Mobile Ecological Momentary Interventions: Assessing the Impact of Combined CBT, ACT, and PPI Strategies on Mental Health

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28 June 2024

Abstract

Background. This study aimed to investigate the impact of an intervention in the form of Ecological Momentary Interventions (EMI) based on principles of Cognitive Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT), and Positive Psychology Interventions (PPIs) on reducing anxiety and depression while enhancing well-being. A secondary aim was to investigate whether EMI completion rates predict outcomes. **Methods.** The sample consisted of 31 participants aged 19-30 with elevated psychological distress scores (K10 ≥ 20). Over 23 days, participants underwent a 7-day baseline period followed by a 16-day intervention period where they received two EMIs daily. The interventions included gratitude journaling, savoring positive memories, an acceptance exercise, and a cognitive reappraisal exercise. Pre and post intervention questionnaires measured anxiety (BSI), depression (BSI), and well-being (MHC-SF). Paired *t*-tests compared pre and post scores, and fixed-effect regression analysis evaluated whether EMI completion rates predict outcomes. **Results.** The intervention significantly reduced anxiety ($t(30) = 2.92$, $p = .01$, $d = 0.52$) and depression ($t(30) = 2.64$, $p = .01$, $d = 0.47$) but did not significantly improve well-being ($t(30) = 1.15$, $p = .26$, $d = .21$). The number of completed EMIs did not significantly predict changes in any of the outcomes. Exploratory analyses suggested greater improvements among participants with higher baseline symptom severity. **Conclusion.** EMIs combining CBT, ACT, and PPI strategies effectively reduce anxiety and depression symptoms but do not significantly enhance well-being. Future research should study optimizing EMI combinations and durations to maximize mental health benefits.

Keywords: Ecological Momentary Interventions, depression, anxiety, well-being, mHealth

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Introduction

Depression and anxiety are among the two most common mental disorders in the world. Globally, these two disorders result in an estimated loss of 1 trillion dollars in economic productivity annually and this figure is projected to rise (The Lancet Global Health, 2020). Approximately 5% of the adult global population is estimated to suffer from depression. Moreover, this is a condition that can lead to suicide, which is the fourth leading cause of death among 15-29-year-olds (WHO, 2023). Furthermore, Javaid et al. (2023) estimated that 4.05% of the global population suffers from an anxiety disorder, which translates into 301 million people. Javaid et al. have also shown anxiety disorders to continuously increase in incidence and prevalence since 1990 which hints at even higher prevalence in the future. Given the substantial burden of mental health issues on both individuals and societies, it is imperative to enhance global mental health.

Psychological distress is a risk-factor for developing anxiety and depression disorders (Orpana et al., 2009). It is characterized by experiencing symptoms of anxiety, depression, and stress. While these symptoms can impact overall quality of life, they are usually not severe enough to meet the criteria for a clinical diagnosis. However, when left untreated, psychological distress can result in diagnosable anxiety and depressive disorders. Therefore, focusing on treating individuals with elevated psychological distress is important to prevent people from developing more severe mental health conditions.

Well-being is often overlooked in mental health treatment. The American Psychological Association (2018) defines well-being as *"a state of happiness and contentment, with low levels of distress, overall good physical and mental health and outlook, or good quality of life."* When well-being is considered in policy or interventions, it is often treated as a goal in itself, however, it might also aid in the treatment of mental health disorders; an absence of psychological well-being has been found to be a risk factor for depression whereas the presence of well-being can also be a protective factor against mental health disorders (Wood & Joseph, 2010; Oliveros et al., 2022). This suggests that maximizing well-being can be an important factor in preventing and treating mental health disorders such as anxiety and depression.

Although effective therapies exist for anxiety, depression, and well-being, many people do not receive treatment. This is due to barriers to treatment such as high costs, insufficient mental health care professionals, and social stigma that comes with mental health disorders

(Wainberg et al., 2017; WHO, 2023). This is even more pronounced in low or middle-income countries where 75% of people suffering from depression do not receive treatment (WHO, 2023). Consequently, there is a growing interest in developing technology to deliver mental health interventions in more flexible, cost-effective, and scalable ways.

Ecological Momentary Interventions

One promising field in response to these challenges is the use of mobile health (mHealth) interventions. mHealth is a healthcare strategy that utilizes mobile technology, such as smartphones and apps, to deliver (mental) health services and support in real-time to individuals in their everyday environments (Linardon et al., 2019). Specifically, Ecological Momentary Interventions (EMIs) are mHealth interventions that show great potential for treating psychological distress. Heron and Smyth (2010) define EMIs as *"treatments that are provided to people during their everyday lives (i.e. in real time) and in natural settings (i.e. real world)"* These treatments are administered through mobile technology, usually smartphones, and can be used independently or together with other therapies (Balaskas et al., 2021). The adaptability and accessibility of EMIs offer new ways of addressing mental health challenges.

EMIs have many advantages over traditional forms of therapy, many of which come with the use of mobile technology. EMIs are delivered in real-time, in the daily context of people's lives, while using the relevant therapeutic approach for the right individual (Versluis et al., 2016). This is different from a one-on-one clinical setting, where clients receive treatment in an environment where their daily life distress might not be present. Delivering treatment in people's normal lives is advantageous as it facilitates the immediate application of therapeutic strategies in the environments where and when distress occurs. Another advantage of EMIs is that 76% of the population is interested in using mobile technology for self-management of depression and anxiety (Proudfoot et al., 2010). With the right EMIs, this potentially offers an effective method to manage symptoms as they occur in daily life. Furthermore, due to the ubiquity of smartphone ownership, EMIs could reach large populations at lower costs.

EMIs can be effective in improving mental health and positive psychological well-being, as found by a meta-analysis by Versluis et al. (2016) and a theoretical review by Schueller et al. (2017). Versluis et al. found EMIs to reduce anxiety with an effect size of Hedges' g = 0.47 and depression with g = 0.48, while increasing well-being by 0.38 (well-being was operationalized as quality of life). These effect sizes were not significantly different from the overall effect size of g = 0.58 for all outcome types combined. This finding suggests

that EMIs are broadly effective but do not show a significantly higher impact on any one specific outcome.

