**PILOT OF A THERAPIST-GUIDED DIGITAL MENTAL HEALTH INTERVENTION (EHEALTH CF-CBT) FOR ADULTS**

**WITH CYSTIC FIBROSIS**

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**ABSTRACT**

**Background:**eHealth CF-CBT is the first digital mental health intervention for depression/anxiety in adults with cystic fibrosis (awCF); an 8-session therapist-guided internet-delivered program that was developed in English and Dutch with stakeholder input and evaluation indicating high acceptability and usability.

**Methods:** Dutch eHealth CF-CBT was piloted in awCF with mild-moderate symptoms of depression and/or anxiety. Feasibility, usability, acceptability, and preliminary efficacy were assessed, measuring pre-post changes in depression (PHQ-9), anxiety (GAD-7), perceived stress (PSS) and health-related quality of life (CFQ-R).

**Results:**  All participants (n=10, 7 female, mean age 29 (range 21-43), mean FEV1 71%pred (range 31-115)) completed all sessions. Patient-rated feasibility, usability and acceptability of eHealth CF-CBT was positive on validated scales, as were qualitative assessments of content and format. GAD-7 improved in 90% of participants; in 50% by ≥ the minimally important difference (MID) of 4 points. PHQ-9 improved in 90%; 40% by ≥ the MID of 5. PSS improved in 80%. CFQ-R improved in the domain Health Perceptions (70%).

**Conclusions:** eHealth CF-CBT demonstrated feasibility, usability, acceptability and promising preliminary efficacy in this pilot trial with Dutch awCF with mild to moderate symptoms of depression and anxiety.

**Keywords:** depression, anxiety, cystic fibrosis, psychotherapy, cognitive-behavioral therapy, digital mental health

**INTRODUCTION**

Adults with cystic fibrosis (awCF) are at increased risk for depression and anxiety negatively affecting health-related quality of life (HRQoL), adherence and health outcomes.1 Consequently, CF Foundation (CFF) and European CF Society (ECFS) guidelines recommend routine screening, treatment, and preventative efforts for depression and anxiety.1-3 However, many barriers to accessing mental health care for awCF remain.4-5 These may include financial and insurance limitations, long waitlists, and balancing mental health care needs with high CF treatment burden. Illness and hospitalization can disrupt establishing and maintaining continuity of outpatient mental health care.5 Infection risk, exacerbated by the COVID-19 pandemic,6 may present a barrier for awCF to weekly in-person individual psychotherapy, particularly for those post-transplant, while in-person group care models are contraindicated. In addition, awCF often feel burdened with educating mental health care providers unfamiliar with CF. As such, awCF may prefer and engage more fully in mental health care that is targeted to their specific concerns and integrated into their routine CF care.7

Telehealth and eHealth/digital interventions developed for awCF offer an opportunity to address barriers to mental health care access and decrease overall healthcare burden.8-11 Internet-delivered cognitive-behavioral therapy (CBT) has been found to be efficient and effective for the treatment of psychiatric conditions.12-13 Digital mental health interventions may be particularly suitable for integration into primary CF care. Partly or completely self-guided, digital health programs can be completed flexibly outside of scheduled visits. Reducing per-patient clinician time increases efficient use of healthcare resources and the potential for more awCF suffering from depression or anxiety to receive targeted evidence-based mental health care. Digital mental health programs may also have an advantage of adaptability for dissemination to international CF centers with variable resources and healthcare systems.

eHealth CF-CBT is the first digital mental health intervention developed for awCF.11 Available in both English and Dutch, eHealth CF-CBT is an 8-session blended care program integrating online self-management sessions with in-person or virtual therapy sessions.11 AwCF can access eHealth CF-CBT from home while continuing to benefit from the expert guidance and feedback of a trained CF care team provider. The program’s theoretical framework is CBT, a structured evidence-based approach for prevention and treatment of depression and anxiety,14 recommended by CFF/ECFS guidelines.1 eHealth CF-CBT was adapted from CF-CBT, a manualized 8-session CF-specific CBT intervention developed in the US with input from awCF and healthcare providers.15-16 A multi-center pilot of CF-CBT integrated into CF team-based care found it to be feasible and highly acceptable, with promising preliminary effectiveness, including large effect size improvement in depression and small to large effect size improvements in anxiety, HRQoL, perceived stress, and coping skills.16 CF-CBT was then adapted to an online platform with additional input from Dutch awCF and healthcare providers.11

