allocation (Kiadaliri et al., 2015). Therefore, it is recommended in the Netherlands to add the instrument when conducting cost-effectiveness research of interventions in the area outside (somatic) health, such as elderly care, chronic illness, general livability and psychiatry (Zorginstituut Nederland, 2015). A Dutch general population tariff is now available, so that the ICECAP-A can be used reliably in Dutch samples. Apart from the ICECAP-A and quality-of-life measures like the EQ-5D, other instruments might be appropriate to use in economic evaluations, depending on the context. For example, Van Krugten et al. (2022) have recently developed the Mental Health Quality of Life questionnaire (MHQoL), a

quality-of-life questionnaire for economic evaluations in the area of mental health specifically. The MHQoL contains seven questions on self-image, independence, mood, relations, daily activities, physical health and optimism about the future. A first study indicated promising psychometric properties (Van Krugten et al., 2022). While additional corroboration is needed to determine its added value, such a measure might further enhance the precision of evaluating intervention benefits in the area of mental health, including internet-based interventions. In summary, the field of cost-effectiveness research for eHealth interventions for mental health is progressing and helps to inform clinicians, subsidy providers and policy makers on the value of such interventions.

## Strengths and limitations

The conclusions from the randomized controlled trial on Featback and expert-patient support were based on a large sample size of 355 participants. The participants were recruited via online platforms in such a way that the final sample was representative of the intended users of the online interventions. Therefore, the results can reliably be generalized to real-world settings. It must be noted, however, that generalization to younger individuals with a shorter illness duration is limited (addressed later in this section). Missing data were multiply imputed, which is preferred over other methods of dealing with missing data (Van Ginkel et al., 2020). This reduced the influence of missing data on the final results, and can be considered a strength. Another major strength of the current dissertation was that results were not limited to effectiveness research, but also included a thorough investigation of the cost-effectiveness of internet-based interventions. This improved the understanding of the value of such interventions from an economic perspective, which is important when making decisions on financing and implementing them.

Several limitations can also be noted. First, intervention and study dropout occurred in the randomized controlled trial. Intervention completers were defined as participants who used at least five out of eight monitoring sessions, five out of eight expert-patient support sessions or both, depending on whether they were allocated to the Featback, expert-patient support or combination condition. Across the three active conditions there were 156 (59%) completers: 74 (84%) in the Featback, 48 (55%) in the expert-patient support and 34 (38%) in the combination condition. Consequently, participants likely experienced barriers to make full use of the interventions, especially with regard to the expert-patient support. Perhaps pro-actively scheduling appointments with a supporter through an online system was too much work or easily forgotten. In comparison, the automated self-help program required less time and effort, as participants only had to click a link in an email that was received every week. In general, intervention dropout appears to be common in internet-based interventions, ranging between 9% and 47% (Dölemeyer et al., 2013). Apart from intervention dropout, study dropout was also a concern. About one-third of the participants dropped out of the study over the course of 14 months. Such study dropout can affect results. Nevertheless, the dropout was similar to the 21% dropout at post intervention found in a recent meta-analysis (Linardon et al., 2020) and substantially lower than in the previous trial (Aardoom, Dingemans, Spinhoven, et al., 2016). This might partly be ascribed to improvements in the software (resulting in less technological issues with Featback), scheduling sessions

and the online questionnaires. Additionally, reminders and communication were optimized and personalized (e.g., sending an email after completing an assessment including words of appreciation and information on when to expect the next questionnaire), with the goal of retaining participants.

A second limitation pertains to the recruited sample of the randomized controlled trial, which, as mentioned before, mostly included participants with severe symptoms and a long duration of eating-related problems. The current sample is therefore hard to generalize to individuals with less severe eating disorder symptoms, for whom such brief low-threshold interventions may be especially useful.

Thirdly, outcomes in the randomized controlled trial were exclusively determined using self-report measures. This limited the diagnostic precision of outcomes and might have introduced recall bias. Nevertheless, relying solely on self-report measures was necessary to maintain the low-threshold character of the interventions and making the research easily accessible for participants.

A fourth limitation worth mentioning concerns the conducted meta-analysis (chapter 4). Specifically, it is hard to precisely value the outcomes of the meta-analyses pooling 37 studies, because the studies show substantial heterogeneity. Heterogeneity between studies is a common problem in meta-analyses (Cuijpers, 2016), but might be especially relevant in meta-analyses on cost-effectiveness data, as differences do not only relate to the design, content of interventions and effectiveness outcomes, but also to the way economic outcomes are assessed. The concerns were addressed by conducting moderator and sensitivity analyses, which help to better understand the available data, but generalizability to other studies remains limited. Still, meta-analyses of cost-effectiveness studies are arguably important, as singular economic evaluations are often conducted after effectiveness analyses and lack power for cost-effectiveness analyses (Hollingworth et al., 2013). The conducted meta-analysis is an illustration on how pooling cost-effectiveness data can be practically accomplished. This has been achieved before in the area of medicine (Bagepally et al., 2019), but is the first in the area of psychiatry. It paves the way for other researchers in the area of psychiatry to build on and improve the presented method.