Cognitive Behavioral Therapy (CBT) approaches are most used when designing an EMI (Marciniak et al., 2020). CBT is recognized as the gold standard in the treatment of psychological distress and disorders due to the extensive amount of empirical support that supports it (Marciniak et al., 2020). CBT aims to modify and replace negative thoughts and behaviors. Although EMIs based on CBT have been shown to also be effective in improving well-being, they primarily focus on treating distress and symptoms, rather than improving the patient's overall well-being (Marciniak et al., 2020; Seligman et al., 2006). To address this limitation, next to CBT, interventions could incorporate Positive Psychology Interventions (PPIs) that are specifically designed with the end goal of improving well-being. PPIs aim to enhance well-being by improving positive psychology concepts such as positive emotions, relationships, and meaning. In addition, PPIs have not only been shown to be effective in improving well-being but also in decreasing symptoms of depression and anxiety (Chakhssi et al., 2018).

Another approach that can possibly be combined with CBT is Acceptance and Commitment Therapy (ACT). ACT involves encouraging people to accept their thoughts and feelings, instead of fighting them. Although often seen this way, ACT is not contrary to, or intended to be a replacement for CBT (Hayes et al., 2013). Hallis et al. (2012) hypothesized that combining CBT and ACT allows for flexible application of techniques that can supplement each other. One example of this flexibility is that it facilitates considering the client's needs and the context, which could be translated into prioritizing one approach over the other. In a later study, Hallis et al. (2017) have shown that combining ACT and cognitive therapy into one treatment can be effective when treating depression. The benefit of combining ACT and CBT approaches into one intervention is that CBT focuses on modifying and replacing negative thoughts and behaviors, while ACT involves encouraging people to accept their thoughts and feelings; this results in two avenues in which experienced distress from negative thoughts and feelings can be mitigated.

Combining CBT, ACT, and PPIs into one intervention might be beneficial because it uses the strengths of each approach that potentially results in a well-rounded treatment. CBT and ACT primarily focus on addressing negative thoughts and behaviors, while PPIs aim to enhance well-being by fostering positive emotions, relationships, and meaning. By combining these approaches, the intervention can simultaneously reduce distress and improve well-being, which could be a more effective and well-rounded treatment than an intervention based on only

one of the three approaches. Additionally, different people react to different treatments; for example, CBT is not effective for all individuals (David et al., 2018). Incorporating these various ways of attempting to improve symptoms can be beneficial because it increases the chance of including an approach that is effective for an individual.

Despite the potential benefits, only one study by Chow et al. (2020) has been found that concerns the combination of simultaneous CBT, ACT, and PPIs in an mHealth intervention. The study by Chow et al. focused on the efficacy of an app designed in 8 different modules that were designed with one of the approaches in mind. Examples of PPIs were fostering gratitude and savoring positive experiences, ACT examples were mindfulness and emotional awareness, and CBT examples were reducing worry and problem solving. The variables of interest were depression, self-efficacy, and sleep disruption in female survivors of cancer. There was a significant decrease in depression symptoms from the initial assessment to the post-intervention assessment, however, after 4 weeks, the decrease was not significant. Other than this, no research was found on the effect of an mHealth intervention or EMI combining CBT, ACT, and PPIs on outcomes of depression, anxiety, or well-being. This indicates that a research gap exists on this combination of approaches when used as EMIs.

Recognizing this gap, a study that aims to address it should select the most appropriate approaches from CBT, ACT, and PPIs when looking to combine them. Existing literature on these individual methods can offer to be a starting point.

A narrative review by Marciniak et al. concluded that CBT-based EMIs can be effective in increasing well-being and reducing mental health symptoms including depression and anxiety. They found studies regarding the application of CBT principles to EMIs, and the most commonly applied principles were: reappraisal (14 studies), self-monitoring (13 studies), reflection (10 studies), and relaxation techniques (8 studies). As reappraisal has been studied extensively, this study will apply a cognitive reappraisal exercise.

EMIs based on ACT principles have been shown to be effective at decreasing anxiety and depression symptoms (Schueller et al., 2017). Pavlacic et al. (2024) found several ways in previous studies in which ACT has been incorporated into EMIs: first, by fostering psychological flexibility processes, such as present-moment awareness, cognitive defusion, acceptance, and values clarification. Second, by means of creative hopelessness, which encourages acknowledgement and acceptance of difficult emotions rather than resisting them. Third, by mindfulness meditation exercises. The present study will include an acceptance exercise adapted from Batink et al. (2016) called ‘opening up’; this exercise encourages

participants to be aware of, sit with, and accept negative thoughts and feelings without controlling them.

Several PPIs have been used in the context of EMIs in previous studies. These include: focusing on personal strength (Schutte & Malouff, 2018), gratitude journaling to increase well-being (Coelhoso et al., 2019), and savoring in an attempt to reduce loneliness in college students (Bruehlman-Senecal et al., 2020). The present study will use a gratitude journaling and savoring exercise. Gratitude journaling is a gratitude exercise. A meta-analysis by Diniz et al. (2023) has shown that these exercises improve positive mood and emotions, which are associated with well-being, and have a small but significant effect on decreasing symptoms of depression and anxiety. Furthermore, savoring refers to recalling or being present in a positive experience. It has been shown to enhance positive affect and protect against depressive symptoms (Ford et al., 2016; Biskas et al., 2018).

Objectives of this Study

The primary objective of this study is to evaluate whether an intervention that combines CBT, ACT, and PPI-based EMIs can be effective in enhancing mental health outcomes of anxiety, depression, and well-being in individuals with increased distress levels. This research aims to fill the gap in knowledge regarding the effectiveness of combining these therapeutic strategies when administered as EMIs. Specifically, the hypotheses are formulated as follows:

1. Participants will experience increased well-being from pre to post intervention.
2. Participants will experience reduced anxiety symptoms from pre to post intervention.
3. Participants will experience reduced depression symptoms from pre to post intervention.

A secondary aim is to answer whether the amount of completed EMIs acts as a predictor of the pre and post-difference in well-being, anxiety, and depression scores of the participants. This explores the role of adherence to the intervention in determining its effectiveness. Understanding whether more frequent engagement with EMIs leads to better outcomes can inform the development of future EMI treatment designs. The hypothesis is formulated as follows:

4. The amount of completed EMIs acts as a predictor of the pre and post difference in well-being, anxiety, and depression scores of the participants.

Methods

This study is part of a project that investigates the efficacy of EMIs on mental health (for more information, please consult the preregistration file at https://osf.io/t9zbd). This

project received approval from the University of Twente BMS Research Committee (approval number 240007).

Participants

Participants were required to be at least 18 years of age, to understand English, and to have a score of 20 or higher on the Kessler Psychological Distress scale (K10). The K10 is among the few instruments that broadly screen for psychological distress while being short (Donker et al., 2010). Other studies have also used the K10 to screen for distress (Lace et al., 2019).

