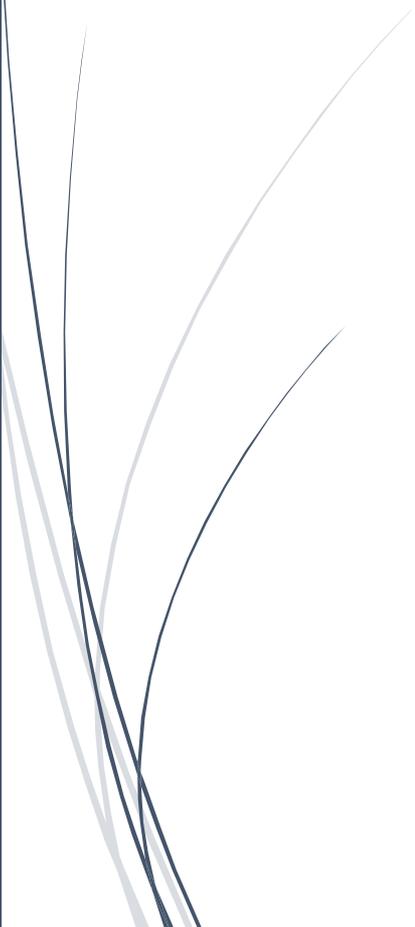Master Thesis

Fear of COVID-19: Exploring the effectiveness of an ecological momentary gratitude intervention in daily life in times of Corona

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Abstract

Objective. The worldwide outbreak of the coronavirus pandemic comes with a significant mental health burden. Current interventions to manage the pandemic were only intended to reduce the spread of the virus by government-imposed restrictions on social life. Therefore, the goal of the present study was to explore if a brief gratitude approach can relieve the mental health burden in terms of fear of Covid, depression, stress, and anxiety and simultaneously enhance happiness and gratitude among a non-clinical study sample.

Methods: The current study is an ecological momentary intervention (EMI) study with a mixed method design to explore the effects of a 16-day gratitude intervention among German participants combining an experience sampling method (ESM) with a pre-and posttest design. Inclusion criteria were to be about 18 years and in possession of a smartphone with an internet connection. A pre-posttest refers to extensive multi-item scales intended to assess the effects of the intervention on trait constructs of fear of Covid, depression, anxiety, stress, gratitude, and happiness. The ESM was conducted to assess daily fluctuations in the constructs and momentary associations with practicing gratitude exercise over time. Pre-post differences in trait constructs were tested using paired sample *t* tests, and daily ESM data were analyzed using a series of Linear Mixed Model (LMM).

Results: Results revealed that the gratitude EMI was not associated with reduced fear of Covid, depression, anxiety, and stress or increased gratitude or happiness over time as trait constructs. Of the state constructs, momentary fear of Covid did significantly, but weakly, decrease over time. The other state constructs of sadness, anxiety, stress, grateful mood, gratitude, and happiness did not significantly change over time. Further, results indicated a non-linear dose-response association between the frequency of performing the gratitude exercise and several state constructs, suggesting that the effects for the outcomes do not improve when the frequency of exercise is increasing.

Conclusion: The current study demonstrated that a gratitude EMI is applicable to assess both state and trait constructs in daily life in times of corona, but that effects on both constructs appear limited. Future studies can integrate a control group with an adaptive just-in-time system to the EMI to tailor the intervention based on the current state feelings of the participants, which in turn can help reach the intended effects of the intervention.

Keywords: fear of corona, experience sampling method, ecological momentary intervention, gratitude, gratitude exercise depression, anxiety, stress, happiness

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Introduction

The coronavirus disease (COVID-19) spread globally and reached a pandemic status, negatively impacting populations worldwide in their social lives (Schlichtiger, Brunner, Steffen, & Huber, 2020) and coming along with a significant mental health burden (Bendau et al., 2020; Bäuerle et al., 2020; Hetkamp et al., 2020). The novelty of the virus and the unpreparedness of the nations created times of uncertainty about how to combat the virus effectively, as there was no medication or vaccinations known at the time of the outbreak of the virus (Shah et al., 2020). Therefore, European countries began to implement behavioral interventions to control the pandemic with extensive restrictions on social, public, and economic life to slow down the spread of the virus (Bäuerle et al., 2020). These actions have led to increased panic and stress in individuals and profound anxiety levels that are spreading almost as quickly as the coronavirus disease (Bakioğlu et al., 2020; Landry et al., 2020).

