AN EVALUATION OF THE COMPAS-Y APP

Effects of a mobile self-compassion intervention on self-compassion, anxiety and depression

Masterthesis

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Abstract

Background: In 2021 approximately 124.000 people were diagnosed with cancer in the Netherlands. It is an important area to study, as living with cancer have been shown to be associated with a number of negative psychological health outcomes. Studies indicate that half of all cancer patients develop a psychiatric disorder, frequently an anxiety disorder or a depression. This comes with many concerns, hence designing interventions that are successful in treating or preventing psychological symptoms is important. Self-compassion has been identified as a promising framework within which to ground interventions aiming to reduce these psychological symptoms. Despite the potential of self-compassion interventions for cancer patients, relatively few interventions exist, and moreover, the interventions that do exist have difficulties in finding participants. The use of technology to practice self-compassion can increase efficiency, improve access and improve the quality of care , thereby reaching patients who may not have participated otherwise. The current study reports on a evaluation of the mobile app Compas-Y, created for recently diagnosed cancer patients.

Aim: The aim of this study was to evaluate the use and appreciation of the Compas-Y app, to assess whether completing the self-compassion intervention positively impacts depression and anxiety symptoms and the levels of self-compassion within participants, and to understand who can benefit from the intervention.

Methods: This study was part of an overarching mixed method study about a self-compassion intervention app for recently diagnosed cancer patients. For this study the purposive sampling method was used. The participants were recruited from two hospitals with the help of Oncology nurses. The study had a one-group pre-test post-test design with assessments conducted at baseline (T0) and post intervention (T1). The participants participated in an 8-week self-compassion mobile app intervention. The questionnaires contained questions on demographics and illness related variables (only at T0), use and appreciation of the app (only at T1) and a number of potential outcome variables: self-compassion, anxiety and depressive feelings (assessed at T0 and T1).

Results: A total of 37 participants were included in the analysis. The mean age (SD) was 52.3 (10.7) years. The Compas-Y app was overall positively appreciated and well used by the participants, yet the drop out number was quite high. This study found a significant decrease in anxiety from T0 to T1 ($p = .002$), although it did not find significant differences on depression ($p = .548$) and self-compassion ($p = .281$). This study also found a significant medium correlation between the changes in self-compassion and changes in depression ($r(35) = -.424$,

$p = .009$), indicating that an improvement in self-compassion was associated with a decrease in depression. The small correlation between changes in self-compassion and changes in anxiety was found to be in the same direction, however this correlation was not significant ($r(35) = -.26$, $p = .120$). Lastly, this study found a nearly significant medium correlation between the changes in self-compassion and the appreciation of the Compas-Y app ($r(31) = -.340$, $p = .053$), indicating that a higher appreciation of the Compas-Y app was associated with bigger improvements in self-compassion.

Conclusion: This study presents an evaluation of a mobile-based intervention for anxiety and depression within recently diagnosed cancer patients, grounded in self-compassion. As such, this study bridges a gap in the knowledge about mobile interventions targeting psychological symptoms within cancer patients. This study found a decrease in anxiety after the intervention, however this result should be interpreted with care, since no control group was used it is unclear which mechanism caused this decrease. Besides that, despite the fact that the intervention failed in increasing the levels of self-compassion, the findings provide preliminary evidence that an increase in self-compassion is associated with a decrease in depression. This study also provides preliminary evidence that a higher appreciation of the app is associated with bigger improvements in self-compassion. Future research should aim to clarify the mechanisms of action of the intervention and who is most likely to benefit from it, and examine its capacity to achieve significant effects on self-compassion.

Overview

1. Introduction

In 2021 approximately 124.000 people were diagnosed with cancer in the Netherlands (KWF, 2022). The number is getting higher every year because people are getting older, the population is growing, and treatments are getting better, which leads to people living with the disease for a longer time (KWF, 2022). Living with cancer has a huge impact on one's live. A chronic illness has the potential to induce profound changes in a person's life, resulting in negative effects on quality of life and well-being (de Ridder et al, 2008). It is an important area to study, as living with cancer have been shown to be associated with a number of negative psychological health outcomes.

Studies indicate that half of all cancer patients develop a psychiatric disorder, frequently an anxiety disorder or a depression (Burgess et al., 2004; Miovic & Block, 2007; Mitchell et al., 2011; Pitman et al., 2018; Razavi & Stiefel, 1994; Spiegel, 2018; Stiefel & Razavi, 1994; Xu Peh et al., 2016). Anxiety and depression can cause disruption and can be detrimental to the quality of life (Nikbakhsh et al., 2014; Stark & House, 2000). Suffering from depression or anxiety does not only impact the quality of life of cancer patients, it also may interfere with the treatment, tribute to a longer hospital stay, reduce adherence to medical treatment and lead to poor cancer survival (Pitman et al., 2018; Zhu et al., 2020). For example, patients can be less likely to take the cancer treatment medication and continue with good health habits (Nikbakhsh et al., 2014). They can also withdraw from family or other social support systems, meaning they will not get the support they need to cope with the cancer (Nikbakhsh et al., 2014). Given these concerns, designing interventions that are successful in treating or preventing these psychological symptoms is important.

Self-compassion has been identified as a promising framework wherein interventions aiming to reduce these psychological symptoms can be grounded (van der Donk et al., 2020; Taveres et al., 2021). Self-compassion has proven to be a skill that can be trained (Austin et al., 2019; Jazaieri et al., 2013; Tavares et al., 2021). It has already been used in compassionate mind training (Germer & Neff, 2019) and compassion focused therapy (Gilbert, 2009). According to Neff (2003), self-compassion refers to a personal attitude that is characterized by being open to one's own suffering, taking an understanding and non-judgmental attitude toward one's failures, and recognizing traumatic experiences as part of human life. It consists of three facets (Neff & Knox, 2016). The first one is self-kindness, which means being kind to yourself, instead of being self-judgmental. The second one is common humanity, which means recognizing that all people suffer and/or make mistakes at one point in their lives, so we tend to feel less isolated

in difficult moments, instead of a sense of isolation, thinking that you are the only person suffering or making mistakes. The last one is mindfulness, which means being aware of present moment experience in a clear and balanced manner, instead of being over-identified with thoughts and feelings. Neff & Knox (2016) state that self-compassion provides warmth and support in difficult times, which gives people the emotional resources necessary to endure painful or challenging experiences. It also softens and soothes negative emotions, allowing them to dissipate more easily, so that people can bounce back quicker. Accordingly, self-compassion can be helpful when dealing with difficult live events.

