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Evaluation of the E-Psycho-Oncological Short-Term Intervention "By Your Side" to Reduce Cancer-Related Distress: A Pilot Study

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Abstract

Objective: A large number of patients with cancer experience distress, but not all of them receive adequate psychological support. The e-psycho-oncological short-term intervention "By your Side" was developed to offer evidence-based and low-threshold support for cancer patients dealing with distress. **Methods:** A longitudinal intervention pilot study was conducted from 4 March 2022 to 4 January 2023. N = 91 participants took part in the study. N = 82 completed the first module, while n = 23 successfully completed the whole intervention and were included in the final data analyses. "By your Side" consists of 16 modules based on cognitive behavioral therapy, acceptance and commitment therapy and mindfulness-based stress reduction. Differences in distress between the baseline (T0), post-intervention (T1), and follow-up (T2) were analyzed using an ANCOVA and post-hoc *t*-tests. Secondary outcomes (anxiety, depression, mindfulness, and self-efficacy) were also compared between measuring points, using ANOVAs and post-hoc tests. **Results:** A significant reduction ($p_{adj} = 0.014$, $d = 0.654$) in distress from baseline (T0, $M = 52.68$, SD = 16.34) to follow-up (T2, $M = 43.84$, SD = 17.59) was observed. There was a significant decrease in anxiety symptoms and a significant increase in mindfulness and self-efficacy. The user's satisfaction ($M = 28.00$, range 8-32) and the usability ($M = 89.57$, range 0-100) of the intervention were high. **Conclusion:** The study provides preliminary evidence that the e-psycho-oncological short-term intervention "By your Side" can successfully reduce the distress of cancer patients. The high dropout rate (74.7%) must be taken into account.

Trial registration: German Clinical Trial Register (https://www.drks.de/search/de/trial/DRKS00036001), DRKS number: 00036001 (retrospectively registered)

Keywords

cancer, CBT, depression, distress, eHealth, MBSR, oncology, psycho-oncological, self-efficacy, short-term intervention

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Introduction

Cancer is one of the greatest challenges for global healthcare in the 21st century. In Germany, the number of new cases of cancer was estimated at 510 200 for the year 2022.[1] Although the number of cancer patients is high, cancer mortality is expected to decrease due to medical advances that enable early cancer detection and treatment.[2] Despite the improved prognosis, cancer patients are faced with psychological problems as every second cancer patient was found to suffer from elevated distress.[3] Moreover, patients with cancer are regularly found to require psychotherapeutic support to deal with depression, anxiety, pain, fatigue and sleep disruption, which negatively affects the quality of life.[4,5] A possible solution for reducing distress in cancer patients and overcoming current barriers to psycho-oncological treatment are psycho-oncological e-mental health interventions.[6] Frequently named barriers include the patient's fear of getting stigmatized, discomfort to ask for help and limited access to mental healthcare.[7] If a high level of availability is offered, psycho-oncological e-mental

health interventions can have the potential to fill an important gap in quality cancer stepped care.[8] Further, users of such technologies could benefit from the opportunity to undergo treatment anonymously and remotely.[9] Previous e-mental health interventions, based on cognitive behavioral therapy (CBT), were found to reduce distress, anxiety, and depressive symptoms in patients with cancer.[10,11] Moreover, CBT-based interventions increased the quality of life in patients with breast cancer.[12] Acceptance and commitment therapy (ACT), which is part of the so-called third wave of CBT, can also be an effective method for e-mental health interventions.[13] However, existing studies regarding the effectiveness of CBT trials predominantly focus on patients with non-advanced cancer and there was weaker evidence for those screened with lower levels of distress.[13] In addition, mindfulness-based stress reduction (MBSR) provides another effective approach to promote coping with cancer-related distress.[14] MBSR-based e-mental health interventions can improve self-efficacy and could even reduce symptoms of anxiety and depression.[15,16] Overall, third wave interventions including ACT and MBSR were found to address coping with behavioral impact of distress rather than directly reducing distress.[13] Most of the existing MBSR programs have an average duration of 8 weeks.[17] MBSR based short-term interventions, which last less than 8 weeks, have also been shown to have the potential for distress reduction, even in lung-cancer-patients.[18] In addition, a 4-week psycho-oncological e-mental health intervention to increase quality of life in patients with breast cancer demonstrated high adherence and completion rates.[19] Thus, the effectiveness of a 4-week intervention program for patients with different types of cancer is worth exploring, given the advantages of distress reduction, potentially high adherence and easy integration into somatic cancer care, as well as into patients' daily lives.

This longitudinal intervention pilot study was conducted to gather initial evidence regarding the effectiveness of the e-psycho-oncological short-term intervention "By your Side," which is a self-guided psycho-oncological intervention, including elements of CBT, ACT, and MBSR, targeting people with cancer, and consisting of 16 interactive modules over a period of 4 weeks. Furthermore, the study was conceptualized to assess the satisfaction with and the usability of the e-psycho-oncological short-term intervention "By your Side," as these parameters are of great importance for its actual use and integration into routine care.