Studies have shown that the prevalence of mental health implications is often more remarkable and lasts longer than the epidemic itself (Ornell et al., 2020), with increasing fear of the epidemic in line with infection numbers (Hetkamp et al., 2020). COVID-19 is a public health emergency of international concern, and because it challenges people's psychological resilience, it is essential to gain as much knowledge as possible on how people feel and deal with the restrictions and uncertainty experienced during the pandemic (Bakioğlu et al., 2020; Wang et al., 2020). While current interventions to manage the pandemic are only intended to reduce the spread of the virus, it is important to explore psychological interventions aimed to reduce the mental health burden in society.

To be able to sustain a positive attitude during moments of a crisis such as the COVID-19 pandemic, a grateful perspective is critical (Fishman, 2020). According to Fishman (2020), "Being grateful is a free mindfulness practice to help cope with anxiety and uncertainty by focusing on what is valued, what is in our control, and what we can give back (Fishman, 2020, p.149). Furthermore, research in positive psychology has shown that positive emotions, including gratitude, can create an upward spiral by promoting happiness and flourishing (Fishman, 2020). However, because gratitude is a broad concept, there is no consensus on its conceptualization as it appears to have different meanings in different contexts. For example, *gratitude* can be defined as an emotion, an attitude, a moral virtue, a habit, a personality trait, or a coping response (Emmons & McCullough, 2003), which can help to respond to stressful events (Lambert et al., 2009; Sansone & Sansone, 2010).

Further, definitions vary from gratitude as either a state or a trait construct. Considering it as a trait construct, it is a stable disposition, lowering the threshold of

experiencing gratitude (McCullough, Tsang, & Emmons, 2004). In contrast, as a state construct, positive emotions like gratitude can be seen as both temporary affects and longer-lasting moods (Wood et al., 2008). While gratitude as an emotion refers to specific, brief, and acute states, gratitude as a mood is a more constant state, lasting longer than an emotion, while still being less constant than stable dispositions (McCullough, Kilpatrick, Emmons, & Larson, 2001). The level of experienced gratitude can be different for individuals and varies across days (McCullough et al., 2004). Furthermore, state levels of gratitude have been found to be positively related to individuals' trait levels of gratitude as individuals high on trait gratitude tend to report higher levels of state gratitude in momentary assessments (Hartanto, Lee, & Yong, 2019; McCullough et al., 2004; Sansone & Sansone, 2010; Wood et al., 2008). Both state and trait gratitude have shown to enhance overall psychological, social, and physical well-being (Emmons & McCullough, 2003).

Several studies have shown that practicing gratitude has the potential to increase well-being and life satisfaction (Otsuka, Hori, & Kawahito, 2012) and decrease stress and depressive symptoms (Wood et al., 2008) among both clinical and non-clinical study samples (Bohlmeijer, Kraiss, Watkins, & Schotanus-Dijkstra, 2021; Davis et al., 2016). According to Davis et al. (2016), the most common strategies for promoting gratitude are simple and easy to incorporate into various treatment strategies. For example, in the study of Emmons and McCullough (2003), participants in the intervention group had to record five things they felt grateful for. Other gratitude studies entailed the task of writing a gratitude letter (Otto et al. 2016; Seligman, Steen, & Peterson, 2005), journaling, or expressing one's gratitude for another person (Davis et al., 2016). In general, a series of meta-analyses provided evidence for the efficacy of gratitude interventions with small to moderate effects of gratitude on mental health compared to the control group. However, it is important to consider that these results depend on the quality of the control group to which the intervention group is compared (Davis et al., 2016).