A pre-pilot evaluation of eHealth CF-CBT demonstrated adequate usability and functionality and high acceptability ratings from awCF and healthcare providers11 with feedback directly informing program improvement. From its earliest stages, the CF-CBT and eHealth CF-CBT programs were created with stakeholders in a central role guiding project development and piloting, to ensure they were addressing the needs of awCF.11, 15-16

The aim of this study was to pilot eHealth CF-CBT with awCF with mild to moderate symptoms of depression and/or anxiety to 1) further evaluate feasibility, usability and acceptability, and 2) examine preliminary evidence of efficacy with regard to key outcomes, prior to wider testing and dissemination. Adequate feasibility, usability, and acceptability parameters and improvement from pre- to post-eHealth CF-CBT in depression and anxiety symptoms, perceived stress, and HRQoL were hypothesized.

**MATERIALS AND METHODS**

**Study design**

The study was an uncontrolled single-center pilot conducted at the CF center of Amsterdam, the Netherlands according to the principles of the Declaration of Helsinki, Fortaleza, 2013, the Medical Research Involving Human Subjects Act (WMO) and other guidelines, regulations and Acts. The medical ethics committee of VU University Medical Center (VUmc), Amsterdam, the Netherlands, approved the study (clinical trial ID NL9349).

**Participants and procedure**

The intervention was delivered to 10 awCF (aged ≥18 yrs.) with symptoms of depression and/or anxiety in the mild to moderate severity range identified during routine CF-clinic screening using the Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder 7-Item Scale (GAD-7). Participants were recruited from a pool of 124 awCF at Amsterdam UMC between March-October, 2021. All awCF with mild or moderate PHQ-9/GAD-7 scores (5-14), without either score above moderate (≥15), were eligible and were invited to participate (N=12). Two eligible candidates declined participation; One due to a mild language barrier and extended stay outside the Netherlands, and another due to time limitations and the fact that this person was already receiving psychological treatment.

Exclusion criteria were: 1) inability to read, write, and/or follow instructions in Dutch, 2) lack of internet access, and 3) severe psychiatric dysfunction, including acute safety risk to self or others (e.g., suicidal intent). Inclusion was not limited by CF severity, transplant status or medical hospitalization. Participants were included with a history of more severe depression or anxiety currently at mild to moderate levels with or without treatment, and those participating in concomitant psychosocial or psychopharmacologic treatments, with the exception of another CBT.

**Intervention**

The 8 eHealth CF-CBT sessions were delivered through blended care: face-to-face contact with the psychologist (at intake/session 1, session 5, session 8) in combination with online self-guided sessions (sessions 2, 3, 4, 6, 7).11 The eHealth CF-CBT program was built into the online platform *Minddistrict,* an internet-based application for mental health intervention delivery approved as a secure information technology vendor for international use. eHealth CF-CBT provides psychoeducation and an introduction to core CBT skills for prevention and treatment of depression and anxiety, including relaxation skills, behavioral activation, cognitive restructuring/adaptive thinking, and graduated exposure to address anxiety.15-16 The program is tailored throughout to address the emotional challenges associated with living with CF, including referencing CF-specific stressors (e.g., medical procedures, illness uncertainty, hospitalizations, survivor’s guilt), use of direct quotes from awCF who participated in qualitative interviews about their own stressors and successful coping strategies, and qualitative modification of skill application to address CF-specific needs. Barriers to CF self-management (e.g., negative medication beliefs) are addressed throughout.15-16 Each session focuses on skill-building and includes a homework assignment for between-session skill practice. The therapist, who can view participants’ online entries, offers individualized feedback following completion of each homework assignment before providing access to the next online session. In-person or virtual sessions with the therapist at the beginning, middle and end of the program allow for support, guidance, monitoring progress, and co-developing a disposition plan.

**Study Procedures**

One CBT-trained psychologist provided treatment to all 10 participants. Eligible awCF were recruited by their pulmonologist based on routine depression/anxiety screening scores. If the awCF was interested and the intervention appropriate to their needs, the study psychologist invited them for an intake, following a 3-week reflection period required by ethics board protocol. After informed consent, participants completed pre-intervention questionnaires and started the introduction and first session during an in-person or virtual video meeting with the psychologist. They then completed weekly online sessions, with session 5 and the final session administered during an in-person/virtual meeting. The final session involved skill review and co-development of a disposition plan, followed by completion of a final set of measures.