Self-compassion has already proven to be beneficial for psychological adjustment to chronic diseases and it seems particularly relevant for those experiencing more negative life events (van der Donk et al., 2020; Taveres et al., 2021). Sirois et al. (2015) found that self-compassion may be an important quality to cultivate for promoting positive health behaviours, due in part to its association with adaptive emotions. Yamaguchi et al. (2014) found that self-compassion lowered depressive symptoms within college students fom the U.S. and Japan, and that people who show compassion to themselves experience greater psychological health and resilience. Also Jazaieri et al. (2013) found that within adults self-compassion is associated with reductions in depression, anxiety, and it is associated with many positive qualities, including greater coping with adversity. Thus, there is strong theoretical grounding for the notion that self-compassion may be effective in decreasing psychological symptoms for people that are experiencing more negative life events.

However, the research focused on the effect of self-compassion on the psychological symptoms within cancer patients is still in its infancy. Previous research in people with cancer has already found that higher levels of self-compassion were associated with fewer symptoms of depression and anxiety. Pinto-Gouveia et al. (2013) found that self-compassion is associated with decreased psychopathological symptoms of stress and depression, and better quality of life in cancer patients. Zhu et al. (2019) found that self-compassion is beneficial for cancer patients in terms of fewer symptoms of depression and anxiety. Hence, increasing self-compassion within cancer patients may reduce the psychological symptoms they are dealing with, but more research is needed to find interventions that are successful in improving self-compassion in clinical samples.

Despite the potential of self-compassion interventions for cancer patients, relatively few interventions exist, and moreover, the interventions that do exist have difficulties in finding participants (Ferrari et al., 2019; Gilbert, 2018). The use of technology to practice self-

compassion can be a useful tool to lower the threshold. At this point, the use of technology in self-compassion-based interventions for cancer patients is scarce (Austin et al., 2019; Austin et al., 2022). As health care costs continue to rise, an important concern is whether it is possible to control costs while maintaining the quality of health care services (Bergmo, 2015). Thereby, people with cancer already face many demands such as many medical appointments and not feeling well enough to join sessions (Austin et al., 2022). The use of technology to practice self-compassion can increase efficiency, improve access and improve the quality of care (Austin et al., 2022; Bergmo, 2015), thereby reaching patients who may not have participated otherwise (Austin et al., 2022).

Given the literature reviewed above highlighting the need for an accessible self-compassion intervention for cancer patients, the current study reports on an evaluation of a mobile app created to fill this gap. The Smartphone app '*Compas-Y*' was developed to provide the self-compassion intervention. Researchers, cancer patients and nurses from oncology departments worked together to make an accessible intervention to increase resilience and give support in the first phase after the diagnosis. The current study aimed to evaluate the use and acceptability of the app, to assess whether completing the self-compassion intervention positively impacts depression and anxiety symptoms and the levels of self-compassion within participants, and to understand who can benefit from the intervention. Therefore, the research questions of this paper will be:

1. To what extend was the Compas-Y app used?
2. How was the Compas-Y app appreciated?
3. Did the levels of self-compassion, anxiety and depression within participants change after the intervention?
4. Is there a correlation between changes in self-compassion and changes in anxiety and depression?
5. To wat extend are personal characteristics (gender, education level, time spend on the app and appreciation of the app) predictive for changes in self-compassion?

2. Methods

2.1 Design

This study was part of an overarching mixed method study about a self-compassion intervention app for recently diagnosed cancer patients. The study had a one-group pre-test post-test design with assessments conducted at baseline (T0), post-treatment (T1, three months after baseline) and at follow up (six months). The participants participated in an 8-week self-compassion mobile app intervention. In addition to the baseline and post-treatment questionnaires, log data were analyzed, interviews were conducted with patients and nurses, and an ESM study was conducted to gain more insight into the longitudinal relationship between self-compassion and mood. For the current research paper only the already collected data of the baseline and post-treatment questionnaires were used.

2.2 Intervention

The Compas-Y app was designed in a previous study, in collaboration with patients and nurses in a series of workshops. Psychologists and oncologists also contributed. In this study, participants practice with the Compas-Y app on different aspects of self-compassion for eight weeks, and every week a new module becomes available. The Compas-Y app contains of six sequential training modules as well as features that are accessible at any time from the home page. An overview of the homepage is giving in figure 2 and a table of content of all the modules and supportive functionalities is presented in table 2.

Table 1

Overview of app modules and supportive functionalities with their key components translated to English

Module	Key components
1. Introduction to the app and self-compassion	- Psycho-education about self-compassion
	- Exercises in mindful awareness and soothing breathing rhythm
	- Exercise in finding (brief) positive experiences throughout the day
2. Emotions in the context of cancer	- Psycho-education about three emotion systems (soothing, drive and threat)
	- Soothing breathing rhythm exercise with imagery (soothing)
	- Compassionate information seeking; finding resources based on own needs (drive)
	- Psycho-education about anxiety; practicing to recognize and allow anxiety (threat)
3. Self-compassion and self-criticism	- Psycho-education about self-compassion and self-criticism
	- Imagery exercises about compassionate self and inner critic
	- Soothing breathing rhythm exercise with compassionate friend
	- Self-compassion expressive writing exercise
4. Taking care of your body	- Soothing breathing rhythm-based compassionate body scan
	- Psycho-education and exercises about the difference between compassionate motivation and self-correction and self-critical motivation or attacking
	- Psycho-education about compassion for own needs in the context of sexuality and intimacy
5. The people around you	- Psycho-education about the three flows of compassion
	- Soothing breathing rhythm-based loving-kindness meditation
	- Setting boundaries and asking for help based on compassion for own needs
6. Continuing with resilience	- Psycho-education and exercises about positive psychology: gratitude, savoring, strengths
	- Reflection on self-compassion practice and how to continue
	- Soothing breathing rhythm meditation with focus on tone of voice, posture etc.