Possible explanations for the effects are that gratitude enables a shift from the negative aspects of life to the positive (Lau & Cheng, 2012; Seligman, Rashid, & Parks, 2005). Research on attentional biases among clinical and non-clinical study samples demonstrated that gratitude enables a positive interpretation of various stimuli and life events which can counteract the negative appraisals of oneself, the world, and the future, being characteristics for depression and anxiety (Mogg & Bradley 2005; Peckham et al., 2010). In addition, the grateful perspective generates a less critical, less punishing, and more compassionate view of oneself (Petrocchi & Couyoumdjian, 2016). Because gratitude can be induced using brief

exercises, it has broad potential applications in clinical and healthcare settings to relieve anxiety (Lau & Cheng, 2011), which can be explained due to its relationship with uncertainty (Carleton et al., 2012). Considering that the intolerance of uncertainty is profound in people with high anxiety levels, practicing gratitude can help people be content in the present circumstances and therefore attenuate a fear of uncertain outcomes.

Because the pandemic is an uncertain time with a substantial mental health burden in society, it can be expected that gratitude exercises can also potentially reduce the fear of Covid, besides the anxiety, stress, and depression associated with the pandemic. Several studies have shown that by re-examining life events with a thankful attitude, fearful thoughts can become less prevalent due to a sense that life has been well-lived (Lau & Cheng, 2011). In addition to reducing the mental health burden in society, gratitude exercises also can enhance positive feelings like happiness (Fishmann, 2020).

Despite the potential that gratitude can improve people's mental health facing stressful events, most studies examining the effectiveness of gratitude exercises or its association with psychopathological symptoms in this area have been based on laboratory experiments and retrospective surveys, rather than actual situations in which people are experiencing stress (Dickens, 2017). These assessments may be subject to recall biases as they do not provide a moment-to-moment assessment of experiences as they occur in daily life. Furthermore, gratitude has been chiefly examined as a trait (Dickens, 2017). Therefore, changes in momentary states of gratitude within individuals over time seem to be crucial to investigate. In contrast to these traditional ways of assessing gratitude in research, the *experience sampling method* (ESM) is a potential research tool to explore such effects as they occur in individuals' everyday lives (Bolger & Laurenceau, 2013; Mehl & Conner, 2012). With the ESM, participants can complete brief surveys on multiple, semi-random occasions throughout the day over a specific period, making it possible to provide a more complete account of the dynamic nature of people's feelings over time under the restrictions of the lockdown. Indeed, researchers such as Heron and Smyth (2010) call for ESM studies to conduct real-time research to gain a better understanding of the impact of lockdowns on mental health. According to them, these types of studies have the potential to discover risk and resilience factors as well as the severity of traumatic distress among the world's population (Heron & Smyth, 2010).

Nevertheless, no previous study has investigated the effect of a gratitude exercise within an ecological design, indicating a research gap in how the effects of gratitude are investigated. ESM allows to investigate both trait and state gratitude within the daily

environment of individuals, while at the same time, the gratitude exercise in the form of an ecological momentary intervention (EMI) is conducted. EMIs are treatments that are provided to people during their everyday lives and in natural settings, often using mobile technology (Heron & Smyth, 2011). They offer a potential for providing easy and cost-effective interventions to improve mental health and positive psychological well-being (Versluis et al., 2016).

Gratitude can enhance well-being and build up resilience, which is especially needed in uncertain times as experienced in the current pandemic. There is no previous research about the effects of a gratitude exercise during the pandemic and the resulting lockdown. However, since gratitude can be easily practiced by everyone without any prior perquisites, gratitude interventions may be suitable as the pandemic affects everybody to some extent. Therefore, the goal of the present study is to explore if a gratitude intervention can reduce daily feelings of fear of Covid, stress, and depression and increase gratefulness and happiness in individuals during the pandemic. The current study explores the effectiveness of performing gratitude exercises by combining an ESM with a traditional pre-and posttest design to assess both trait and state gratitude and psychological constructs such as depression, anxiety, stress, gratitude, and happiness.

The following sub-research questions are examined in this study:

1. Is performing gratitude exercises associated with reduced fear of Covid, depression, anxiety, and stress over time as both trait and state constructs in a non-clinical German study sample?