Depression, anxiety, and perceived stress were measured at the first, fifth and final sessions, HRQoL at the first and last, and feasibility, usability and acceptability at program completion. AwCF completed the Outcome Rating Scale (ORS) and provided program feedback with each weekly session.17 Participation was reimbursed at €100 total. Travel costs were reimbursed if applicable.

**Measures**

***Descriptives***

Socio-demographic variables were collected via questionnaire and medical variables obtained from record review at baseline.

***Feasibility, usability and acceptability***

Feasibility was assessed by rate of attrition, duration to program completion, and calculation of per-session patient and therapist time. Perceptions and suggestions for improvement were collected through feedback questionnaires at study end. Participants completed the following questionnaires to assess feasibility, usability and acceptability:

*Client Satisfaction Questionnaire (CSQ-8)*

Widely used to assess patient satisfaction with services and programs,18 CSQ-8 consists of 8 items on a 4-point scale, with total scores between 8-32, and higher scores indicating greater satisfaction.19 Scores of 8-13 correspond with ‘poor,’ 14-19 with ‘fair,’ 20-25 with ‘good,’ and 26-32 with ‘excellent’ satisfaction.20

*System Usability Scale (SUS)*

The SUS is a 10-item, reliable scale for assessing usability of products and services including websites and applications, e.g., “I felt very confident using eHealth CF-CBT,” with a 5-point scale from “strongly disagree” to “strongly agree”.21 SUS scores between 68.0-80.3 are considered good, above 80.3 excellent.22

*eHealth Impact Questionnaire (eHIQ)*

Designed to assess effectiveness of web-based programs containing health information, e-HIQ includes 2 independently administered and scored scales (eHIQ-Part 1, eHIQ-Part 2) with good internal consistency and test-retest reliability.23 Each item has 5 response options (“strongly disagree” to “strongly agree”). Each scale is transformed to a 0–100 metric, where 0 = low perceived value for health, and 100 = high perceived benefit in relation to health.24 The eHIQ is a continuous scale with a score of ≥65 considered positive.24 We administered **the Dutch translation of eHIQ-Part 2** (26 items), measuring 3 domains: 1) Motivation and confidence to act (10 items), 2) Information and presentation (13 items), and 3) Identification (3 items).24

*eHealth CF-CBT Feedback Questionnaire*

This questionnaire, designed for the development of eHealth CF-CBT,11 invited participants to provide their overall impression of the program by open response and rating on 10-point scale (0= “very bad,” 10= “excellent”), and detailed session-by-session feedback on the presentation of information and functionality of the program, both open-ended and rated on a 1-5 scale from “strongly disagree” to “strongly agree”.11

***Primary outcome measures***

*Patient Health Questionnaire-9 (PHQ-9, Dutch version)25*

PHQ-9 consists of 9 items corresponding to DSM-5 diagnostic criteria for major depression. Items are scored on a 4-point scale: 0 (‘not at all’) to 3 (‘nearly every day’). Totals range from 0-27, with higher scores indicating more severe depressive symptoms. Scores can be categorized by severity: ‘minimal’ (0-4), ‘mild’ (5-9), ‘moderate’ (10-14), ‘moderately severe’ (15-19) and ‘severe’ (20-27). A minimal clinically important difference score (MID) of 5 points has been established.25

*Generalized Anxiety Disorder Scale 7-item (GAD-7, Dutch version*)*26*

GAD-7 assesses anxiety symptoms with excellent psychometric properties.26 It consists of 7 items, with response options of 0-3 similar to the PHQ-9. Total scores range from 0-21; scores of 5, 10 and 15 points are used as cut-offs for mild, moderate, and severe anxiety, respectively. An MID of 4 points has been established.27