Participants were recruited using convenience sampling from three sources. Firstly, through social (media) circles of the researchers and general internet groups that are interested in participating in research. Secondly, through the SONA system at the University of Twente; psychology students are required to participate in studies done through SONA. Here, students could register for the current study for subject hours. Lastly, through distributing posters and flyers at the University of Twente. Participants were compensated in SONA credits or Amazon gift cards for a maximum of 50 euros in proportion to their compliance with the study, with additional incentives for completing pre and post-study questionnaires (see the preregistration for more detail https://osf.io/t9zbd).

The sample size was based on power calculations for micro-randomized trials (see the preregistration https://osf.io/t9zbd). To reach 80% power, 72 participants were necessary to detect moderate proximal effects of EMIs. The current study, however, used a paired sample *t*-test, and by assuming a 25% drop-out rate on the sample of 72 participants, this results in a sample of 54. A sample of 54 yields 82% power to detect a small to moderate effect on the pre and post-questionnaires in a paired sample *t*-test, with a Cohen's $d = 0.4$, and a two-tailed alpha level of = .05.

However, since the actual sample ($N = 31$) was smaller than the desired sample size, a new power analysis was performed for a paired *t*-test. The analysis was done using the pwr package from R. Power was set to 0.80 and the significance level to 0.05, using a two-sided test. The results indicated that this study is capable of detecting an effect size of 0.52.

Design

The current study is part of a micro-randomized trial that assessed proximal outcomes of individual EMIs via Ecological Momentary Assessments (EMAs) and distal outcomes of the whole intervention through a pre and postquestionnaire. For the current study, only the pre and post questionnaires were analyzed as the primary objective of this study was on the

outcomes of the whole intervention of combined EMIs. The EMAs were analyzed by other researchers in different studies.

Participation in the study lasted 23 days. During this timeframe, participants received multiple EMAs per day. For all participants, two different sampling techniques were employed across two different phases of the study to gather the proximal outcomes data:

Baseline Period (7 days). Participants were issued four EMA questionnaires daily. There were four time blocks between 8:30 and 21:00 and questionnaires were semi-randomly dispatched within these intervals; in total 28 EMA questionnaires for the week.

Intervention Period (16 days). A similar semi-random sampling strategy along with the time blocks from the baseline phase were used for the EMAs. Participants received pre and post EMAs in the same time block, which doubled the daily EMAs to eight; in total 128 questionnaires after 16 days. Furthermore, they received two EMIs daily in two of the four time blocks. This resulted in 32 EMIs over 16 days. A further layer of between-person randomization was used to control for potential sequence effects of the interventions. Participants are evenly assigned to one of two groups who received the interventions in reverse order (see the preregistration for more detail: https://osf.io/z645p/).

Materials

Pre and Post Questionnaires

To gather data on the outcomes of depression, anxiety, and well-being, a questionnaire was made using existing instruments. The same questionnaire was used as a pre and post measure and totaled 126 items. Not all items were relevant to this study; only the relevant instruments and subscales for this study will be discussed below (the relevant items can be found in Appendix B). The questionnaires were sent to the participants and completed by them on their own electronic devices using the online software Qualtrics (www.qualtrics.com).

Depression and Anxiety. Depression and anxiety were assessed using the Brief Symptom Inventory (BSI) (Derogatis, 1975). This is a self-report instrument for evaluating psychological symptomatology overall but also for specific subscales such as the depression subscale and the anxiety subscale. The items are answered by participants only considering the past seven days, and the participants indicate their level of distress for each item on a 5-point Likert scale. This scale ranges from 0 (not at all) to 4 (extremely), which results in a mean score for each subscale between 0 and 4. Quintana et al. (2024) supported the reliability and construct validity of the anxiety and depression subscale through a Confirmatory Factor Analysis (CFA), which showed a good fit (CFI = 0.98, TLI = 0.98, RMSEA = 0.08).

Depression Subscale. The depression subscale includes items that concern low mood, hopelessness, and loss of interest in things. One example is: *"During the past 7 days, how much were you distressed by: feeling blue?"* Quintana et al. (2024) demonstrated the depression subscale to have a Cronbach's Alpha (α) of .90 or higher. In this study, good internal consistency was indicated for the pre-questionnaire (α = .83) and the post-questionnaire (α = .81).

Anxiety Subscale. The anxiety subscale includes items about symptoms of anxiety, such as nervousness, tension, and fearfulness. One example is: *"During the past 7 days, how much were you distressed by nervousness or shakiness inside?"* Quintana et al. (2024) showed the subscale to have a Cronbach's Alpha of .90 or higher. In the current study's questionnaire, the anxiety subscale had a Cronbach's Alpha of .85 for pre assessment and .84 for post assessment, which indicates a good internal consistency.

Well-Being. Well-being was measured with the Mental Health Continuum-Short Form (MHC-SF) (Keyes, 2009). This instrument includes 14 items that focus on emotional, social, and psychological well-being. For example: *"In the past month, how often did you feel satisfied with your life?"* Every item is answered on a 6-point Likert scale from 1 (every day) to 6 (never). This results in a mean score between 1 and 6, with a lower score being indicative of higher well-being. Keyes (2009), states that the MHC-SF has a Cronbach's Alpha higher than 0.80, which indicates good internal consistency. In the pre-questionnaire, the MHC-SF had excellent internal reliability (α = .92) and in the post-questionnaire a good internal consistency (α = .87). Using single-factor CFA, Lamers et al. (2010) demonstrated adequate validity for the MHC-SF (RMSEA = 0.05, CFI was 0.98).

EMIs

Four EMIs were used in this study: two PPIs, one ACT intervention, and one CBT intervention (see Appendix C for the EMIs). The EMIs were delivered through m-Path; an app that is specifically designed for research with EMAs and EMIs (www.m-path.io). m-Path facilitates data collection and implementation of a randomization scheme such as the one used in this study. Additionally, it includes a notification function to remind participants to comlete their EMIs. Through the app, the number of completed EMIs per participant was tracked to examine compliance.

Before engaging in an exercise, participants were instructed to read an instruction about its efficacy and how it was supposed to alleviate symptoms. Each EMI session was expected to last around 10 minutes. Each EMI came with a short introduction to its purpose and how it

is supposed to work. Participants were instructed to spend around 10 minutes per EMI and they were invited to do reflective writing within each of these EMIs.

PPI: 'Gratitude Journal.' It involves participants writing down events, experiences, or anything else they are grateful for. They were then invited to reflect on these things and were instructed to pay attention to the emotions that arose during this reflection.

PPI: 'Savoring: Positive Memory.' This EMI makes participants recall a positive memory in detail. Participants were informed that by focusing on the positive emotions they felt in that moment, they could bring about more positive feelings in the present. Participants spent about 10 minutes savoring a positive event.