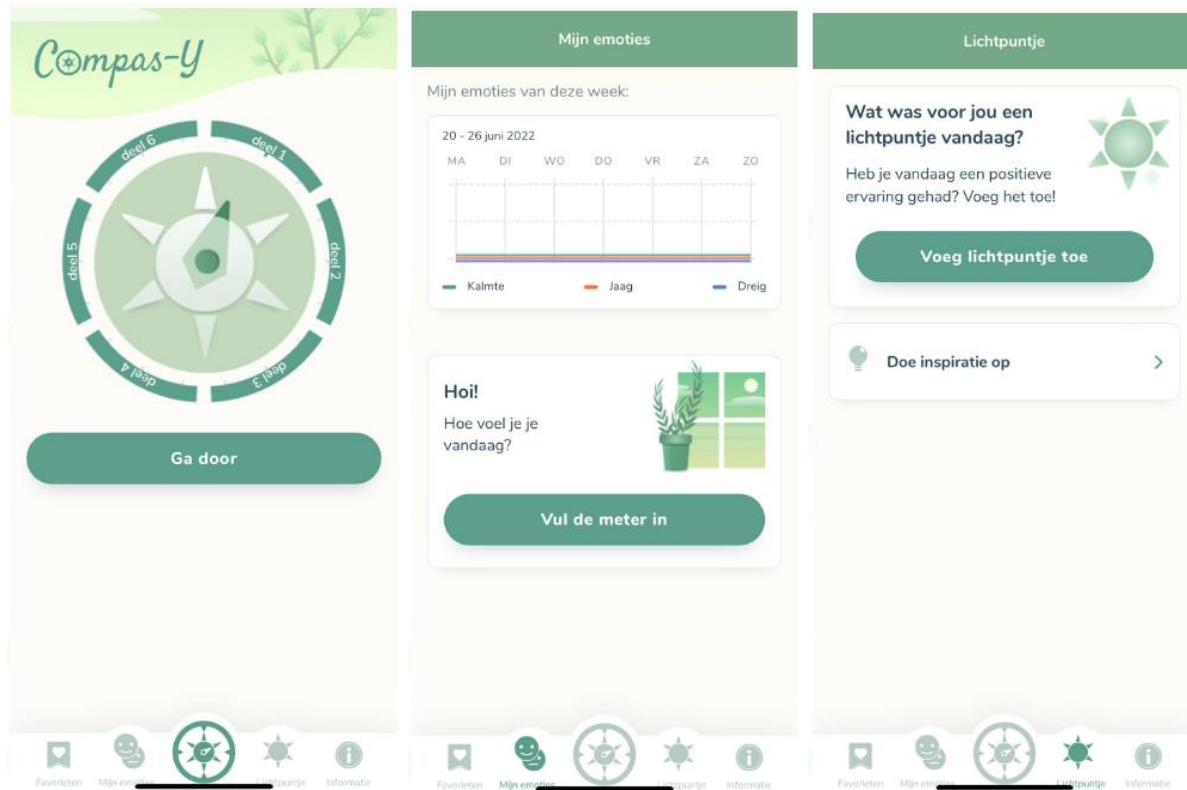| Supportive functionalities	Description
Overview of modules	Visual element central to the homepage (compass symbol) that depicts the (availability of) 6 modules and user progress
Mood tracker	Mood tracking (one question for each emotion system) with automated feedback based on three emotion systems
Favorite exercises	Marking exercises as favorite within the modules, which then appear in the users' personal list of favorites
Light of the day	Exercise where user types a (brief) positive experience of their day, supported by examples
Practical information	List with weblinks about (living with) cancer, each with descriptions
Push notifications	Daily messages containing quotes and brief exercises, with an option to reduce the frequency or turn messages off

Figure 2. *On the left: Homepage of the Compas-Y app, containing a compass navigation element with the six modules (with every module unlocked) and a menu bar with the supportive functionalities. In the centre: The supportive functionality 'mood tracker'. On the right: The supportive functionality 'light of the day'.*

Each module has a theme, some subjects that are featured are being kind to yourself, handling anxiety and insecurity, taking care of your body, asking for support from others or setting boundaries and being aware of the positive sides of your life. Each module includes some exercises (for example: How do I treat a friend?) and psycho-education aimed at cultivating self-compassion. Besides that, the app also has some other supportive functionalities. There is a mood tracker, to help gain insight in your emotions. A light of the day, where users type a (brief) positive experience of their day to help spend attention to the positive aspects in your life. Daily notifications containing quotes and brief exercises, to help bring moments of rest, attention or appreciation to your day and to stimulate integration of the content into daily life. And practical information links, to help find reliable information about cancer, living with cancer, and self-compassion. Users can track their progress on the home page, were a compass symbol indicates which (components of) modules are completed as well as which component was last opened.

2.3 Participants & Procedure

The study was ethically approved by 'De Ethische Commissie BMS' from the University of Twente, and the 'Raad van Bestuur' from the 'Medisch Spectrum Twente' (MST) and the 'Universitair Medisch Centrum Groningen' (UMCG).

Applicants had to meet the following criteria to participate in the study: (1) they needed to be aged 18 and older; (2) the cancer diagnosis needed to be recently (within 12 months); (3) the treatment needed to be curative intended; (4) they needed to be proficient in Dutch; (5) they should have a smartphone, computer or tablet at their disposal; (6) they needed to be willing to try out the app for 2 hours per week and fill in the questionnaires.

For this study the purposive sampling method was used. The participants were recruited with the help of Oncology nurses. The oncology nurses of the MST and the UMCG were informed about the research and the app, and they informed patients about the study with a brochure. On the brochure there is a QR-code and a web-link that directs towards the website of the study. The prospective participants can read more about the study and self-register for the study through the website. With this registration the data of first names, last names, hospital and phone numbers were collected.

87 Participants entered the study, 47 of them withdrew during the intervention. Three of the participants did not complete the questionnaires. After removing them from the data, 37 participants were included in the analysis. Three participants did not finish the last questionnaire about the use and appreciation of the app. After removing them from the data, 34 participants were included in the analysis about use and appreciation of the app.