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| *Perceived Stress Scale (PSS)*  The PSS is a widely used self-report questionnaire,28 including 14 items assessing the degree to which respondents perceived their lives in the last 2 weeks as unpredictable, uncontrollable and overloaded. Response options are on a 5-point scale from ‘never’ (0) to ‘very often’ (4). Totals range from 0-56, with higher scores indicating greater perceived stress.28  *Health-related Quality of Life (CFQ-R)*  The Cystic Fibrosis Questionnaire-Revised (CFQ-R) is a self-report questionnaire measuring HRQoL in 12 domains.29 The Dutch CFQ-R has shown robust internal consistency and psychometric properties.30 Higher scores indicate better quality of life. |

*Outcome Rating Scale (ORS)*

The [ORS is](https://www.psycholooghengelo.nl/wp-content/uploads/ORS-SRS-invulschema.pdf) a 4-item scale assessing change in well-being during and following a psychological intervention with good psychometric properties.17 Well-being is assessed in 4 domains: Individual, interpersonal, social and overall. Total score ranges from 0-40, with ≥6-point increase considered reliable and change of ≥6 points crossing the clinical cut-off of 25 considered clinically significant.17

**Statistical analysis**

## Frequency and percentages of feasibility, usability and acceptability scores were calculated and the themes of qualitative data summarized. The differences between baseline and post-intervention were analyzed using paired t-tests or Wilcoxon signed rank tests. P <0.05 was considered statistically significant. SPSS version 26 was used for all analyses.

**RESULTS**

**Participants**

*Demographics*

See Table 1 for sociodemographic and medical characteristics at baseline.

**Table 1. Participant (N=10) Characteristics**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sociodemographic Characteristics** | | | |  | | |
| **Age in years** | | | | **Mean (SD), Range** | | |
|  | | | | 29.00 (7.21); 21-43 | | |
| **Gender** | | | | **N** | | |
|  | | Female | | 7 | | |
|  | | Male | | 3 | | |
| **Highest level of education*1*** | | | |  | | |
|  | Low | | | 1 |  | | |
|  | Middle | | | 6 |  | | |
|  | High | | | 3 |  | | |
| **Main employment status** | | | |  |  | |
|  | | Wage employed | | 5 | | |
|  | | Self-employed | | 1 |  | |
|  | | Currently not working | | 2 |  | |
|  | | Work at home, e.g., housekeeping | | 2 |  | |
| **Average working hours per week** | | | |  |
|  | | 0 | | 3 |  | |
|  | | 1-12 | | 3 |  | |
|  | | 13-24 | | 1 |  | |
|  | | ≥25 | | 3 |  | |
| **Relational status** | | | |  |
|  | | Single | | 5 |  | |
|  | | Living together/Married | | 5 |  | |
| **Medical and mental health history** | | | |  | | |
| **Body mass index (BMI)** | | |  | **Mean (SD), Range**  22.38 (3.16), 18.12-27.01 | |  |
| **Age at diagnosis (years)** | | |  | **N** | |  |
| 0-6 | | |  | 10 | |  |
| **Lung transplant recipient** | | | | 0 | |  |
| **Placed on lung transplant waiting list** | | | | 1 | |  |
| **Number of CF-related hospitalizations in past year** | | | |  | | |
|  | | 0 | | 9 | | |
|  | | 1 | | 1 | | |
| **Most recent ppFEV1** | | | | **Mean (SD), Range**  71.00% (28.56), 31%-115% | | |
| **History of diagnosed anxiety disorder or depression** | | | | **N**  6 | | |
| **Previous psychological treatment** (counseling, coaching, psychotherapy) | | | | 9 | | |
| **Experience with online psychological care** (e.g., websites, apps, self-help programs) | | | | 1 | | |

1Education level, “Low”: Primary school or lower vocational secondary education, “Middle”: intermediate general secondary education or intermediate vocational education, and “High”: higher general secondary education, higher vocational education, or university education. All participants had Dutch nationality.

**Treatment feasibility, usability and acceptability**

All participants completed the entire 8 session program. Mean duration to complete eHealth CF-CBT was 9 weeks (range 8-11); 2 participants required 11 weeks because of vacation or medical problems. Participants indicated they spent an average of 1.52 hours per online session, including homework. All participants completed all assigned homework.

Overall, the CBT-therapist spent 60 minutes for face-to-face/video sessions (45 to meet, 15 for documentation), and 20 minutes for online sessions (15 to read participants’ responses and provide feedback, 5 for documentation). This represented a reduction of more than 3 hours of therapist time per client; normally in clinical CF care in the Netherlands, a 45-minute consultation is scheduled with 15 minutes administrative time. After participation, 7 awCF indicated that they did not need continuation of psychological treatment, 1 continued care with the same therapist, and 2 required more intensive trauma therapy outside the institution.