Methods

Procedure and Participants

To gather initial evidence of the effectiveness of the e-psycho-oncological short-term intervention "By your Side," a longitudinal pilot study with a pre-post design was conducted between 4 March 2022 and 4 January 2023. Participants were recruited through the study website, public events, social media, flyers and by contacting cancer-related support groups. Inclusion criteria were a diagnosis of cancer, a minimum age of 18 years, good command of the German language and Internet access. Digital informed consent was given before the start of the study. The study was approved by the ethic committee of the Medical Faculties of the University of Tübingen (293/2018BO1). In error, this trial was not prospectively registered, but we have now registered it retrospectively at the German Clinical Trial Register (https://www.drks.de/search/de/trial/DRKS00036001) with the registration number DRKS00036001.

E-Psycho-Oncological Short-Term Intervention 'By Your Side'

The e-psycho-oncological short-term intervention "By your Side" is a self-guided psycho-oncological intervention, which combines effective psychotherapeutic methods of CBT, ACT, and MBSR. It aims to support patients in developing psychological resources, managing emotions and coping with stress and anxiety. The intervention is offered in the form of a web app, which is accessible via any Internet browser and any web-connected device such as laptops, smartphones or tablets. Previously downloaded material can also be used offline. The intervention includes 16 modules that are directly accessible to the patients. The large number of modules ensures that as many relevant topics as possible are covered and that patients have as much choice as possible. Table 1 provides an overview of the intervention topics

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Table 1. Overview of the E-Psycho-Oncological Short-Term Intervention's "By Your Side" Modules.

Module	Content	Mindfulness (M)
Technical Introduction (Module 1)	Technical introduction to the web-app intervention	No exercise
Module 2	Introduction to the content	Breathing 1
Module 3	Balancing exercise/relaxation (C)	Breathing 2
Module 4	Stress management (C)	Seeing
Module 5	Art-therapy	Doodling
Module 6	Self-care (C)	Self-compassion
Module 7	Physical and mental health	Smelling
Module 8	Dealing with emotions (A)	Experience
Module 9	Dealing with anxiety (C)	Thoughts
Module 10	Dealing with pain (A)	Bodyscan 1
Module 11	Body image (A)	Bodyscan 2
Module 12	Better sleep (C)	Letting go
Module 13	My resources (C)	Listening
Module 14	Staying positive (A)	Here and now
Module 15	Maintaining relationships (C)	Loving-kindness
Review (Module 16)	Review of the whole "By your Side" intervention (A; C)	Favorite exercise from modules 2 to 15

Abbreviations: (A) ACT, acceptance and commitment therapy; (C) CBT, cognitive behavioral therapy; (M) MBSR, mindfulness-based stress reduction.

and how they are covered in each module. The content of the modules is presented by various media such as explanatory and expert videos, audio-guided mindfulness exercises, an interactive skills training and an individual skills box. The average engagement time per module is calculated to be 20 to 30 minutes. The duration of the e-psycho-oncological short-term intervention "By your Side" is 1 month, with a minimum of 7 modules to be completed. The study participants were not informed in advance that they had to complete at least 7 modules in order to be counted as completers. The modules start with an assessment of the patient's current level of distress, perceived mindfulness, coping skills and a brief personal entry in a gratitude journal. Following this, there are 3 main components of psychoeducation, skills training and mindfulness practice, which are included in every module. The skills box helps patients gather specific skills, supportive information and videos during each module. At the end of the training, patients can create a personalized summary of their completed modules and receive a mindfulness exercise plan. To motivate patients to continue the training, a reward system is integrated into the app and, after completing a module, patients can choose between a yoga video, or a cooking recipe adapted to the needs of cancer patients. During the intervention, e-mail reminders are sent when participants are inactive for more than 2 days to ensure adherence to the program.

Assessment Instruments and Schedule

Quantitative data were collected via the online survey platform Unipark. The baseline assessment (T0) was conducted before the start of the intervention. Participants were only able to access the intervention once they had completed the initial assessment. The post-intervention assessment (T1) was conducted after 1 month and the completion of a minimum of 7 modules. The follow-up assessment (T2) took place 1 month after the completion of the intervention. This study included an assessment of sociodemographic and medical data, as well as primary, secondary, and tertiary outcomes, which were collected using validated assessment instruments and self-generated items. All psychometric instruments used were applied in the German-language versions. The assessment schedule and the respective measuring instruments are shown in Table 2.