ACT: 'Opening Up.' This EMI is made to help participants accept their thoughts and feelings rather than trying to change them. Participants were instructed to identify recent negative emotions and to write these down. Next, they were asked to observe these emotions with an open attitude instead of pushing them away.

CBT: 'Cognitive Reappraisal Exercise.' This intervention focuses on identifying and restructuring negative or unhelpful thoughts. Participants were instructed to recognize a negative thought, challenge its validity, and replace it with a more balanced or positive thought.

Procedure

The data collection period was from 11-03-2024 to 30-05-2024.

Potential participants were directed to the study via QR codes, advertisements, and the SONA research system. Upon showing interest, they completed a registration survey on Qualtrics, where they provided their email address and phone number, and received a unique personal ID. This ID was used to anonymize their data. Participants then received an email with a link to a screening questionnaire hosted on Qualtrics. Here they entered their ID and after the informed consent form (see Appendix D), completed the screening items concerning age and psychological distress (K10). Eligible participants were invited to a briefing session via email.

During the briefing, researchers introduced the study by explaining its focus on assessing and potentially mitigating psychological symptoms through EMIs. Participants were informed that their data was managed according to privacy protocols which ensured that their data were handled with confidentiality and integrity. They were also instructed about the compensation scheme. Afterward, participants were assisted in installing the m-Path app, used for delivering the EMIs, on their smartphones. A test push notification ensured the app's functionality and a demo questionnaire was practiced with participants to familiarize them with the types of questions and response scales for the EMAs (see the preregistration for the EMA:

https://osf.io/z645p/). Participants were informed that completion of the EMIs had to be done within 30 minutes of receiving the notification, otherwise, the EMIs would expire. Participants were also encouraged to maintain their routine daily activities without adjustments for the study.

Following this, the baseline period of seven days started where participants only received EMAs. Next was the intervention period of 16 days where they received EMAs and EMIs. If participants did not fill out a questionnaire on any given day, they were reached out to and reminded of the importance of filling out as many questionnaires as possible. Non-responsive participants received reminder emails. At the end of the study, participants received an email with a link to the post-questionnaire and debriefing options.

Data Analysis

For all analyses, *p* values with a significance level (alpha) of .05 were used. All analyses were performed using R in RStudio version 2024.04.01 + 748.

Data Cleaning

Data cleaning was done by excluding participants based on incomplete the screenings, duplicates, and incomplete pre or post questionnaires. Then, the sample was inspected for outliers, in this study defined by +- 3 *SD* from the group-level mean for all variables, which would result in their exclusion in sensitivity analyses for all models (see Table 2 for descriptive statistics of the questionnaires). Based on this exclusion criterion, only one participant would have been excluded due to their score being more than 3 *SD* from the mean on the K10 scale. However, since the K10 is used as a screening tool rather than an outcome variable that is relevant to the analyses, this participant was retained in the sample.

Statistical Analyses

Primary Analysis. To evaluate the primary hypotheses, paired *t*-tests were conducted to compare pre and post questionnaire scores for each outcome of well-being, anxiety, and depression. Effect sizes (Cohen's *d*) were calculated for all outcomes in all analyses to provide a measure of the magnitude of changes. This helps in interpreting the practical significance of the results. The commonly used interpretation of small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) effect sizes was used. Furthermore, the assumption of normality was checked in the difference scores of the pre and post questionnaire outcomes of MHC-SF, BSI depression subscale, and BSI anxiety subscale. Histograms, Q-Q plots, and Shapiro-Wilk test results (MHC-SF: $W = 0.96$, $p = 0.33$; BSI Depression: $W = 0.97$, $p = 0.46$; BSI Anxiety: $W = 0.96$, $p = .26$) indicated normality. This meets the assumptions required for conducting paired t-tests.

Fixed-Effect Regression Analysis. To assess whether the number of completed EMIs has an effect on the outcomes of depression, anxiety, and well-being, a regression analysis was performed using a fixed-effect regression model (using package lmtest). The difference in scores between pre and post questionnaire was calculated for every participant. This new score was then used as the dependent variable and the number of completed EMIs constitutes the fixed effect. The assumptions for conducting a fixed-effect regression model were met. A summary of these assumption checks is provided in Appendix E.

Exploratory Analysis. Exploratory analyses were performed using multiple regression analyses to investigate other potential predicting variables that might influence the effectiveness of the interventions, such as demographic variables (age, sex, occupation, education), and pre-questionnaire symptom severity (using package lmtest). Most assumptions were met in the checks for the other analyses.

Assumptions

Assumptions were checked for all analyses. The normality is assumed in the difference scores of the pre and post questionnaire outcomes of MHC-SF, BSI depression subscale, and BSI anxiety subscale. The histograms and Q-Q plots indicated decently symmetric distributions that were centered around zero. The Shapiro-Wilk test results (MHC-SF: $W = 0.96$, $p = 0.33$; BSI Depression: $W = 0.97$, $p = 0.46$; BSI Anxiety: $W = 0.96$, $p = .26$) further confirmed that the difference scores are normally distributed. This meets the assumptions required for conducting paired *t*-tests. Normally, additional assumption checks for independence of residuals and multicollinearity would be conducted for exploratory analysis, however, given the limited generalizability of the exploratory analysis due to a small sample size, further assumption checks were not seen as useful and might even overstate the reliability of the results.

Results

The final sample included 31 participants with an age range of 19-30 years ($M = 22.19$, $SD = 2.50$). More females were included in the sample than males: 22 females (70.97%) and 9 males (29.03%). In regard to nationality, there were 11 (35.48%) Germans, 6 (19.35%) Dutch, and the remaining 14 participants (45.16%) had other nationalities. Regarding completed education, 17 (54.84%) had completed high school, 11 (35.48%) had a bachelor's degree, 2 (6.45%) had a master's degree, and 1 (3.23%) had done some college but no degree. Lastly, regarding occupation, there were 14 students (45.16%), 12 working students (38.71%), 3 employed participants (9.68%), and 2 unemployed participants (6.45%). See Table 1 for all demographic characteristics of the final sample.

Table 1

Demographic Characteristics of Participants Included in the Final Sample.

Variable	Value	*n*	%
Gender	Male	9	29.03
	Female	22	70.97
Nationality	German	11	35.48
	Dutch	6	19.35
	Other	14	45.16
Highest Form of Completed Education	High school	17	54.84
	Bachelor's degree	11	35.48
	Master's degree	2	6.45
	Some college but no degree	1	3.23
Occupation	Student	14	45.16
	Working student	12	38.71
	Employed	3	9.68
	Unemployed	2	6.45

Note. $N = 31$. Participants were on average 22.19 years old ($SD = 2.50$).