See Table 2 for acceptability and usability ratings. Average overall experience with the program (CSQ-8) was rated as good. Thirty percent rated the experience as “excellent” and none reported a negative experience. Ratings on the eHIQ were positive for ‘Information and presentation’ with a mean of 77.69. Participants rated ‘Motivation and confidence to act’ just below the cut-off score of 65 (61.25), and ‘Identification’ was 52.50. Mean SUS ratings for usability of 76.75 (range 72.50- 85.00) were good to excellent. Participant ratings of their overall impression of eHealth CF-CBT were good, with mean 7.55 and range 6-9 on a 10-point scale.

Open-ended feedback regarding the program using theeHealth CF-CBT Feedback Questionnaire was largely positive. Participants noted that CF-CBT offered a helpful exploration of different techniques to improve mental health and praised the flexibility of the model, i.e., being able to work on the program from anywhere and plan their own time, while still having support from a psychologist. Three participants indicated an overall preference for face-to-face therapy.

**Table 2. Usability and acceptability ratings**

|  |  |
| --- | --- |
| **Client Satisfaction Questionnaire (CSQ-8)** | **(N=10) Mean (SD)** |
| Average total score | 23.50 (2.68) |
| Excellent\* | 3 |
| Good | 6 |
| Fair | 1 |
| **System Usability Scale (SUS)** | 76.75 (4.72) |
| **eHealth Impact Questionnaire (eHIQ)** |  |
| Motivation and confidence to act | 61.25 (14.45) |
| Information and presentation | 77.69 (8.27) |
| Identification | 52.50 (19.66) |
| **Overall impression of eHealth CF-CBT** | 7.55 (1.07) |

*Note:* higher scores indicate a more favorable experience. \* Classification based on separate participants’ total CSQ-8 score.

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| Evaluation of individual eHealth CF-CBT sessions  Overlapping questions from feedback questionnaires for all 8 sessions were combined into one pooled score. All (100%) indicated that they “agreed” or “totally agreed” with the statement, “I understand the session’s subjects”. Most or all participants rated that they “agreed” or “strongly agreed” with the following statements: “The amount of text is good” (78.57%); “The use of language is good” (97.11%); “The pictures are suitable” (81.43%); “Functions work well” (100%); and “Homework is clear” (93.33%). About half (54%) indicated that “The perspectives of people with CF are useful”. |

***Primary outcome measures***

Symptoms of depression (PHQ-9) improved in 90%; 40% by ≥ the MID of 5 points. Anxiety (GAD-7) improved in 90% of participants; in 50% by ≥ the MID of 4. Perceived stress (PSS) improved in 80%. HRQoL improved significantly in the CFQ-R domain ‘Health Perceptions’ (70%), with a trend for improvement in ‘Vitality’ (70%), ‘Respiratory symptoms’ (50%) and ‘Weight’ (30%). See Table 3 and Figures 1 (PHQ-9 & GAD-7), and 2 (PSS) for results of pre-post comparison testing and calculation of effect size change for primary outcome measures. There were no statistical differences in outcomes between male and female participants.