Sociodemographic and Medical Data

Sociodemographic (ie, age, gender, marital status, level of education and population size of place of residence) and medical data (ie, tumor location, treatment status, mental illness, psychological and psychopharmacological treatment) were collected at the baseline (T0). The participants' attitudes toward online interventions were assessed as a covariate at baseline (T0) with the Attitudes Toward Psychological Online Interventions questionnaire (APOI).[20] APOI scores range from 16 to 80, with higher scores indicating more positive attitudes toward online interventions. Internal consistency of this scale was good (Cronbach's $\alpha = .77$).

Primary and Secondary Outcome Measures

The primary and secondary outcomes were assessed at the baseline (T0), post-intervention (T1) and follow-up (T2). The primary outcome distress was examined with the German

Table 2. Assessment Schedule of the Study.

Measures	Time of measurement		
	Baseline (T0)	Post-intervention (T1)	Follow-up (T2)
Primary outcome			
PSQ-20	X	X	X
Secondary outcome			
PHQ-2	X	X	X
GAD-2	X	X	X
GSES	X	X	X
FMI	X	X	X
Evaluation of "By your Side"			
APOI	X		
SUS		X	
CSQ-I		X	
Sociodemographic and medical data	X		

Abbreviations: PSQ-20, perceived stress questionnaire-20; PHQ-2, patient health questionnaire-2; GAD-2, generalized anxiety disorder scale-2; GSES, general self-efficacy scale; FMI, Freiburg mindfulness inventory; APOI, attitudes toward online interventions; SUS, system usability scale; CSQ-I, client satisfaction questionnaire adapted to internet-based interventions.

version of the Perceived Stress Questionnaire (PSQ-20).[21] The PSQ-20 scores range between 20 and 80, with higher scores indicating a higher level of distress. Internal consistency was excellent (Cronbach's $\alpha = .89$-$.93$). For secondary outcomes, depression symptoms were measured with the Patient Health Questionnaire-2 (PHQ-2).[22] PHQ-2 scores range from 0 to 6, with higher scores indicating higher levels of depression symptoms. Internal consistency ranged between questionable and good (Cronbach's $\alpha = .42$-$.79$). The Generalized Anxiety Disorder Scale-2 (GAD-2)[23,24] was used to examine generalized anxiety symptoms. GAD-2 scores range from 0 to 6, with higher scores indicating higher levels of anxiety symptoms. Internal consistency ranged between questionable and good (Cronbach's $\alpha = .39$-$.80$). Self-efficacy was assessed with the General Self-Efficacy Scale (GSES).[25] GSES scores range from 10 to 40, with higher scores indicating more self-efficacy. Internal consistency was excellent (Cronbach's $\alpha = .85$-$.95$). The Freiburg Mindfulness Inventory (FMI)[26] was administered as a measurement of mindfulness, with scores ranging from 14 to 56. Higher FMI scores indicate a higher level of mindfulness. Internal consistency was excellent (Cronbach's $\alpha = .85$-$.92$).

Tertiary Outcome Measures

The post-intervention (T1) usability of and satisfaction with the intervention were evaluated using the System Usability Scale (SUS)[27] and Client Satisfaction Questionnaire adapted to Internet-based Interventions (CSQ-I).[28] The SUS scores range between 0 and 100 and the CSQ-I scores range from 8 to 32 with higher scores indicating a higher level of usability and user satisfaction, respectively. Internal consistency of CSQ-I was good (Cronbach's $\alpha = .84$), while the internal consistency of SUS was questionable (Cronbach's $\alpha = .52$).

Statistical Analyses

Statistical analyses were performed using R (Version 4.3.1)[29] and RStudio.[30] While the sum scores were calculated for the relevant scales, SUS scores were calculated based on the sum scores. Descriptive statistics were applied to examine the sociodemographic, medical and outcome measures. Participants who completed the full assessment schedule and study dropouts of were compared regarding their sociodemographic and medical characteristics, as well as the outcome measures at baseline via *t*-tests, χ^2-tests, and Fisher's exact tests. The primary and secondary outcome measures and continuous covariates were standardized before the analysis. Repeated measure analysis of covariance (ANCOVA) and post-hoc tests were conducted to determine the difference in distress (PSQ-20) between the baseline (T0), post-intervention (T1) and follow-up (T2) while age, gender, education, mental illness, and attitudes toward online interventions (APOI) were added as covariates. The variables of age and APOI were included in the model in a standardized form. A Shapiro-Wilk test did not indicate no-normality, while Mauchly's test for sphericity showed no violation of the assumption of sphericity. Outliers were checked with the "identify_outliers" function of the R package "rstatix"[31] and 1 outlier was detected. ANCOVAS were calculated including and excluding the relevant outlier and no differences were detected in the results. Therefore, the ANCOVA including the outlier is reported. For the secondary outcomes, repeated-measure ANOVAs and post-hoc tests were conducted, comparing depression symptoms (PHQ-2), generalized anxiety symptoms (GAD-2), self-efficacy (GSES) and mindfulness (FMI) between the baseline (T0), post-intervention (T1) and follow-up (T2). Due to the outliers and violation of the assumption of normality, additional robust ANOVAs were calculated with the R package "WRS2"[32] to verify the results. To evaluate the usability of and satisfaction with the distributions, the mean values and sum scores for SUS and CSQ-I were examined and the P-values were adjusted for multiple comparisons. Furthermore, η^2 and Cohen's *d* were used as effect sizes, with η^2-values around 0.01, 0.06, and 0.14 considered small, medium, and large effects, and *d*-values of 0.2, 0.5, and 0.8 considered small, medium, and large effects, respectively.[33]