In total, 376 individuals initially completed the first part of the registration process. However, when asked to complete the screening in the second part (K10 questionnaire and age), only 174 individuals participated. Ultimately, 72 individuals engaged in the main part of the study. This significant decrease in participant numbers was due to two primary factors: many individuals were excluded based on the criteria of being under 18 years old or having a K10 score below 20, and there was a considerable number of bot-generated sign-ups which were identified by fake email addresses and phone numbers.

Initially, a total of 72 responses were recorded. Following data cleaning procedures, 3 exclusions were made based on duplicates, and 2 exclusions were made on incomplete pre or post questionnaires and/or not having made both questionnaires. Furthermore, 36 were excluded based on less than 60% completion rate of the EMIs (19 was the cut-off point based on 32 EMIs and a 60% completion rate). This was done to ensure that participants engaged in the intervention sufficiently to provide reliable data for making inferences.

Table 2

Descriptive Statistics for Questionnaires.

Variable	*M*	*SD*
Pre-questionnaire MHC-SF	3.35	0.90
Post-questionnaire MHC-SF	3.22	0.73
Pre-questionnaire BSI Depression	1.38	0.84
Post-questionnaire BSI Depression	0.95	0.73
Pre-questionnaire BSI Anxiety	1.53	0.95
Post-questionnaire BSI Anxiety	1.06	0.85
K10	27.52	5.94

Note. $N = 31$. Also, note that a decrease in scores in this version of the MHC-SF is associated with increased well-being.

Paired *t*-test

The paired *t*-tests indicated that the intervention significantly reduced symptoms of depression and anxiety, which was consistent with the hypotheses, but did not improve well-being, which was inconsistent with the hypothesis (see Table 3 for results).

The BSI depression scores significantly decreased between pre and post questionnaire ($t(30) = 2.64$, $p = 0.01$, 95% CI [0.10, 0.76], mean difference = 0.43). Similarly, the BSI Anxiety scores significantly decreased ($t(30) = 2.92$, $p = 0.01$, 95% CI [0.14, 0.79], mean difference = 0.46), with an effect size ($d = 0.52$). However, the MHC-SF scores for well-being did not show a significant difference between pre and post assessment ($t(30) = 1.15$, $p = 0.26$, 95% CI [-0.10, 0.35], mean difference = 0.13). However, regarding power, the effect size ($d = 0.21$) is too small for this study's power threshold ($d = 0.52$). This indicates that if there were actual changes in well-being, this study could not conclude this.

Table 3

Results from the Paired t-test and Cohen's d for Pre and Post Questionnaire Scores

Measure	*t*-value	*df*	*p* value	Mean Difference	95% CI (Lower)	95% CI (Upper)	Cohen's *d*
MHC-SF	1.15	30	.26	0.13	-0.10	0.35	0.21
BSI Depression	2.64	30	.01	0.43	0.10	0.76	0.47
BSI Anxiety	2.92	30	.01	0.46	0.14	0.79	0.52

Note. Effect sizes were inverted so that a positive sign indicates improvement of symptoms to maintain consistency with other studies.

Fixed-Effect Regression Analysis

Inconsistent with the hypothesis, among participants who completed at least 60% of the EMIs, the fixed effect regression analyses showed no significant impact of the number of completed EMIs on changes in the scores of the MHC-SF (well-being) (b = 0.03, p = .38), BSI depression (b = 0.02, p = .69), or BSI anxiety (b = -0.02, p = .72).

Table 4

Results from the Fixed-Effect Regression Analysis with Amount of Completed EMIs as Predictor Factor.

Predictor	Estimate (b)	Std. Error	t-value	p value	R^2	Adjusted R^2	F-statistic (df1, df2)	p value (F)
				Well-being (MHC-SF)				
Intercept	0.53	0.75	0.71	.49	0.03	-0.01	0.78 (1, 29)	.38
Completed EMIs	0.03	0.03	-0.89	.38				
				Depression (BSI)				
Intercept	0.01	1.11	0.01	.99	0.01	-0.03	0.16 (1, 29)	.69
Completed EMIs	0.02	0.05	-0.40	.69				
				Anxiety (BSI)				
Intercept	0.85	1.08	-0.79	.42	0.00	-0.03	0.13 (1, 29)	.72
Completed EMIs	-0.02	0.05	0.37	.72				

Note. Since only participants were included with a 60% completion rate of EMIs, the intercept represents the expected value of the dependent variable when this cut-off point of 60% of EMIs is achieved. The coefficient for the number of EMIs completed shows the change in the outcome variable for each additional EMI completed. The p values indicate the statistical significance of the predictors. R-squared values reflect the proportion of variance in the dependent variable explained by the independent variable. The F-statistic tests the overall significance of the model.

Exploratory Analysis

For all results of the exploratory analysis, see Tables F1, F2, and F3. The regression analyses indicated that pre-questionnaire scores significantly predicted changes in post-intervention scores for well-being, depression, and anxiety. Namely, higher initial scores on the pre-questionnaire, which indicated worse anxiety and depression, and lower well-being, were associated with greater improvements (BSI Anxiety: $b = 0.75$, $p < .001$; BSI Depression: $b = 0.74$, $p < .001$; MHC-SF: $b = 0.27$, $p = .02$).

Furthermore, for the MHC-SF, there was a near-significant trend for being female ($b = 0.47$, $p = .08$). The variables age, occupation, education, and nationality did not significantly influence the change in well-being scores.

For depression scores, there was a near-significant trend for education level, where participants with a bachelor's degree showed more improvement ($b = 0.56$, $p = .09$). Age, gender, occupation, and nationality were not shown to be significant predictors.

Regarding anxiety scores, a bachelor's degree showed a significant decrease in scores ($b = 0.73$, $p = .04$). Additionally, being from The Netherlands was associated with a significant increase in scores ($b = -0.98$, $p = .03$). The other variables did not significantly influence the change in anxiety scores.

Discussion

The primary aim of this study was to see whether an intervention of multiple EMIs that combined principles of CBT, ACT, and PPI could be effective in reducing symptoms of depression, and anxiety, and increasing well-being. A secondary aim was to assess whether the number of completed EMIs served as predictor for change of symptoms from pre to post questionnaire. Lastly, an exploratory analysis was done to see if any other predictors were present.

Results showed that anxiety and depression symptoms decreased significantly post-intervention. However, well-being symptoms increased slightly post-intervention but not significantly.