After registration, the participants received an introduction (*appendix 1)* and were asked to sign the informed consent (*appendix 2*) where exclusion questions were asked (*Are you 18 years of older?*; *Are you recently (within 12 months) diagnosed with cancer?*; *Is your treatment focused on curing?*). By answering '*no'* to one of these questions, people were excluded from the study. After the questions they could choose between participating in the study or not. After continuing, they received an information letter about the study and they had to agree to the terms of conditions of the study (*appendix 3*). People who consented to participate were lead to an online questionnaire. After completion of this questionnaire, they received an email with an invite and access code for the Compas-Y app to start with the intervention. After 8 weeks when the intervention was completed, another email was sent to fill in an online questionnaires again. The questionnaires took around 15-25 minutes at a time.

2.4 Instruments

The questionnaires contained questions on demographics and illness related variables (only at T0), use and appreciation of the app (only at T1) and a number of potential outcome variables: self-compassion, anxiety and depressive feelings (assessed at T0 and T1).

Demographics and illness related variables.

Information concerning demographics and clinical variables was gathered with multiple questions (see table 2 for the answering options). Measured were age (*What is your age (in years)?*), gender (*I am a …*), marital status (*What is your marital state?*), work status (*Which of the following describes your most important daily activities the best at this moment?*) and education level (*What is the highest education you completed with a diploma?*). Information concerning clinical variables was gathered with multiple questions (see table 2 for the answering options). First, there was an open question about the diagnosis. Second, there was an open question about how long ago they have been diagnosed with cancer. Third, there is a question with multiple answers possible about which treatments they received or are currently undergoing. Last, there is a question with multiple answers possible about which additional treatments they received or are currently having.

Use and appreciation of the Compas-Y app.

The use and the appreciation of the app was measured with multiple questions and questionnaires. The first question was about how much time they spend on the app and the exercises. It was rated on a six-point ordinal scale (*1 = less than 30 minutes a week, 2 = between 30 and 60 minutes a week, 3 = 1 hour a week, 4 = between 1 and 2 hours a week, 5 = between 2 and 3 hours a week, 6 = more than 3 hours a week*). Next, there was a questionnaire about what parts of the app they used (e.g., *Part 1 Introduction to the app and self-compassion*). Items were rated on a four-point Likert scale (*1 = not, 2 = partly, 3 = mostly, 4 = fully*). Next, there was a questionnaire about how far the different functionalities of the app appealed to them (e.g. *The informative texts*). Items were rated on a four-point Likert scale (*1 = not, 2 = partly, 3 = mostly, 4 = fully*). Regarding appreciation, we asked participants to indicate how they thought of different aspects of the app (e.g., *What did you think of the language use?* Items could be answered on a five-point Likert scale (*1 = bad, 2 = mediocre, 3 = reasonable, 4 = good, 5 = very good*). There were also some open questions about the app (e.g., *What did the app bring you, how did it help you?, Which three parts of the app did you like the most?, Do you have any*

tips for improving the app?). Engagement was assessed with the *Twente Engagement with eHealth Technologies Scale* (*TWEETS*; Kelders et al., 2020).. It defines engagement as a combination of behavior, cognition and affect. The TWEETS consists of 9 items on a five-point Likert scale (*1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree*). Of the 9 items, 3 are aimed at assessing behavioral engagement (e.g., *I think Compas-Y became part of my daily routine*), 3 on cognitive engagement (e.g., *Compas-Y made it easier to be kind to myself*), and 3 on affective engagement (e.g., *I enjoyed using Compas-Y*). Furthermore, the scale allows for adaptation to the studied technology by adding the technology, the goal, and the behavior relating to the goal. The scale showed good reliability in the current study (α = .88)

Anxiety & Depression

Anxiety and depressive feelings were measured with the 14 item *Hospital Anxiety and Depression Scale* (*HADS;* Pouwer & Snoek, 1997). It assesses anxiety feelings with 7 items (e.g., *I feel tense lately*) and depressive feelings with 7 items (e.g., *I still enjoy the things I used to enjoy*). Items are rated on an ordinal four-point Likert scale (e.g., 0 = *Most of the time,* 3 = *Not at all*; 0 = *Definitely as much,* 3 = *Barely*). Scores for anxiety feelings can be calculated by recoding the negative items and subsequently summing the uneven questions, with higher scores indicating higher feelings of anxiety. Scores for depressive feelings can be calculated by recoding the negative items and subsequently summing the even questions, with higher scores indicating higher feelings of depression. For the subscales, a total score of 0-7 indicates no anxiety disorder or depression, 8-10 indicates possibly an anxiety disorder or depression and 11-21 indicates likely an anxiety disorder or depression. The total score is the sum of the two subscales. The scale showed good reliability in the current study (α = .90 at T0, α = .88 at T1). The subscales also showed good reliability (subscale anxiety: α = .82 at T0, α = .87 at T1; subscale depression: α = .84 at T0, α = .77 at T1)

Self-compassion

Self-compassion was measured with the *Self-compassion Short-form* (*SCS-SF;* Raes et al., 2011) (12 items instead of 26), with subscales *Self-Kindness, Self-Judgment, Common Humanity, Isolation, Mindfulness* and *Over-identification* (e.g., *When I fail at something important to me, I become consumed by feelings of inadequacy*). The short form correlated almost perfectly with the original, longer version of the scale (Neff, 2003). Items are rated on a

seven-point Likert scale (0 = *Seldom or never,* 7 = *Almost always*). Subscales scores are computed by calculation the mean of subscale item responses. The total self-compassion score can be calculated by recoding the negative subscale items (*Self-judgement, Isolation and Over-identification*) and then compute a total mean, with higher scores indicating greater self-compassion. The scale showed good reliability in the current study (α = .88 at T0, α = .87 at T1).

2.5 Data-analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 28.0.1.0 Missing data were removed. Items 1, 3, 5, 11 and 13 for anxiety, 6, 8 and 10 for depression and 1, 4, 8, 9, 11 and 12 for self-compassion were recoded, as they were negative, meaning a high score on these questions did not cohere with the other questions in the construct. For anxiety, the total score for all participants was computed by summing the uneven questions. For depression, the total score for all participants was computed by summing the even questions. For self-compassion, the total score for all participants was computed by calculating the mean. To calculate the changes in self-compassion, anxiety and depression for all participants, the scores at post-treatment were subtracted from the scores at baseline. The total score for all participants on the appreciation questionnaire (TWEETS) was computed by calculating the mean.