Results

Study Population

Baseline (T0) data were collected from n = 91 individuals, n = 82 (90.1%) of whom completed the first module.

Table 3. Sample Characteristics of the Study Population.

Variables	N (%)
Marital status	
Single	4 (17.4)
In a relationship	4 (17.4)
Married	11 (47.8)
Divorced/separated	2 (8.7)
Widowed	1 (4.3)
Other	1 (4.3)
Place of residence (population size)	
Large city (>100 000 residents)	6 (26.1)
Medium sized city (>20 000 residents)	10 (43.5)
Small town (>5000 residents)	4 (17.4)
Rural area (<5000 residents)	3 (13.0)
Level of education	
University education	14 (60.9)
Higher education entrance qualification	5 (21.7)
Secondary school	3 (13.0)
Other	1 (4.3)
Tumor location	
Breast	7 (30.4)
Lymphatic, hematopoietic tissue	3 (13.0)
Skin	3 (13.0)
Endocrine	2 (8.7)
Urinary organs	2 (8.7)
Eye	1 (4.3)
Head and neck	1 (4.3)
Liver/gall bladder	1 (4.3)
Lungs	1 (4.3)
Pancreas	1 (4.3)
Prostate	1 (4.3)
Treatment status	
Currently receiving treatment	12 (52.2)
Treatment is completed	3 (13.0)
Currently receiving aftercare	7 (30.4)
I cannot answer that	1 (4.3)
Total	23 (100.0)

Of all participants, n = 34 (37.4%) completed 7 modules in 1 month, n = 28 (30.8%) took part in the post-intervention assessment (T1). Twenty-five participants could be assessed in the 1-month follow-up (T2), while complete data of all 3 measure points were available from n = 23 (25.3%) participants, which were included in the final data analysis.

Of the N = 23 participants, 82.6% (n = 19) were female. The average age was M = 55.52 (SD = 11.05) years and the age ranged between 31 and 79 years. A total of 73.9% (n = 17) of the participants had children. Overall, 34.8% (n = 8) reported a diagnosis of mental illness and 65.2% (n = 15) received psychological treatment while 21.7% (n = 5) were currently treated with psychopharmacological medications. For additional sample characteristics, see Table 3.

The n = 68 participants who dropped out of the study did not significantly differ from the participants that completed the full assessment schedule regarding the sociodemographic and medical variables reported in this section (all $P > .05$). Further, there were no significant differences regarding baseline values of the primary and secondary outcomes covered in the next sections (all $P > .05$).

Primary Outcome Measure: Distress (PSQ-20)

The PSQ-20 scores were higher at baseline (T0, $M = 52.68$, SD = 16.34) than at post-intervention (T1, $M = 46.96$, SD = 16.79) and at the one-month follow-up (T2, $M = 43.84$, SD = 17.59). Figure 1 visualizes the PSQ-20 scores stratified by measure point. A repeated-measure ANCOVA revealed a significant effect of time on distress between measure points after controlling for age, gender, education, mental illness, and attitudes toward online interventions ($F(2,36) = 4.10$, $p = .025$, $\omega^2_p = 0.02$. The post-hoc tests showed that distress was significantly lower at the 1-month follow-up (T2, $t(22) = 3.14$, $p_{adj} = .014$, $d = .654$) compared to the baseline (T0). There was no difference in distress between the baseline and post-intervention assessment.

Secondary Outcome Measures: Depressive Symptoms (PHQ-2), Anxiety (GAD-2), Self-Efficacy (GSES), and Mindfulness (FMI)

The descriptive statistics of the secondary outcome measures are reported in Table 4. Repeated-measures ANOVAs were conducted to compare secondary outcome measures between the different assessment points. There were no significant differences in depressive symptoms ($F(2, 44) = 2.73$, $p = .077$) between measure points.

Time had a significant effect on anxiety symptoms ($F(2, 44) = 10.05$, $p < .001$, $\omega^2_p = 0.11$). The post-hoc tests revealed that anxiety was significantly higher at baseline (T0) than at post-intervention (T1, $t(22) = 2.89$, $p_{adj} = .025$, $d = .603$) and follow-up (T2, $t(22) = 3.84$, $p_{adj} = .003$, $d = .801$).