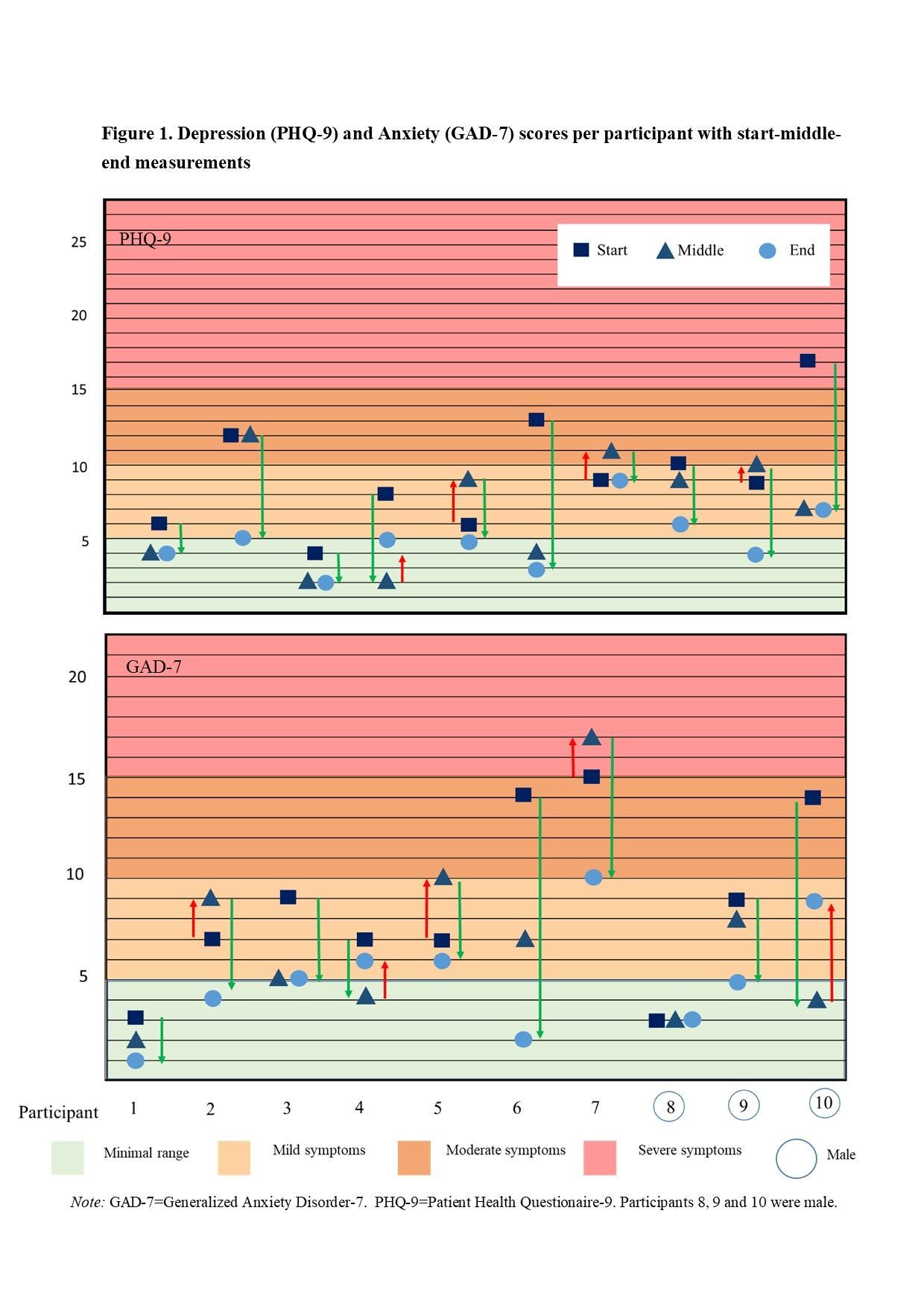
**Table 3. Average scores (Mean (SD)) over the course of the eHealth CF-CBT program**