2. Is performing gratitude exercises associated with enhanced gratitude and happiness over time as both trait and state constructs in a non-clinical German study sample?

Methods

Design

The current study is an ecological momentary intervention (EMI) study with a mixed method design to explore the effects of a 16-day gratitude intervention among German participants combining an experience sampling method (ESM) with a traditional pre-and posttest design.

While the pre-posttest entailed extensive multi-item scales intended to assess the effects of the intervention on trait constructs of fear of Covid, depression, anxiety, stress,

gratitude, and happiness, the ESM was conducted to assess daily fluctuations in the constructs and momentary associations with practicing gratitude exercises over time.

Three daily state assessments were administered throughout the 16 days of data collection with an interval contingent administration, requiring participants to respond in a prescribed time range (Alliger & Williams, 1993). Daily assessments included morning (8 am to 12 am) and evening assessments (6 pm to 11 pm) of psychological state constructs and a grateful mood assessment in between these (1 pm to 3 pm). Measurements were not randomized within a time range. The gratitude exercise was administered twice a week on Wednesday and Saturday.

The study was conducted among German participants and was performed from the 9th of November 2020 to the 25th of November. The mobile App "Ethica" (https://ethicadata.com/) was used to both deliver the gratitude exercises and to send the pre- and posttest, and the daily questions. The study was approved by the ethical committee of the University of Twente in the Netherlands (201221).

Participants

Participants were recruited via convenience sampling from the researcher's personal network including family members and friends. Inclusion criteria were to be above the age of 18 years, native German-speaking, and in possession of an iPhone or Android smartphone with an internet connection and a valid email address. A total of 107 people registered for the study on Ethica, from which 82 participants completed the pretest. A total of 57 participants completed both the pre-and posttest, and 41 participants completed at least 40% of the ESM measurements. A possible explanation for the dropout of participants might be due to technical issues with the Ethica App at the beginning of the study that could not be solved immediately. The 41 completers encompassed 27 (65.9%) females and 14 (34.1%) males. The age ranged between 18 and 60 and above years. The educational qualification ranged from lower school level, possessed by 7 (25.9 %) of the participants, to a master's degree, obtained by 2 (7.4%) participants (see Table 1 in Results). *Figure 1* illustrates the flow chart of participants during the study.

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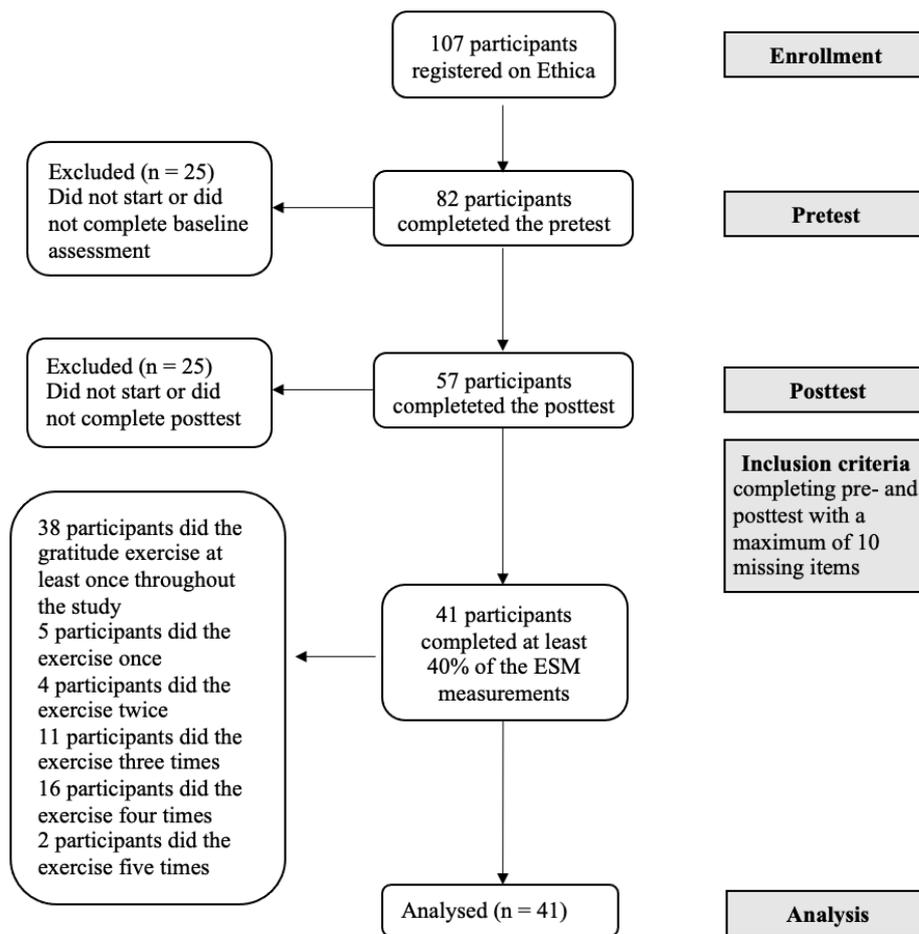