Further, repeated-measures ANOVA revealed a significant effect of time on self-efficacy ($F(2, 44) = 10.26$, $p < .001$, $\omega^2_p = 0.09$). Self-efficacy was lower at the baseline (T0) than at post-intervention (T1, $t(22) = -2.88$, $p_{adj} = .026$, $d = .600$) and follow-up (T2, $t(22) = -3.84$, $p_{adj} = .003$, $d = .800$).

Furthermore, time did also significantly effect mindfulness ($F(2, 44) = 13.84$, $p < .001$, $\omega^2_p = 0.13$). Post-hoc tests showed that mindfulness was significantly lower at the baseline (T0) than at post-intervention (T1, $t(22) = -3.28$, $p_{adj} = .010$, $d = .683$) and follow-up (T2, $t(22) = -4.29$, $p_{adj} < .001$, $d = .895$).

Due to outliers and violation of the assumption of normality, additional robust ANOVAs were calculated to verify the results of the initial comparisons. Robust ANOVAs

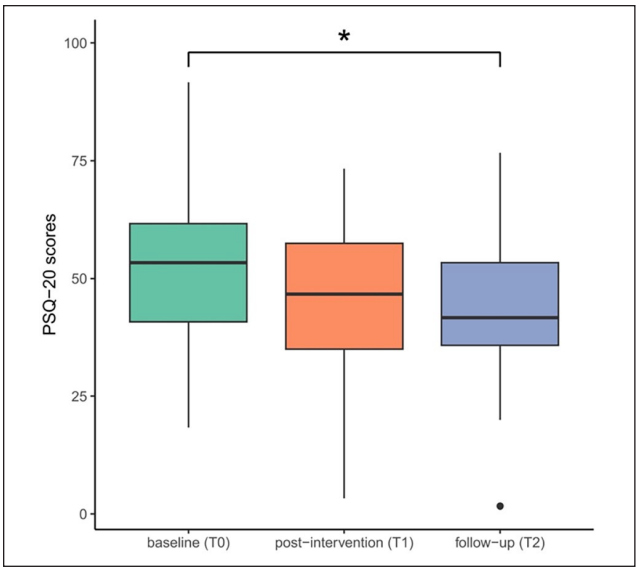

Figure 1. Distress by measure point.
N = 23. PSQ-20 = perceived stress questionnaire-20. *$t(22) = 3.14$, $p_{adj} = 0.014$, $d = 0.654$.
Secondary outcome measures: Depression symptoms, anxiety symptoms, self-efficacy, and mindfulness.

Table 4. Depression Symptoms, Generalized Anxiety Symptoms, Self-efficacy, and Mindfulness by Measure Point.

	Baseline (T0)	Post-intervention (T1)	Follow-up (T2)
Variables	*M* (SD)	*M* (SD)	*M* (SD)
PHQ-2	2.26 (1.21)	2.04 (0.93)	1.74 (0.96)
GAD-2	3.13 (1.52)	2.30 (1.29)	1.96 (1.15)
GSES	26.70 (4.74)	28.96 (3.60)	30.09 (4.10)
FMI	34.74 (6.76)	39.3 (7.19)	41.52 (7.49)

N = 23.
Abbreviations: PHQ-2, patient health questionnaire-2; GAD-2, general anxiety disorder scale-2; GSES, general self-efficacy scale; FMI, Freiburg mindfulness inventory.

were conducted with the R package "WRS2."[32] Time had a significant effect on anxiety symptoms ($F(2, 24) = 7.72$, $p = .004$), self-efficacy ($F(2,27) = 11.38$, $p < .001$), and mindfulness ($F(2, 28) = 19.35$, $p < .001$).

Tertiary outcome measures: Usability (SUS) and user satisfaction (CSQ-I)

Regarding the usability of the e-mental health short-term intervention "By your Side," responses to the SUS were examined. The average participant's SUS score was $M = 89.57$ (SD = 8.04, Mdn = 92.50), indicating good usability. Responses to the individual items are shown in Figure 2.

To investigate satisfaction with the intervention, the CSQ-I was inspected. For this sample, the CSQ-I was $M = 28.00$ (SD = 3.03, Mdn = 28.00), indicating high satisfaction with the intervention. The responses to the items of the CSQ-I are shown in Figure 3.

Discussion

The aim of this study was to gather initial evidence regarding the effectiveness of the e-psycho-oncological short-term intervention "By your Side" that incorporates CBT, MBSR, and ACT techniques and is tailored to reduce distress in patients with cancer. Participants reported a significant reduction in distress 1 month after completing the intervention. This effect was not dependent on age, gender, education, mental illness, or attitudes toward online interventions. In addition, the patients' anxiety symptoms were significantly lower than before the intervention while mindfulness and self-efficacy were increased. However, there was no significant effect on symptoms of depression. The participants evaluated the usability of the digital intervention as high while user satisfaction was also high.