## Future directions

Low-threshold interventions like Featback appear to be useful in bridging the eating disorder treatment gap, by reaching individuals who indicated never to have had eating disorder treatment before. However, seeing how participants in the conducted randomized controlled trial were already severely ill, the challenge remains to detect individuals at the beginning stages of their eating disorder. Shifting the attention of all those involved in eating disorder treatment to this task will likely be beneficial in several ways (Moessner & Bauer, 2017), including the realization of cost savings. Apart from conventional dissemination techniques that might help to reach youngsters with eating disorder symptoms, such as handing out flyers in high schools (Bauer et al., 2019), other approaches need to be explored. First, it may be valuable to work with experts in communication and sales, as health professionals and researchers are often not well versed in (non-scientific) mass communication. Second, social media such as Instagram and TikTok have become an increasingly large part of the

lives of teenagers and their use is frequently associated with eating disorder symptoms (Padín et al., 2021). Understanding these platforms and using them to reach and inform those with eating-related problems appears to be an essential step for wide dissemination of internet-based self-help programs for eating disorders. For example, creating and maintaining a channel to promote effective interventions or working together with influencers with a large network might help to reach individuals with eating disorder symptoms at an early stage.

Two large trials on Featback, either with guidance from psychologists (Aardoom, Dingemans, Spinhoven, et al., 2016) or expert patients (chapter 3), found no added effect of guidance on eating disorder symptom reductions. Indeed, apart from higher satisfaction, it appears difficult to specify benefits of adding support to unguided internet-based interventions such as Featback. The results advocate a reappraisal of the role of guidance in internet-based interventions for eating disorders. The unguided version of Featback is highly scalable and likely to be more efficient than its guided form. Abandoning guidance in the form of psychologist or expert-patient support altogether and focusing on improving the automated part of the intervention, then, seems sensible. Nevertheless, investigating how adding (expert-patient) support to Featback influences uptake might still be an interesting research avenue. Additionally, future trials on internet-based interventions for eating disorder are recommended to include an unguided version of the intervention of interest to investigate whether human support is necessary for effectiveness.

Another venerable pursuit is the continuation of high-quality cost-effectiveness research. A recommendation for researchers would be to always include an economic evaluation when planning future randomized controlled trials on eHealth interventions and to involve a health economist early in the conceptualization phase. Growing the body of evidence in this field will provide a clearer picture of the economic impact of internet-based interventions for eating disorders. This will inform both clinicians and policy makers on the value of such interventions.

Lastly, future directions may also concern further personalization of internet-based interventions for eating disorders. Technological possibilities become increasingly versatile, making it feasible to have interventions that adapt to the needs of the user. Currently, the majority of interventions are limited in their responsiveness to user input and are often text based (Burger et al., 2020). It seems that the development of an internet-based intervention is still frequently approached as taking an effective (face-to-face) treatment and translating it into an online application. However, the technological innovations at our disposal open up possibilities that might aid in reaching a large audience and developing engaging and effective interventions. When considering to incorporate novel technologies, working together with intended end-users during development might have beneficial effects. Indeed, such a co-creation process engages users from an early stage and identifies actual needs of end-users, arguably leading to effective and persuasive designs that users enjoy engaging with (Alpay et al., 2019). Advancement in areas like, but not limited to, Virtual Reality, machine learning, artificial intelligence and gamification may offer unique opportunities to enhance existing interventions. For example, a chatbot for eating disorder prevention, simulating human conversation, has been developed and tested in a randomized controlled trial and was found to reduce weight and shape concerns and overall eating disorder psychopathology (Fitzsimmons-Craft et al., 2022). Another approach, making use of smartphone technology, is just-in-time (JIT) interventions. In such JIT interventions, data are collected frequently,

for instance using short questionnaires on mood and well-being, or even in real-time (e.g., physical activity and heartrate). These data are then used in (machine-learned) algorithms to predict the optimal timing and content of interventions, messages, or exercises for a specific individual. This approach is uncommon still in eating disorders, but enables highly personalized interventions (Juarascio et al., 2018). The two examples mentioned here serve as illustration of innovative ways to use technology and as inspiration of how existing interventions might be creatively enhanced without requiring new, large research trials that take years to complete. Indeed, there is some evidence to suggest that using gamification, videos or Virtual Agents may be useful in improving mental health and intervention engagement (Abd-Alrazaq et al., 2020; Fleming et al., 2017). Similarly, Barakat et al. (2019) found that using multiple features that address different modalities might have a positive influence on the effectiveness of technology-enhanced eating disorder treatments. The Featback intervention already involves some responsiveness to user input (i.e., personalization), by sending a message to users that is based on the symptoms they report. However, the intervention may become more effective and appealing to use when other features are added, such as a Virtual Agent that sets goals and motivates users to try out the tips in the feedback messages or rewarding intervention usage with badges or unlockable clothing for a virtual character that users see when logging in. Replacing expert-patient support with a chatbot that is available upon demand or sending an appropriate feedback message as a response to passively collected data via the smartphone (i.e., JIT intervention) are other examples. Arguably, such enhancements are most effective when they have a scientific underpinning, are found to be feasible in a co-creation process, and are incorporated in collaboration with technical experts.

## Conclusion

Based on the current dissertation and earlier research, it appears low-threshold internet-based interventions for eating disorders, such as Featback, can complement existing treatment options in three ways. First, they have been repeatedly found to be effective in reducing eating disorder symptomatology. Second, such interventions can reach individuals that are currently not reached by other forms of treatment and stimulate them to get professional help. Finally, internet-based interventions are likely to be cost-effective compared to care as usual. Concordantly, implementing highly scalable and easily accessible interventions like Featback likely helps to reduce both the individual and societal burden of eating disorders.