To examine the usage and appreciation of the app the descriptive statistics were used.

To examine the changes in self-compassion, anxiety and depression after the intervention, a paired samples t-tests were used. Prior to calculating, it was concluded that the assumptions of normality and normality of difference scores were not violated after outputting and visually inspecting the relevant histograms. The effect size was calculated using Cohen's d formula (J. Cohen, 1988). Cohen's *d* is an effect size used to indicate the standardized difference between to means.

To assess the size and direction of the linear relationship between changes in self-compassion and changes in anxiety and depression, and between changes in self-compassion and the appreciation of the Compas-Y app, bivariate Pearson's product-movement correlation coefficients were calculated. Prior to calculating, the assumptions of normality, linearity and homoscedasticity were assessed and found to be not violated.

To examine whether any subject-specific characteristics (gender, education and time spend on the app and exercises) modulated changes in self-compassion from baseline to post-

treatment, multiple one-way between groups analysis of variance (ANOVA) were used. For this analysis, education was divided in to two groups: low to mediate and high. Prior to calculating, inspection of the skewness, kurtosis and Shapiro-Wilk statistics indicated that the assumption of normality was supported for all conditions. Levene's statistic was non-significant for all conditions, and thus the assumption of homogeneity of variance was not violated.

3. Results

3.1 Description of the study group

The sociodemographic data and characteristics of the participants are summarized in table 2. The average age of the participants was 52.3 (SD 10.7, range 28-77) years. Most participants were female (78%), married (78%), working (43%) and mediate educated (51%). The most common type of cancer was breast cancer (40%) and the most common type of treatment was chemotherapy (73%).

Table 2

Sociodemographic characteristics of participants (N =37).

Variable	Category	n (%)	Mean (SD)
Gender	Male	8 (22)	
	Female	29 (78)	
Age			52.3 (10.7)
Marital status	Married, registered partners or living together	29 (78)	
	Single, divorced or widow(er)	8 (22)	
Work status	Paid work	16 (43)	
	Incapacitated	2 (5)	
	Sickness law	10 (27)	
	Retired	4 (11)	
	Housewife/man	3 (8)	
	Other	2 (5)	
Education	Low	1 (3)	
	Mediate	19 (51)	
	High	17 (46)	
Diagnosis	Breast cancer	16 (40)	
	Prostate cancer	5 (13)	
	Esophagus cancer	4 (11)	
	Lymphoma	3 (8)	
	Lung cancer	2 (5)	
	Melanoma	2 (5)	
	Colorectal cancer	1 (3)	
	Ovarium cancer	1 (3)	
	Other	3 (8)	
Treatment	Chemotherapy	27 (73)	
	Operation	13 (35)	
	Immunotherapy	12 (32)	
	Radiotherapy/radiation	10 (27)	
	Hormonal therapy	7 (19)	
	No therapy	2 (5)	
	Targeted therapy	1 (3)	
	Other	3 (8)	

3.2 Usage of the Compas-Y app

The majority of participants (60%) spend more than 30 minutes a week on the Compas-Y app and the exercises (table 3).

Table 3

Time spend on the Compas-Y app and the exercises (N=34)

Item	Category	Frequency (%)
Time (app and exercises)	Less than 30 minutes a week	15 (41)
	Between 30 and 60 minutes a week	10 (27)
	1 Hour a week	6 (16)
	Between 1 and 2 hours a week	3 (8)
	Between 2 and 3 hours a week	0 (0)
	More than 3 hours a week	0 (0)
Missing		3 (8)

Modules 1 to 4 were fully used by more than half of the participants (53%-71%), though the number of participants claiming to use the part fully declined per part (table 4). Modules 5 and 6 were reported as 'not used' by more than a third of the participants (35%-38%).

Table 4

Self-reported usage of the different modules and supportive functionalities of the Compas-Y app, scale 1-4 (N=34).

	Frequency (N)				Mean (SD)
What components of the app did you use?	Not (1)	Partly (2)	Mostly (3)	Fully (4)	
Modules					
Module 1 Introduction to the app and self-compassion	0	3	7	24	3.6 (.7)
Module 2 Emotions in the context of cancer	4	4	4	22	3.3 (1.1)
Module 3 Self-compassion and self-criticism	7	3	3	21	3.1 (1.3)
Module 4 Taking care of your body	7	3	6	18	3.0 (1.2)
Module 5 The people around you	12	5	4	13	2.5 (1.3)
Module 6 Continuing with resilience	13	6	6	9	2.3 (1.2)
Supportive functionalities					
Light of the day	15	13	3	3	1.8 (.9)
Practical information	14	15	5	0	1.7 (.7)
Mood tracker	20	11	2	1	1.5 (.7)
Favourite exercises	19	13	2	0	1.50 (.6)

The supportive functionalities were less used. Almost all participants (82%-94%) did not use them at all or only used them partly (table 4).

3.3 Appreciation of the Compas-Y app

There was some variation in how much the different functions of the app appealed to the participants (table 5). The informative texts were most appreciated: these texts appealed (at least partly) to nearly all participants (94%). Most participants also liked (at least partly) the exercises, the push notifications, the experiences by others and the light of the day (82%-91%). Aspects that were less appreciated were: the links to the practical information, the option to mark favourites and the mood-tracker. These functionalities were marked as 'not appealing' by about a third of the participants (29%-31%)

Table 5

To what extend different functionalities of the Compas-Y app appealed to the participants, scale 1-4 (N=34).

	Frequency (N)				Mean (SD)
To what extend does … appeal to you?	Not (1)	Partly (2)	Mostly (3)	Fully (4)	
The informative texts	2	10	16	6	2.8 (.8)
The exercises	3	15	10	6	2.6 (.9)
The push notifications	5	13	10	6	2.5 (1.0)
Others experiences	9	7	12	6	2.4 (1.1)
The light of the day	6	14	9	5	2.4 (1.0)
The practical information	10	11	11	2	2.1 (.9)
My favourites	13	9	8	4	2.1 (1.1)
The mood tracker	14	14	6	0	1.8 (.7)

Nearly all participants (76%-91%) rated the language use, the amount of text, the design of the app and the ease of use of the app with at least good (table 6).