Findings did not show that the amount of completed EMIs acted as a predictor for change in symptoms from pre to post questionnaire. Furthermore, the exploratory analysis found that higher scores on the pre-questionnaire resulted in greater improvements.

Interpretation of Findings

The findings suggest that the intervention was effective in reducing anxiety and depression but not in significantly enhancing well-being. In the context of previous research, the effect sizes on anxiety and depression of this study were comparable to those found in a

meta-analysis on the general efficacy of EMIs by Versluis et al. (2016). They found $g = 0.57$ for anxiety, depression, and well-being. the effect size of well-being was smaller for this study and not large enough to achieve statistical power.

When comparing the effect size of well-being to findings of a different meta-analysis by Chakhssi et al. (2018) that focused on the efficacy of PPIs, the results become more similar. However, their study was based on randomized controlled trials, therefore, results are not completely comparable. They found that PPIs had a small effect on well-being and depression, and they found a moderate effect on anxiety. Chakhssi et al.'s findings of well-being and anxiety are similar to those of this study, but this study had a greater effect on depression.

Overall, the intervention appears to be effective in treating anxiety and depression due to the significant effect sizes that are comparable to existing literature, but its impact on well-being was not significant and the effect size was not large enough to achieve statistical power. The most probable reason for why no significant changes in well-being were found was the sample size. This merits future research to include a larger sample to achieve statistical power.

A second, although less likely, explanation for why significant changes in well-being were not observed, is that the intervention duration might have been too short for changes to occur. In this study, the PPI-based EMIs were selected specifically for improving well-being. Bolier et al. (2013) advised PPIs to last at least 4 weeks and preferably 8 or longer. Additionally, van Agteren et al. (2021) found in their meta-analysis of interventions to improve well-being that duration of interventions is predictive of positive changes in well-being. Therefore, it could be the case that the PPIs in this study would take longer to be effective than the CBT and ACT-based EMI. Extending the duration of the intervention could be done as previous research has shown that this led to greater changes in the outcomes.

Furthermore, van Agteren et al. (2021) found that the most effective approach for improving well-being was mindfulness. PPIs were effective, especially in conjunction with other approaches, but mindfulness interventions such as breathwork and meditation appeared to be the most effective. Future research could extend the duration of the intervention and investigate applying an additional mindfulness exercise in the mix of approaches used in this study.

The number of EMIs completed did not appear to be a significant predictor for the difference in pre and post questionnaire scores. This suggests that the quality of engagement with the EMIs and not the amount of completed EMIs is the more significant factor. Future research could include a feature in the app of delivery that tracks how much time a participant spends on an EMI.

However, this finding of the analysis should be analyzed further in future research as only participants who completed 60% of interventions were part of this analysis. The 60% cut-off point was chosen to ensure that participants engaged sufficiently with the intervention to make better inferences about the effectiveness of the intervention. This was also used to account for possible implications of low engagement such as reduced reliability due to inconsistent participation, which may stem from external factors which were not controlled for in this study. This is why an analysis for participants with less than 60% completion rate was not carried out in this study, as the data were not gathered in a way that reliably controlled for external factors which could result in unreliable results. Future studies should explore whether the amount of completed EMIs affects outcomes before reaching 60% completion. This can be done by including methods such as gathering qualitative feedback from participants on their engagement and barriers to completion, which would enable researchers to make informed decisions about which data to include and exclude without implementing a cut-off point.

Findings from the exploratory analysis indicated that participants with higher initial scores on the pre-questionnaire experienced greater improvements. This suggests that the intervention was more effective for participants who started with worse symptoms, which indicates that the intervention has greater efficacy for people who need it most. This justifies the continuation of the development of the intervention. Additionally, being from The Netherlands and having obtained a bachelor's degree influenced the results. This suggests that nationality and education could be predictors of the intervention's efficacy.

Limitations

Limitations of this study were the characteristics of the sample and its size. Most participants were from either Germany or The Netherlands while having done or currently doing higher education. This was a result of convenience sampling and it means that the findings of this study are limited in generalizability to other populations. The sample size was below the desired 54 participants which resulted in lower power. It is possible that with a larger sample size, the change in well-being scores could have had a large enough effect size.

Furthermore, despite recognizing that a sample size of 31 is too small to conduct an adequately powered multiple regression analysis with multiple levels (Brysbaert, 2019), the analysis continued due to practical constraints as recruiting more participants was not feasible due to limited time. The results of the exploratory analysis should not be seen as conclusive but as indicative of patterns that could be investigated in future studies. Future research should aim to broaden its sample in both size and demographic characteristics.

A second significant limitation of this study was the high attrition rate; more than half of the participants from the initial sample did not complete at least 60% of the EMIs and were excluded. The high proportion of participants that were excluded from analysis, might have resulted in attrition bias, which affects the generalizability and reliability of the findings. Future research should focus on exploring and addressing barriers to adherence to inform EMI design choices to improve participant engagement in the intervention which could result in better mental health improvements.

A third limitation of this study is a lack of control group, which prevents making causal inferences about the efficacy of the intervention. Without control group, it is difficult to determine whether the observed changes in anxiety, depression, and wellbeing are attributable to the effects of the intervention or on external factors. A future study using a Randomized Controlled Trial (RCT) design would make it possible to compare outcomes between the intervention group and control group (Hariton & Locascio, 2018). This would provide stronger evidence of the efficacy of the intervention, and it would facilitate, although not guarantee, drawing causal conclusions.

Implications

One implication of this study is that the primary findings support the efficacy of a new treatment that combines CBT, ACT, and PPI EMIs within a single intervention. This method has the potential of addressing multiple mental health outcomes simultaneously, which potentially offers a more flexible and effective intervention than those that are based on a single therapeutic approach. Although results do not show that this intervention is more effective than others, it is the first version. As one of the first studies to explore this combination, it provides pilot data that can be used to inform future research designs that could focus on optimizing combinations of these therapies to maximize treatment efficacy for different populations.

Such studies could also investigate dose responses. The dose-response effect refers to *"the relationship between the dose (e.g., length, frequency) of treatment and the subsequent probability of improvement*." (Robinson et al., 2019). The concept of dosage is important because different individuals or populations may respond differently to the same EMI (Shim et al., 2021). By varying the frequency of each EMI within the same study population, it is possible to study responses from different populations while at the same time identifying the most effective combinations and frequencies for the outcomes of anxiety, depression, and well-being. This could facilitate the tailoring of interventions maximize effectiveness for each population.