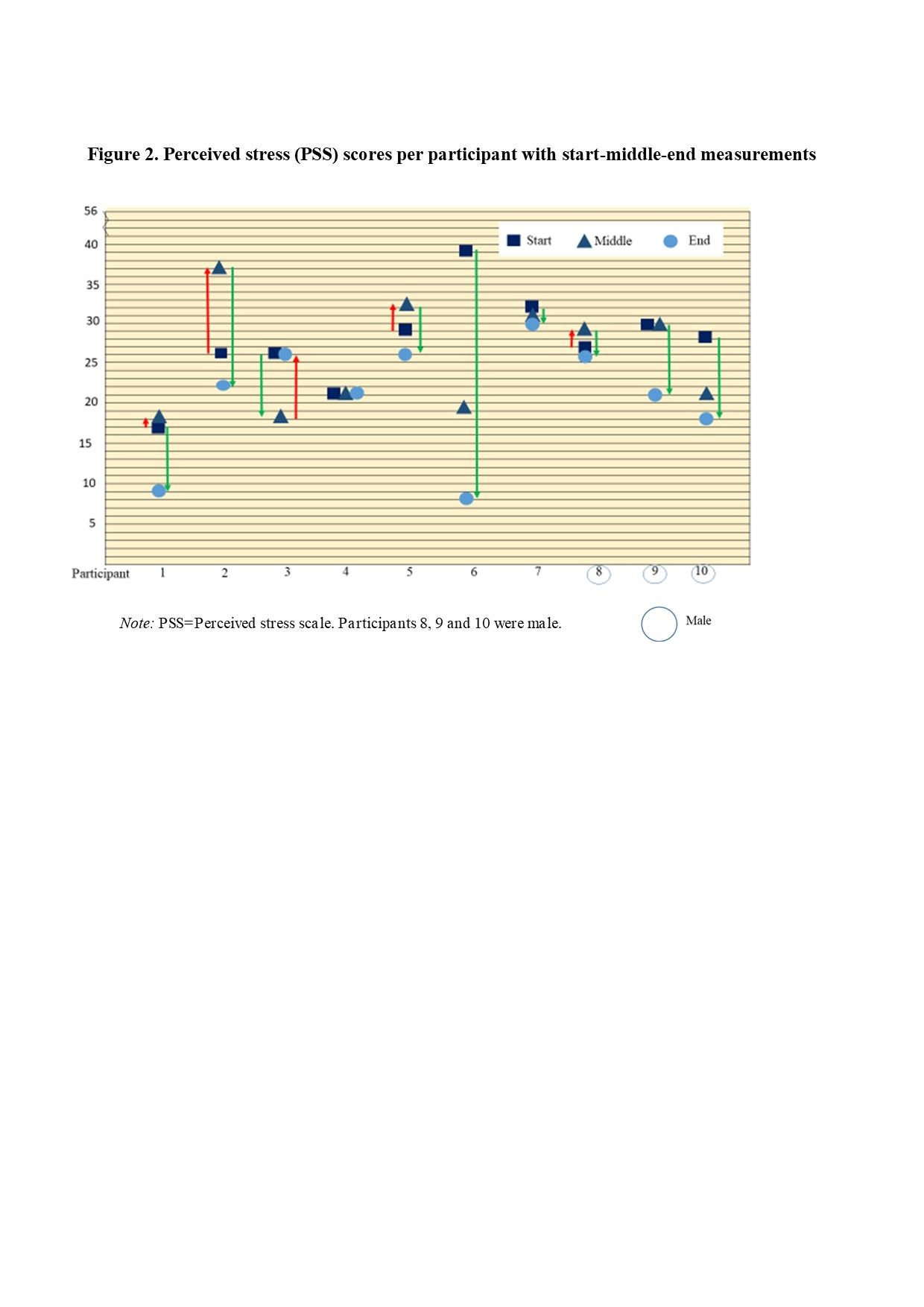
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Start (before session 1)** | **Session 5** | **End (after Session 8)** | ***t (df 9)*** | ***P*** | ***Cohen’s d*** |
| **PHQ-9** | 9.40 (3.83) | 7.00 (3.74) | 5.00 (2.00) | -3.90 | .004 | -1.23\*\*\* |
| **GAD-7** | 8.80 (4.34) | 6.90 (4.43) | 5.10 (2.85) | -3.44 | .007 | -1.09\*\*\* |
| **PSS** | 27.50 (5.95) | 25.60 (6.93) | 20.70 (7.29) | -2.32 | .046 | -.73\*\* |
| **CFQ-R** |  |  |  |  |  |  |
| Health Perceptions | 45.60 (18.73) |  | 58.00 (19.61) | 3.19 | .011 | 1.01\*\*\* |
| Vitality | 41.60 (17.66) |  | 53.30 (18.75) | 2.012 | .075 | .64\*\* |
| Weight | 66.60 (38.59) |  | 76.70 (27.52) | 1.96 | .081 | .62\*\* |
| Respiratory symptoms | 74.30 (12.83) |  | 77.60 (14.10) | 1.92 | .087 | .61\*\* |
| Physical functioning | 67.90 (18.35) |  | 74.30 (22.28) | 1.80 | .105 | .57\*\* |
| Emotional functioning | 60.00 (15.40) |  | 69.50 913.83) | 1.71 | .121 | .54\*\* |
| Treatment burden | 62.40 (22.47) |  | 69.20 (11.36) | 1.51 | .166 | .48\* |
| Digestive symptoms | 79.00 (16.99) |  | 84.60 (13.91) | 1.35 | .210 | .43\* |
| Social functioning | 56.20 (16.10) |  | 62.20 (16.78) | 1.15 | .282 | .36\* |
| Role functioning | 73.30 (16.14) |  | 70.00 (19.04) | -1.06 | .316 | -.34 |
| Body image | 75.70 (32.56) |  | 70.00 (31.13) | -1.07 | .314 | -.34 |
| Eating disturbances | 82.40 (20.87) |  | 79.00 (30.68) | -.497 | .631 | -.16 |
|  |  |  |  |  |  |  |