The effect of distress reduction occurred steadily after the intervention (T1) and became significant 1 month after the intervention (T2). A meta-analysis of interventions promoting resilience in cancer patients clarified that interventions with more modules and a longer duration have stronger effects on resilience and that resilience, which is related to lower distress, can improve until 1 year after an intervention.[34,35] The findings indicate that distress reduction may evolve over time. This may be due to the time participants need to integrate new strategies into their daily routine, which might take longer than the intervention itself. A Chinese study published in 2023, in which 175 participants with lung cancer took part in a 4-week guided and supervised MBSR program, showed an immediate reduction of distress after completion.[18] This shows that distress reduction through MBSR programs seems to be feasible after completing a short 4-week intervention. In addition to increased mindfulness, this result was also assumed by the social support from family and friends which participants received.[18] The possibility of a stronger integration of social support into "By your Side" might therefore lead to an even faster reduction of distress, which is necessary given the high rates of distress in patients with cancer.[4] The results of our study are in line with prior research on mindfulness-based online interventions and Internet-delivered CBT as effective approaches for distress reduction in psycho-oncological patient treatment.[6,9]

Another finding about the effects of the e-psycho-oncological short-term intervention "By your Side" was a decrease in anxiety, while no significant effect was observed concerning the reduction of depressive symptoms. A meta-analysis found interventions with a duration over 6 weeks to show

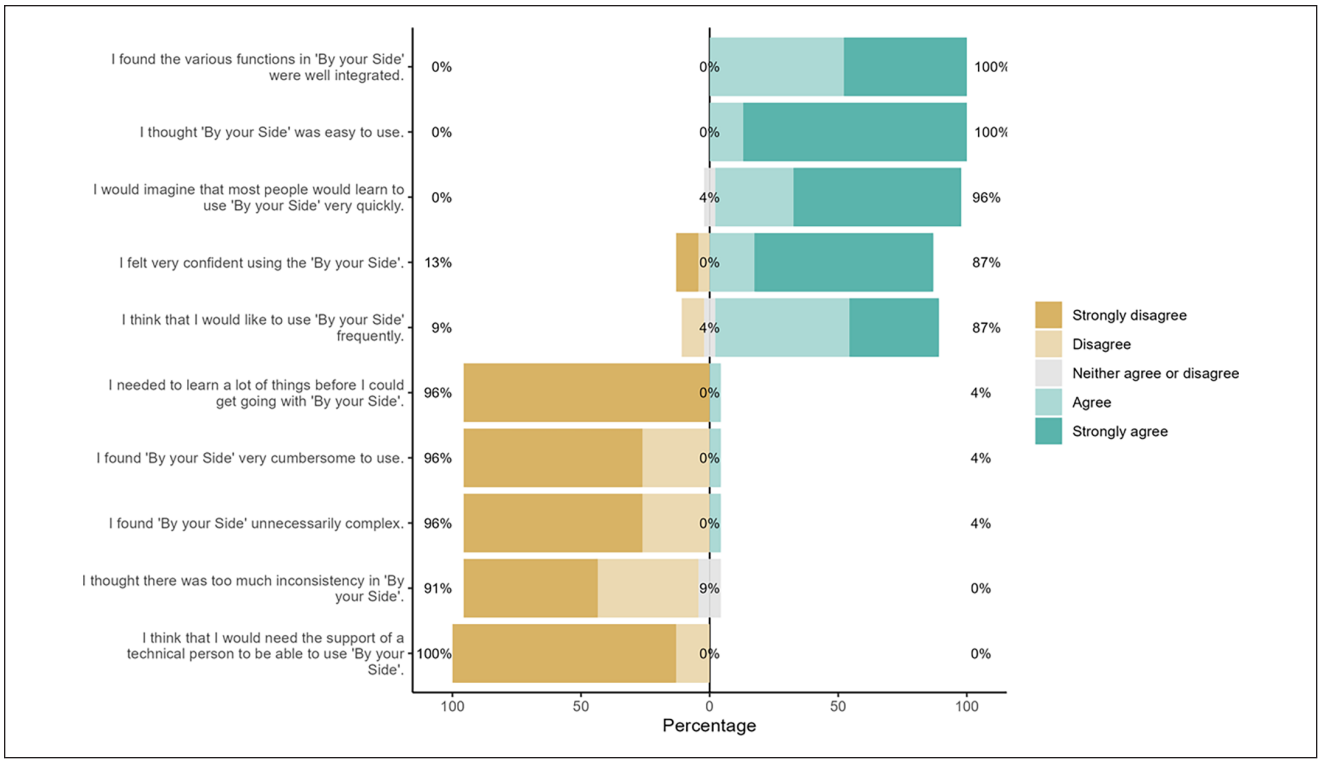

Figure 2. Responses on the system usability scale.
N = 23. Reponses were given on a five-point Likert scale (0 = Strongly disagree, 4 = Strongly agree).