The findings also suggest that these combined interventions, offered via a mobile platform, could be useful for practitioners to treat mental health issues, especially in settings where the mental health sector is underfunded, or stigma is a concern. Furthermore, research has shown that EMIs can be more effective when under the supervision of a professional (Schueller et al., 2017). This means that an intervention such as the one described in this study could be implemented alongside traditional one-on-one therapy, potentially yielding greater improvements in anxiety, depression, and well-being outcomes. An implication for future research would be to study whether a similar intervention to the one used in this study could be used alongside one-on-one therapy effectively.

Conclusion

This study shows that EMIs combining CBT, ACT, and PPI strategies can reduce symptoms of anxiety and depression. However, the intervention did not significantly enhance well-being. Previous studies have suggested the need for longer intervention periods and more targeted well-being activities for this. The new combined EMI approach and use of mobile technology introduce the potential for scalable and accessible mental health interventions. Future research should address the identified limitations, which include incorporating a larger sample size, and improving adherence to the intervention. Furthermore, future studies should explore adjustments to enhance efficacy, applying an RCT design, study dose-responses, and determining the optimal duration for this intervention.

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Appendix A

Use of AI in Education at the University of Twente

During the preparation of this work, the author used ChatGPT to write prompts to find relevant literature in repositories, summarize articles and ideas, and solve problems regarding coding in RStudio. After using this tool/service, the author reviewed and edited the content as needed and took full responsibility for the content of the work. No AI-suggested sentences were used. Furthermore, Grammarly was used to correct grammatical errors, not to rewrite sentences.

Appendix B

Pre and Post Questionnaire

BSI

Answer scale:

0 = Not at all

1 = A little bit

2 = Moderately

3 = Quite a bit

4 = Extremely

Depression

DURING THE PAST 7 DAYS, how much were you distressed by:

- Thoughts of ending your life
- Feeling lonely
- Feeling blue
- Feeling no interest in things
- Feeling hopeless about the future
- Feelings of worthlessness

Anxiety

DURING THE PAST 7 DAYS, how much were you distressed by:

- Nervousness or shakiness inside
- Suddenly scared for no reason
- Feeling fearful
- Feeling tense or keyed up
- Spells of terror or panic
- Feeling so restless you couldn't sit still

MHC-SF

1 = Every day

2 = Almost every day

3 = About 2 or 3 times a week

4 = About once a week

5 = Once or twice

6 = Never

In the past month, how often did you feel...:

...happy?

...interested in life?

...satisfied with your life?

...that you had something important to contribute to society?

...that you belonged to a community (like a social group, your neighborhood, your city, your school)?

...that our society is a good place, or becoming a better place, for all people?

...that people are basically good?

...that the way our society works makes sense to you?

...that you like most parts of your personality?

...good at managing the responsibilities of your daily life?

...that you had warm and trusting relationships with others?

...that you had experiences that challenged you to grow and become a better person?

...confident to think or express your own ideas and opinions?

...that your life has a sense of direction or meaning?

Appendix C

Overview of Utilized EMIs

PPIs

Gratitude Journal

This activity, the **Gratitude Journal**, is designed to focus on things in your life you're thankful for. This practice can be about anything from simple pleasures (like enjoying a delightful lunch) to major life events (such as the birth of a healthy niece).

Viewing positive experiences as gifts helps prevent taking them for granted. Research indicates that regularly engaging in this exercise can significantly boost well-being.

Instructions

1. **List down three things** currently in your life – events, experiences, people, or any other aspect – that you feel grateful for. You can write them down in the textbox below or on paper.
2. Reflect on **why** you are grateful for these particular things. You can write these reflections down in the textbox below, use pen and paper, or simply ponder them without writing.
3. **Pay attention to the feelings that arise** during your reflection on them. You can ask yourself the following questions:
   - Which emotions do you notice as you reflect on what makes you grateful right now?
   - How does your body react to these feelings of gratitude? (Do you feel warmer, more relaxed, or perhaps a smile forming on your face?)
   - What changes do you observe in your mood as you focus on these grateful feelings?

Savouring: Positive Memory

Experiencing positive emotions can often be achieved by revisiting joyful memories. The **Positive Memory** exercise is an effective way to do just that.

This exercise involves recalling a happy memory in as much detail as possible and focus on how you felt during that moment. Good example memories for this exercise are those where you felt significant positive emotions such as joy, love, or inspiration, but it can also be any other memory you experienced as pleasant.

Instructions

1. Think of a memory where you experienced strong positive emotions.

2. Aim to reconstruct the memory in as much detail as possible. If you like, you can write your thoughts in this textbox or use pen and paper. Consider these question to guide your writing:
    - What exactly happened in the memory you selected?
    - What were your feelings at the moment it occurred?
    - How do you feel now as you revisit this memory?
    - What changes do you observe in your mood as you focus on this positive memory?

Try to include many details to vividly recall the experience, but remember to keep the writing process enjoyable.

ACT Intervention

Opening up

The goal of this exercise is to accept and embrace negative thoughts and emotions instead of trying to get rid of them. Resisting unpleasant feelings may actually cause them to become stronger and more frequent. By embracing our thoughts and feelings and accepting that they are there, we don't need to suffer from our struggles in trying to control them.

Instructions

1. What have you been struggling with lately (e.g., stress, anger, sadness, insecurity, guilt, shame, pain, worries...)? You can write it down in the text box below
   [TEXT BOX]
2. See if you can open up to these unpleasant thoughts and feelings, allowing them to just be there.
3. Explore what there is to experience—Are the feelings getting heavier, lighter, do they remain the same, or do they fluctuate?
4. Can you stay present with these difficult thoughts and feelings and keep in touch with them?
5. See if you can continue giving some space to these unpleasant feelings for a while, instead of trying to control them or trying to get rid of them.

CBT Intervention

Cognitive Reappraisal Exercise

With this exercise, we will have a good look at unpleasant thoughts you may have and help you to investigate if they are really helpful and true, or if there are more positive alternative thoughts that are more realistic. The unpleasant thoughts you may have, such as worries about the future, negative thoughts about yourself or others, or memories about an unpleasant situation in the past, are often unrealistically negative and not helpful. With this exercise, we will see if we can replace these unpleasant thoughts with more positive, more realistic thoughts.

Instructions

1. Think of an unpleasant thought that is causing you stress or negative emotions lately. Take a moment so you have the unpleasant thought clear in your mind, and write it down in the text box below

   [TEXT BOX]

2. Now try to challenge this unpleasant thought a little: Is it really true? What evidence do you have for it? Is this unpleasant thought helping you?
3. What would you tell a close friend if they were having these thoughts?
4. Now try to come up with another, more positive interpretation, and write it in the text box below. What evidence do you have for this more positive thought? Is this thought more helpful to you?