Table 6

How participants thought about different aspects of the Compas-Y app, scale 1-5 (N=34).

	Frequency					Mean (SD)
What did you think of …	Bad (1)	Mediocre (2)	Reasonable (3)	Good (4)	Very good (5)	
The language use	0	1	2	24	7	4.1 (.6)
The amount of text	0	0	7	23	4	3.9 (.6)
The design of the app	0	0	8	22	4	3.9 (.6)
The ease of use of the app	0	3	3	24	4	3.9 (.7)

Most participants (62%-82%) agreed that Compas-Y was easy to use, they could use Compas-Y as much as needed, Compas-Y motivated them to be kind to themselves, they enjoyed using Compas-Y and Compas-Y made it easier to be kind to themselves (table 7). Around half of the participants (47%-53%) disagreed of were neutral about Compas-Y helping gain more insight in their emotions and Compas-Y suiting them as a person. More than two third (68%) of the

participants disagreed or were neutral about liking seeing their progress in Compas-Y. 41% of the participants disagreed with Compas-Y becoming part of their daily routine.

Table 7

Overall appreciation of the Compas-Y app (TWEETS), scale 1-5 (N=34).

I think that …	Frequency					Mean (SD)
	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	
Compas-Y was easy to use	0	0	5	22	6	4.0 (.6)
I could use Compas-Y as much as needed (for reaching my goals)	0	0	8	21	4	3.9 (.6)
Compas-Y motivated me to be kind to myself	1	3	6	18	5	3.7 (1.0)
I enjoyed using Compas-Y	1	1	10	16	5	3.7 (.9)
Compas-Y made it easier to be kind to myself	1	1	10	16	5	3.7 (.9)
Compas-Y helped me gain more insight in my emotions	2	0	14	13	4	3.5 (.9)
Compas-Y suits me as a person	2	3	13	12	3	3.3 (1.0)
I liked seeing my progress in Compas-Y	1	1	21	9	1	3.2 (.7)
Using Compas-Y became part of my daily routine	3	11	11	8	0	2.7 (.9)

When inspecting the open questions about the app, the only thing standing out is participants reporting that they liked the (breathing/relaxation) exercises the most. There were no helpful tips regarding improving the app.

3.4 Baseline and post-treatment differences on self-compassion, anxiety and depression

Participants scored significantly lower on the anxiety subscale at T1, compared to T0. Cohen's *d* for this test was .51, which can be considered medium. No significant differences were found on the depression subscale and the self-compassion scale. (table 8).

Table 8

Baseline and post-treatment comparison (N=37).

Variables	Baseline mean (SD)	Post-treatment mean (SD)	Difference	*p*
Anxiety and Depression (HADS)				
Anxiety	7.84 (3.58)	6.00 (3.64)	-1.84	.002*
Depression	5.97 (3.66)	5.62 (3.44)	-.35	.548
Self-compassion (SCS-SF)	4.87 (.952)	4.99 (.840)	.12	.281

*$p < .05$.

3.5 Correlation between changes in self-compassion and changes in anxiety and depression at baseline and post-treatment

A Pearson correlation coefficient was computed to assess the linear relationship between changes in self-compassion, anxiety and depression. There was a significant medium correlation between changes in self-compassion and changes in depression (table 9), indicating that an improvement in self-compassion was associated with a decrease in depression. There was also a medium correlation in the same direction between changes in self-compassion and changes in anxiety, indicating that an improvement in self-compassion was associated with a decrease in anxiety. However, this correlation was not significant.

Table 9
Pearson correlations of changes in self-compassion, anxiety and depression between T0 and T1 N=37.

Variable		Self-compassion
Anxiety	Pearson's r	-.260
	p-value	.120
Depression	Pearson's r	-.424
	p-value	.009*

*$p = <0.05$.

3.6 Subject-specific characteristics modulating changes in self-compassion

There were multiple exploratory one-way ANOVA analyses conducted to investigate whether any subject-specific characteristics modulated changes in self-compassion from T0 and T1. There were no statistically significant changes in scores between the groups in gender: male and female ($F(1,35) = .224$, $p = .639$), education: low to mediate and high ($F(1,35) = .387$, $p = .538$), and time spend on the app and exercises: less than 30 minutes a week, between 30 and 60 minutes a week, 1 hour a week and between 1 and 2 hours a week ($F(3,30) = .644$, $p = .593$).

A Pearson correlation coefficient was computed to assess the linear relationship between changes in self-compassion and the mean scores on the appreciation questionnaire (TWEETS). A nearly significant medium correlation between changes in self-compassion and appreciation was found, $r(31) = -.340$, $p = .053$, indicating that people who scored higher on appreciation of the Compas-Y app were associated with bigger improvements in self-compassion.

4. Discussion

People who are recently diagnosed with cancer are at high-risk for developing an anxiety disorder or a depression, and can benefit from an intervention targeting these psychological symptoms. Self-compassion has been proven to be helpful to decrease multiple psychological symptoms, including anxiety and depression. Interventions aimed at increasing self-compassing, delivered through mobile apps, have been identified as having a high potential for success (Economides et al., 2018). However, to date there is a gap in available mobile interventions developed specifically for cancer patients. Thus, to bridge this gap, the Compas-Y app was developed in cocreating with cancer patients and oncology nurses. The aim of the current study was to examine the use, appreciation and potential impact of the self-compassion smartphone app Compas-Y, on self-compassion, anxiety and depression, to examine the correlation between changes in self-compassion and changes in anxiety and depression and to examine whether there were any subject-specific characteristics that modulated the changes in self-compassion.

4.1 Findings

Overall, the Compas-Y app was positively appreciated and well used by the participants, yet the drop out number was quite high. Moreover, this study found a significant decrease in anxiety from T0 to T1, although it did not find significant differences on depression and self-compassion. This study also found a medium correlation between the changes in self-compassion and changes in depression, indicating that an improvement in self-compassion was associated with a decrease in depression. The small correlation between changes in self-compassion and changes in anxiety was found to be in the same direction, however this correlation was not significant. Lastly, this study found a nearly significant medium correlation between the changes in self-compassion and the appreciation of the Compas-Y app, indicating that a higher appreciation of the Compas-Y app was associated with bigger improvements in self-compassion.