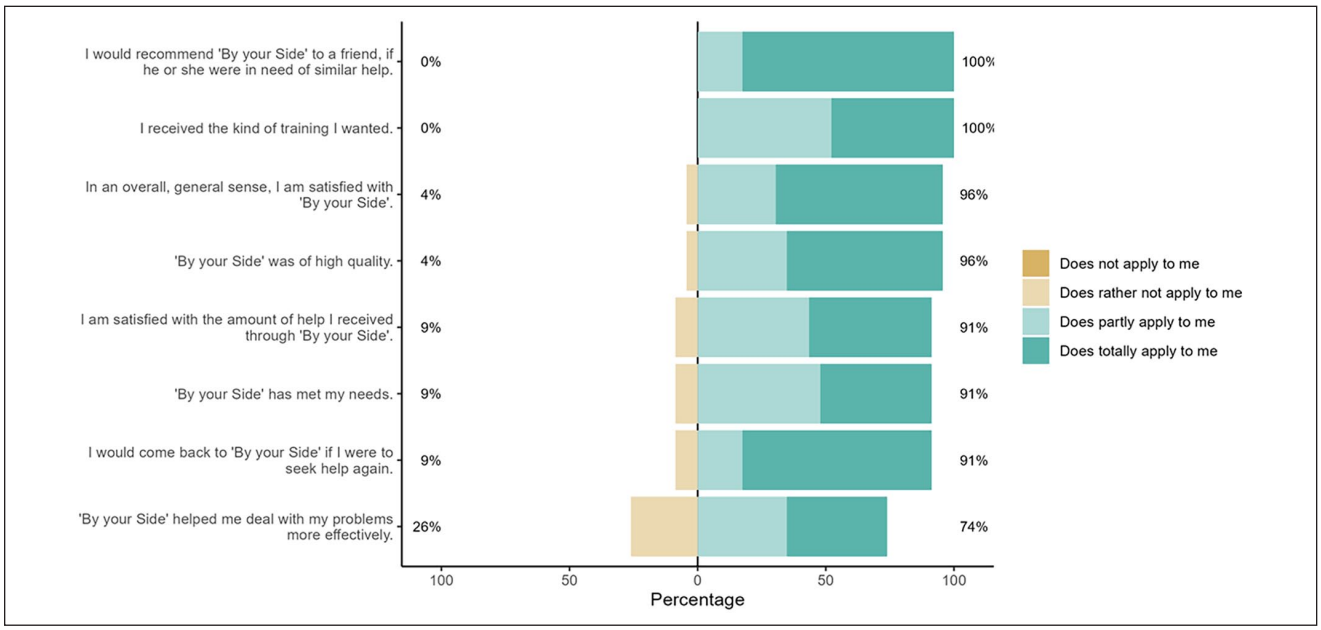

Figure 3. Responses on the client satisfaction scale-I.
N = 23. Reponses were given on a four-point Likert scale (1 = Does not apply to me, 4 = Does totally apply to me).

higher effects on reducing depressive symptoms .[36] Therefore, the relatively short intervention duration of 4 weeks might have been insufficient for achieving a significant reduction in depression. A possible solution to the problem of reconciling short-term interventions and the reduction of depressive symptoms through longer intervention periods could be

provided through targeted screening. For example, this could be achieved by using screening tools for depressive symptoms and offering targeted additional intervention time if psychometric depression scores reach levels of clinical relevance, as seen in the e-mental health intervention "I Can Do."[37]

Further, patients who used the e-psycho-oncological short-term intervention "By your Side" for 4 weeks experienced an increase in self-efficacy and mindfulness. Based on Bandura et al's[38] theory, self-efficacy is the conviction to organize certain actions to achieve a certain goal at the end. This coping effect can result from setting and pursuing goals as well as from developing resilience to setbacks.[38] An increase in self-efficacy through short-term online interventions is in line with another study, which revealed a significant increase in self-efficacy in patients with breast cancer through a 6-week e-mental health intervention, which included daily MBSR home training and a weekly guided session of 2 hours.[15] Mindfulness has been described as a non-judgmental and accepting awareness of the present moment.[39] The result of increasing mindfulness during a 4-week MBSR intervention is in line with recent studies.[18,19]