   [TEXT BOX]

5. Take a moment to think about both thoughts. Is it possible that your unpleasant thoughts are not the most realistic or helpful ones? See if you can challenge your unpleasant thoughts this way for a while, and replace them with more helpful, more positive thoughts

Appendix D

Informed Consent Form

Dear participant,

With this questionnaire, you can register for participation in the ALERT study. In this study, we aim to understand how we can optimally support people's mental health in daily life. For that, daily mental health exercises will be provided that are aimed at enhancing your mental health and the way you deal with stress in daily life.
For more information on the procedure and different components of the study, see: https://www.utwente.nl/en/bms/mobile-health/Procedure%20ALERT/
The current survey is the first part of the registration for the study, in which we ask you to provide your contact information (your name and surname, email and phone number). After receiving your contact information we will send you an email with the second phase of the registration.

Read the following text carefully before answering YES.

Informed Consent

By clicking **YES** below, I agree to the following: I understand that my participation is voluntary. I also understand that I have the right to withdraw from the study at any time without needing to give a reason. Furthermore, it is clear to me that all data that are collected are treated completely anonymously and cannot and will not be traced back to my identity. I agree to participate in the study:

- Yes
- No

Appendix E

Assumptions for Fixed-Effect Regression Model

Assumption	Method/Test	MHC Results	BSI Depression	BSI Anxiety
Normality	Shapiro-Wilk Test	$W = .97$, $p = .52$	$W = .97$, $p = .60$	$W = .96$, $p = .36$
	Histogram	Approximately Normal: Yes	Approximately Normal: Yes	Approximately Normal: Yes
	Q-Q Plot	Deviations: No	Deviations: No	Deviations: No
Homoscedasticity	Breusch-Pagan Test	$BP = 3.08$, $p = .08$	$BP = 2.28$, $p = .13$	$BP = 0.75$, $p = .39$
	Residuals vs. Fitted Plot	Pattern: No	Pattern: No	Pattern: No
Linearity	Scatter Plot with Fit Line	Linearity: Yes	Linearity: Yes	Linearity: Yes

Note. The normality of residuals was assessed using the Shapiro-Wilk (W) test. This test statistic indicates better normality the closer it is to 1. A *p* value greater than .05 implies that the residuals are approximately normally distributed. Homoscedasticity was evaluated using the Breusch-Pagan (*BP*) test, which assesses the variance of the residuals, with larger values indicating more evidence against homoscedasticity, however, a *p* value greater than .05 indicates that the residuals have constant variance, which meets the homoscedasticity assumption. Linearity was visually assessed through scatter plots with fitted regression lines. When a linear pattern is observed in the plots, it indicates that the linearity assumption is met.

Appendix F

Multiple Regression Analysis Results

The tables below summarize the results of multiple regression analyses which explore how age, gender, occupation, education, nationality, and pre-questionnaire symptom severity affect the intervention outcomes: well-being, depression, and anxiety.

Table F1, F2, and F3 provide the regression results for the MHC-SF (well-being), BSI Depression, and BSI Anxiety outcomes. The dependent variables are the difference scores between pre and post questionnaires for MHC-SF, BSI Depression, and BSI Anxiety. The pre-intervention scores (MHC_mean_pre, BSI_Depression_mean_pre, BSI_Anxiety_mean_pre) are included as predictors. Furthermore, other predictors were age, sex (“Male” as reference), occupation (“Student” as reference), education level ("Master's degree" as reference), nationality (“Germany” as reference and grouping participants other than Germany or Netherlands as "Other").

In the tables, the regression coefficients (Estimates) show how each predictor affects the change in scores from pre to post questionnaire. *P* values of .05 indicate if these effects are statistically significant (significance values of .001, .01, and .05 are indicated by ***, **, and *, respectively). Furthermore, the residual standard error measures prediction accuracy of the model, *R*-squared indicates the proportion of variance explained by the model, and adjusted *R*-squared adjusts for the number of predictors. The *F*-statistic and its *p* value test the overall significance of the model.

Table F1

Results form Multiple Regression Analysis for the MHC-SF (Well-Being).

Variable	Estimate	Std. Error	*t*-value	*Pr*(>|*t*|)
(Intercept)	-0.78	2.62	-0.62	.54
age	0.08	0.05	1.54	.14
Sex Female	-0.47	0.25	-1.86	.08
Occupation Working student	-0.26	0.23	-1.12	.28
Occupation Employed part time	-0.12	0.39	-0.29	.77
Occupation Unemployed looking for work	0.04	0.48	0.09	.93
Education Bachelor degree	0.28	0.23	1.23	.23
Education Some college but no degree	0.82	0.51	1.62	.12
Nationality Netherlands	0.53	0.31	1.73	.10
Nationality Other	0.07	0.21	0.33	.75
MHC_mean_pre	-0.27	0.11	-2.55	.02*

Table F2

Results form Multiple Regression Analysis for the BSI Depression.

Variable	Estimate	Std. Error	*t*-value	*Pr*(>|t|)
(Intercept)	-1.51	1.56	-0.97	.34
age	0.10	0.07	1.44	.17
Sex Female	0.01	0.35	0.02	.98
Occupation Working student	-0.12	0.32	-0.36	.72
Occupation Employed part time	0.35	0.53	0.67	.51
Occupation Unemployed looking for work	-0.33	0.65	-0.51	.62
Education Bachelor degree	-0.56	0.32	-1.77	.09
Education Some college but no degree	0.93	0.68	1.36	.19
Nationality Netherlands	0.59	0.41	1.43	.17
Nationality Other	0.00	0.29	0.01	.99
BSI_Depression_mean_pre	-0.74	0.16	-4.51	< .001***

Table F3

Results form Multiple Regression Analysis for the BSI Anxiety.

Variable	Estimate	Std. Error	*t*-value	*Pr*(>|*t*|)
(Intercept)	0.69	1.75	0.40	.70
age	0.01	0.07	0.07	.94
Sex Female	0.10	0.39	0.26	.80
Occupation Working student	-0.41	0.32	-1.29	.21
Occupation Employed part time	0.21	0.53	0.40	.67
Occupation Unemployed looking for work	-0.35	0.64	-0.54	.60
Education Bachelor degree	-0.73	0.33	-2.20	.04 *
Education Some college but no degree	-0.16	0.68	-0.24	.81
Nationality Netherlands	0.98	0.42	2.35	.03 *
Nationality Other	0.08	0.29	0.28	.79
BSI_Anxiety_mean_pre	-0.75	0.19	-3.85	.001 **