A lot of participants were overall satisfied with the Compas-Y app and liked using it, which is in line with other studies reporting a high satisfaction with their mobile apps about mindfulness and self-compassion (Donovan et al., 2016; van Emmerik et al., 2018; Huberty et al., 2019). However, a lot of participants reported that they felt that Compas-Y did not suite them as a person. It is understandable that practicing self-compassion does not work for everyone. Robinson et al. (2016) found that part of the answer may lie in how people view self-

compassionate vs. self-critical behavior and in their assumptions about which reaction to life's difficulties is most beneficial for their emotional well-being, performance, and outcomes. Some people resist the idea that behaving in self-compassionate ways is beneficial and even advocate for being particularly hard on oneself (Robinson et al., 2016). The way people look at this can play a part in the effectiveness of practicing self-compassion. When inspecting the open question about their tips for improvement, no useful things came forward to implement in the intervention. Understanding who is most likely to benefit from an app-based self-compassion intervention is an important ongoing question, and future studies should attempt to replicate these results with a larger sample size to discover these characteristics.

A lot of participants withdrew during the intervention. Many eHealth based intervention studies share the common concern of a high attrition rate (Eysenbach, 2005; Mak et al., 2018). Van der Mispel et al. (2017) investigated characteristics related to the attrition rate in eHealth, and found that attrition levels are higher for the fulfilment of questionnaires than for the more interactive components. This seems to be in line with this study finding that some participants reported they liked the (breathing/relaxation) exercises the best. Van der Mispel et al. conclude that eHealth interventions should avoid the use of extensive questionnaires. Eysenbach also stated that the workload and time required has an influence on the attrition rate, filling in the follow-up questionnaires may create such a burden that causes participants to drop out. This study implemented multiple questionnaires at T0 and T1 to investigate a lot of variables, further studies should aim to keep the amount of questionnaires to a minimum to reduce the attrition rate.

Also, almost half of the participants spend less than 30 minutes a week on the app and the exercises. The previous mentioned high attrition rate and the low amount of time spend on the app is not surprising, as cancer patients have a number of barriers that may keep them from practicing daily (e.g. medical appointments, not feeling well). Although unguided self-help apps can lower the threshold and reduce the cost and labor in providing guidance, it may compromise adherence and overall efficacy of the intervention (Mak et al.). Lauricella (2013) found that people who participated in a face-to-face intervention followed by a digital session of the same technique, preferred the in-person version as compared to the digital practice. Eysenbach (2005) also stated that personal contact during the intervention has an influence on the dropout, the more 'virtual' the contact is, the more likely participants will drop out. Hence, something that could help to increase the usage and effectiveness of the app is 'blended care', combining face-to-face patient consultations with eHealth support. Talboom-Kamp et al.

(2018) showed that studies with blended care lead to higher and better use of an eHealth platform. However, previous research shows that there is a lack of knowledge on what exactly constitutes blended care, who can benefit from it, and how blended treatments should be set up (Wentzel et al., 2016). Thereby, adding face-to-face sessions eliminates some of the benefits from the mobile intervention app, such as the accessibleness and the low threshold. Therefore, future studies should explore whether mobile-based self-compassion interventions for cancer patients could benefit from it and how this should be implemented.

This study found a significant decrease in anxiety between T0 and T1. However, this study did not find a significant difference in self-compassion at T0 and T1. Hence, it can not be said that the decrease in anxiety is due to an improvement in self-compassion. These findings seem to contradict previous findings of Misretta & Davis (2022), who conducted a meta-analysis and found some evidence that self-compassion interventions can increase self-compassion in individuals with chronic illness. Given that many people with chronic illness face additional uncertainty, self-blame, and self-criticism, it is plausible that self-compassion interventions for chronic illness are equally and possibly more effective for people with chronic illness compared to healthy adults (Misretta & Davis, 2022). However, there is a reasons to question this assumption. The additional suffering faced by people with chronic illness can make self-compassion difficult to cultivate. Individuals with chronic illness can face an erosion of their support networks and hopelessness as they adapt with the fluctuations of chronic illness. This can make it more challenging for individuals to foster compassion for themselves, which is a key skill taught in self-compassion training (Misretta & Davis). Future research is needed to clarify the mechanisms needed for increasing self-compassion within people living with a chronic illness and to explore whether the Compas-Y app is sufficient in doing so.

This study also found a medium significant correlation between changes in self-compassion and changes in depression, indicating that an increase in self-compassion is correlated with a decrease in depression, as expected. This is in line with the study of López et al. (2018), who examined the association of depressive symptoms with the SCS total score within a large representative sample of community adults and also found a correlation between self-compassion and depression. The small correlation between changes in self-compassion and changes in anxiety was found to be in the same direction, however this correlation was not significant, possibly because of the small sample size. Although we should be careful with interpreting because we did not find a significant increase in self-compassion or a significant decrease in depression, these results suggest that self-compassion does seem to play a part in

reducing depression. This result is beneficial for future self-compassion interventions, because it provides preliminary evidence that increasing self-compassion can lead to a decrease in depression within cancer patients. Future research should aim to replicate this finding with a larger sample size.

Lastly, this study investigated the correlation between the changes in self-compassion and the appreciation of the Compas-Y app, this medium correlation was nearly significant. Despite not being significant, it does seem beneficial to report this analysis. When visually inspecting the data, there does seem to be a detectible correlation, indicating that participants who reported a higher appreciation of the app improved more in levels of self-compassion. Further research is necessary to clarify this possible correlation, because it adds to the ongoing question of who is most likely to benefit from self-compassion interventions and therefore future self-compassion interventions could benefit from this information.

4.2 Limitations & further directions

The present study has some limitations. First, this study did not use a control group. Without a control group, it cannot be certain that it is the intervention that is producing the outcome that is measured. Besides that, the target group are people who are recently diagnosed with cancer, and at T1 eight more weeks of living with cancer and undergoing chemo or other kinds of treatments has gone by. Cancer patients already have a high change of developing anxiety and depression (Pitman et al., 2018). Therefore, it is expected that the levels of anxiety and depression increase after eight weeks. The intervention could have had a preventive influence on these psychological symptoms and/or self-compassion without knowing it. Future studies should aim to implement a control group to examine the actual effects of the intervention on self-compassion, anxiety and depression.