Participants of the "By your Side" evaluation, who completed 7 modules of the intervention, reported high rates of usability and satisfaction with the intervention. Moreover, most completers could imagine future users being able to quickly learn how to use the intervention. In addition, all completers would recommend the intervention to friends affected by cancer. A possible reason for the high level of satisfaction and usability might be the intervention's patient-centric process of development.[40] In contrast, the initial assumption was that short interventions would be associated with higher adherence. This assumption is based on the study of Wang et al,[19] who also tested a 4-week IMBSR intervention in patients with cancer and found good results in terms of completion rate and a 90% adherence rate. The e-psycho-oncological short-term intervention "By your Side" showed a comparatively poorer adherence with a high dropout rate, so that the advantage of an increased adherence with shorter chosen intervention periods, in this case 4 weeks, cannot be confirmed for this intervention. At least the majority of all participants (90%) of the e-psycho-oncological short-term intervention "By your Side" used the intervention at least minimally by completing the first module. Potential reasons for the high dropout rate are discussed in more detail in the Section "Study Limitation."

Study Limitations

Some important limitations of the present study need to be considered. Firstly, the study was not preregistered which may have introduced some biases into the results.

Secondly, the most important limitation is the small study sample. Only a few participants completed the minimum amount of 7 modules within the 4-week period and were therefore included in the final analysis. By establishing a minimum of 7 completed modules, it was ensured that the content of this short-term intervention complies with the recommended period of MBSR interventions.[17] However, the resulting higher intensity of the intervention may have led participants to drop out. One possible reason for this could be that cancer patients might have less capacity to complete such intensive training due to treatment, emotional and socioeconomical burden. Another reason for the high dropout rate might have been the presentation format of the "By your Side" intervention: The use of digital treatment offers requires a basic level of digital knowledge and skills. Technical problems or dissatisfaction might have further contributed to dropouts or non-adherence. While user satisfaction was high, possible reasons for dropouts could not be collected from participants who did not complete the assessment. Another reason for the high dropout rate could be the study participants' unawareness of the fact that at least 7 modules had to be completed in order to be considered a completer. Further studies should therefore investigate how these utilization skills can be better supported and how technological barriers of use and additional reasons for dissatisfaction can be removed in order to ensure higher adherence to digital interventions.

Moreover, the sample of subjects was selected by convenience sampling due to cost-time effectiveness. It is therefore not suitable for deriving generalized statements. As the small study sample was mostly composed of women with higher education, the study sample can cannot be considered representative. Further, adherent participants may have been more self-motivated or more capable to self-guide themselves through the modules than those who dropped out. Therefore, selection bias needs to be considered when interpreting the results. To draw further conclusions about the intervention's effect, a similar investigation conducted with a more representative sample would be necessary and individuals with a greater need for external guidance need to received targeted support.

Thirdly, due to the study design of a pilot study, no control group was implemented. Therefore, it is not guaranteed that the positive effects observed in the study can be attributed to the intervention. Although the results of the e-psycho-oncological short-term intervention "By your Side" are promising, a precise evaluation of its efficacy is not possible based on the limited data gathered in this pilot study. In order to draw more reliable conclusions about the intervention's effectiveness, a randomized controlled trial would be required.

Finally, only a single follow-up assessment was conducted after 1 month. Additional follow-ups over longer periods of time would be helpful to draw conclusions concerning long-term effects.

The presented data are based on self-report. Especially the diagnosis of cancer can therefore not be objectively verified. However, participants were recruited primarily in cancer-specific contexts to address this limitation.

Nevertheless, this study gives a first promising indication of the intervention's potential and adds to the evidence supporting the use of e-psycho-oncological short-term interventions in general.

Conclusion

In summary, the present longitudinal pilot study provides prelimited evidence that the e-psycho-oncological short-term intervention "By your Side" seems to be an helpful tool for reducing distress and anxiety symptoms by simultaneously improving mindfulness and self-efficacy in cancer patients. Despite the positive effects, the high dropout rate (74.7%) and small convenience sample must be taken into account. Future research should address possible barriers to adherence in a larger, more representative sample. Nevertheless, the intervention shows promising indications for a practicable implementation into the "real world" healthcare system, as usability and satisfaction were rated high. E-psycho-oncological short-term interventions such as "By your Side" are one way to provide low-threshold support to cancer patients within a short period of time that is not tied to a specific location. This could be an important advantage to address existing barriers and gaps in cancer care. The results from this longitudinal intervention study are promising and indicate a good enhancement of current treatment approaches.

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Autorship

AB and JG conceptualized the study. Project administration was performed by SRS and AW. Recruiting was supported by JBK, JH, CS, YE, MT and EMS. LMJ were responsible for data curation, statistical analyses, and reporting the results (with SES). AB supervised the statistical analyses. SES wrote the draft of the manuscript. AB and JG supervised the draft preparation. All authors gave substantial feedback to the initial draft of the manuscript. All authors reviewed and approved the final manuscript.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of Conflicting Interests

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Patient Consent Statement

Digital informed consent was given before the start of the study.

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