*Note:* PHIQ-9= Patient Health Questionaire-9, GAD-7= Generalized Anxiety Disorder-7, PSS= Perceived stress scale. CFQ-R = Cystic Fibrosis Questionnaire revised.

P-values are calculated by performing paired-sample T-tests between start and end session data.

Effect sizes of pre-post mean change scores are presented, with green blocks\*\*\* indicating a positive large effect size (≥0.8), yellow blocks\*\* indicating a positive medium effect size (0.5-0.79), orange blocks\* indicating a positive small effect size (≥0.2-0.49), and blue blocks indicating a negative small effect size (≥0.2-0.49) or negligible effect size (<0.2).

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ORS scores increased with a mean of 8.46 between start and the last session, exceeding the clinical reliable change cut-off of 6 points and crossing the clinical cut-off score17 with mean total of 28.96 (see supplementary table 1), indicating a positive effect of therapy on overall well-being.

**DISCUSSION**

eHealth CF-CBT, an 8-session therapist-guided internet-delivered program is the first eHealth intervention for depression and anxiety in awCF.11 Originally, CF-CBT was designed as an intervention for mild depression and anxiety symptoms screened in clinical care.15-16 In this pilot, awCF with mild to moderate symptoms of depression/anxiety were included and showed improvements in depression and anxiety symptom scores, demonstrating that those with moderate scores could also benefit. The CF-CBT and eHealth CF-CBT programs may be useful as a first-line intervention to engage awCF with mild to moderate symptoms in care, acting as a bridge to follow-up therapy and/or psychiatric medication treatment for a subset.4, 11, 15-16

Feasibility was supported by completion of all 8 sessions and 100% of weekly homework assignments by all participants within a reasonable timeframe. Acceptability and usability were indicated by positive feedback on standardized measures and qualitative assessments. The blended-care model was efficient compared with standard therapy models. As the demand for mental health care far exceeds clinician availability,12-13 an eHealth intervention tailored to CF-specific needs and integrated into routine CF care has the potential to reduce barriers to mental health care access for awCF and associated healthcare costs.

Nonetheless, there are awCF for whom the eHealth CF-CBT program might not be appropriate. Those with severe depression and anxiety or suicidality may need more intensive and entirely in-person treatment options. The eHealth CF-CBT program incorporates synchronous (in-person or telehealth) sessions as well as close monitoring and feedback of self-guided sessions to determine on an ongoing basis the appropriateness of the intervention or need for increased synchronous visits. For some, more than 8 sessions of CF-specific CBT-based sessions may be needed to address depression, anxiety or mental health comorbidities.

Almost all participants (90%) had engaged in psychotherapy before, comparable with the CF-CBT pilot study,16 suggesting that these samples may represent a population with chronic depression and anxiety symptoms. Therefore, more research is needed to understand if results generalize to those who are treatment-naïve or with first onset of symptoms. For some awCF, additional interventions or CBT booster sessions may be appropriate.16 Following eHealth CF-CBT, most participants (70%) in this study did not require follow-up psychological treatment. Generalizability may also be limited by the relatively small sample size with mostly female participants, although differences in primary outcomes by sex were not detected here.

In this pilot study, feasibility, usability and acceptability to awCF of eHealth CF-CBT were positive and the program demonstrated promising preliminary efficacy. Symptoms of depression and anxiety, perceived stress, and the HRQoL domain Health Perceptions improved from immediate pre-to post-eHealth CF-CBT measurement. However, a longitudinal controlled study would be needed to further examine efficacy, maintenance of effect, and potential impact on adherence and long-term physical health outcomes for awCF. As a next step, eHealth CF-CBT will be made available to awCF in The Netherlands and implemented into regular CF care in Dutch CF-centers (Corno Grant 2023).

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**Conflict of interest statement**

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