Second, the results are limited by a modest sample size of 37 participants in total. A small sample size makes it difficult to determine if the outcomes are a true finding. Besides that, looking at the different characteristics of people who did and did not increased in self-compassion after the intervention is difficult with the small sample size, because some characteristics were underrepresented. Future studies should aim to increase the sample size, to discover these characteristics and help understanding who is most likely to benefit from an app-based self-compassion intervention.

Lastly, it would have been interesting to investigate if there were any differences between the different types of cancer or how long it has been since the diagnosis. However,

because of troubles with securely sharing the sensitive information, the data could not be analyzed. Future studies should aim to take these variables into account, since it could give more insight in possible differences between groups of patients and who can benefit from the intervention.

5. Conclusion

This study presents an evaluation of a mobile-based intervention for anxiety and depression within recently diagnosed cancer patients, grounded in self-compassion. As such, this study bridges a gap in the knowledge about mobile interventions targeting psychological symptoms within cancer patients. This study found a decrease in anxiety after the intervention, however this result should be interpretated with care, since no control group was used it is unclear which mechanism caused this decrease. Besides that, despite the fact that the intervention failed in increasing the levels of self-compassion, the findings provide preliminary evidence that an increase in self-compassion is associated with a decrease in depression. This study also provides preliminary evidence that a higher appreciation of the app is associated with bigger improvements in self-compassion. Future research should aim to clarify the mechanisms of action of the intervention and who is most likely to benefit from it, and examine its capacity to achieve significant effects on self-compassion.

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Appendix 1 Introduction letter

Introductie

Welkom!

Bedankt voor je deelname aan dit onderzoek.
Voordat je de vragenlijst kunt invullen informeren we je over het onderzoek en het verwerken van je gegevens. Dit is dezelfde informatie die je misschien ook al op de website hebt gelezen.

Deze vragenlijst duurt ongeveer 25 minuten in totaal. Het is mogelijk om de vragenlijst op een later moment af te maken. Je antwoorden worden dan bewaard en je kunt verder gaan waar je was gebleven. Als je concentratie verminderd is, kan dit je helpen.

In deze vragenlijst vragen wij eerst of je tot de doelgroep behoort. Dan vragen wij toestemming voor het meedoen aan het onderzoek en het verwerken van je gegevens. Vervolgens stellen we vragen over je diagnose & behandeling, je mentale gezondheid en daarnaast een aantal algemene vragen en gegevens.

Het kan voorkomen dat je je soms wel in de vragen herkent, en soms niet. Sommige dingen, zoals een somber gevoel, vragen we omdat dit vaker bij mensen met kanker voorkomt. Probeer alle vragen te beantwoorden zoals dat bij jou past.

Wanneer je deze vragenlijst hebt voltooid dan sturen we je een uitnodiging met de toegangscode voor de app Compas-Y.

Appendix 2 Informed consent

Informed consent

Ben je 18 jaar of ouder?

○ Ja

○ Nee

Je hebt aangegeven jonger te zijn dan 18 jaar. Dat betekent helaas dat je niet mee kunt doen aan dit onderzoek. Wij zullen geen contact meer met je opnemen en je hoeft niets te doen. Mocht je nog vragen hebben dan kun je contact opnemen met zelfcompassiebijkanker@utwente.nl

Ben je recent (binnen 12 maanden) gediagnosticeerd met kanker?

○ Ja
○ Nee

Voor dit onderzoek zijn we specifiek op zoek naar mensen die recent gediagnosticeerd zijn met kanker. Dat betekent dat je helaas niet mee kunt doen aan dit onderzoek. Wij zullen geen contact meer met je opnemen en je hoeft niets te doen. Mocht je nog vragen hebben dan kun je contact opnemen met zelfcompassiebijkanker@utwente.nl

De app Compas-Y is bedoeld voor mensen waarbij de behandeling is gericht op genezing. Mensen die niet meer genezen kunnen worden, krijgen meestal te maken met andere thema's dan wanneer genezing nog wel mogelijk is. Hier wordt in de app geen aandacht aan besteed. Daarom zoeken we mensen waarbij de behandeling gericht is op genezing, en stellen we deze vraag:

Is je behandeling gericht op genezing?

○ Ja
○ Nee, genezing is niet mogelijk
○ Weet ik niet/onzeker

Omdat in de app geen aandacht wordt besteedt aan thema's waar mensen mee te maken krijgen die niet meer genezen kunnen worden, zoeken we voor dit onderzoek mensen waarbij de behandeling is gericht op genezing. Zodat de app goed past en kan ondersteunen. En we kunnen onderzoeken of het goed werkt voor deze doelgroep.

Voor psychologische ondersteuning verwijzen we je daarom door naar de medisch psycholoog van je ziekenhuis, of naar www.hdi.nl. In plaats van mee te doen aan dit onderzoek.

Heb je hier nog vragen over? Neem dan contact met ons op via zelfcompassiebijkanker@utwente.nl.

Appendix 3 Information letter

Informatiebrief

Als je op onderstaande link klikt dan opent deze in een nieuw tabblad.
Deze vragenlijst blijft actief, daar kun je altijd naar terugkomen.
Deze informatie is hetzelfde als de informatie op de website www.compas-y.nl.

Informatiebrief PDF

Door een vinkje te zetten bij de volgende voorwaarden ga je akkoord met het onderzoek.

⊓

⊔

1. Ik heb de informatiebrief voor deelname aan het onderzoek gelezen.

2. Ik heb de mogelijkheid gehad om vragen te stellen. Mijn vragen zijn genoeg beantwoord.

3. Ik had genoeg tijd om te beslissen of ik meedoe.

4. Ik weet dat meedoen helemaal vrijwillig is. Ik weet dat ik op ieder moment kan beslissen om toch niet mee te doen. Daarvoor hoef ik geen reden te geven.

5. Ik weet dat sommige mensen mijn gegevens kunnen zien. Die mensen staan vermeld in de informatiebrief.

6. Ik geef toestemming om mijn gegevens te gebruiken, voor de doelen die in de informatiebrief staan.

7. Ik geef toestemming om mijn onderzoeksgegevens 10 jaar na afloop van dit onderzoek te bewaren.

8. Ik wil meedoen aan dit onderzoek