Figure 1. Flow-chart of participants.
Note. Most of the participants completed the gratitude exercise three or four times throughout the study.

Measures

After the sociodemographic data were obtained, participants had to complete four questionnaires at baseline and posttest to measure trait levels of fear of Covid, anxiety, depression, stress, gratitude, and happiness. Next to the trait questionnaires at baseline and posttest, participants received three daily assessments of momentary state levels of these outcomes of interest and a gratitude exercise once a week.

Sociodemographics. Participants had to indicate their gender (male, female), age (in categories), nationality, their currently highest completed educational level and their occupational status before starting with the first questionnaire.

Pre-and Posttest (Trait assessments)

The Fear of COVID-19 scale is a 7-item scale specifically developed for assessing the fear of COVID-19. Each item has 5 response options (1=*Strongly Disagree*; 5=*Strongly*

Agree), reflecting how participants feel, think, or act towards COVID-19. Higher scores indicate a more severe fear of COVID-19. An example item is "I am most of afraid of Corona". Findings have demonstrated that the Fear of COVID-19 Scale has good psychometric properties. According to Ahorsu et al. (2020), it is reliable and valid in assessing the fear of COVID-19 among the general population with high internal consistency ($\alpha = .82$). For the current study, the English-language scale was translated into German using a forward-backward translation, a multistep approach to ensure quality in translation (Acquadro, Conway, Hareendran, & Aaronson, 2008), and can be found in Appendix A. First, the English version was independently translated into German by two German native speakers. Then, both versions were consolidated by the researcher. This consolidated version was retranslated into English by a third independent translator to check its consistency with the original English version. Cronbach's α was high in the current study with $\alpha = .86$ at baseline and $\alpha = .92$ at posttest, respectively.

The Depression, Anxiety and Stress Scale-21 (DASS-21) contains 21-items that are divided into three subscales that measure depression, anxiety and stress in the past week, with each subscale containing 7 items. Participants responded on a 4-point Likert-scale from 0 (*did not apply to me at all)* to 3 (*applied to me very much or most of the time*), with higher scores indicating higher levels of depression, anxiety, and stress. An example item for the depression subscale is "I find it hard to wind down", for the anxiety subscale it is "I found it difficult to relax" and for the stress subscale it is "I felt I was close to panic". Recommended cut-off scores for conventional severity labels (normal, moderate, severe) can be found in Appendix B. According to Bibi, Lin, Zhang, and Margraf (2020), the psychometric properties of the DASS-21 indicate that it is a reliable instrument that can be applied for screening of depression, anxiety and stress symptoms in a German population. It exhibited good internal consistency and a Cronbach's alpha of $\alpha = .93$ in a study with a German sample. Furthermore, it has good construct and structure validity (Bibi et al., 2020). Cronbach's α for the complete questionnaire was high in the current study with $\alpha = .95$ at both the baseline and posttest. Furthermore, Cronbach's α for the subscales were sufficiently high at baseline (depression $\alpha = .79$, anxiety $\alpha = .89$ and stress $\alpha = .85$) and high at posttest ($\alpha = .86$ for depression, $\alpha = .89$ for anxiety and $\alpha = .85$ for stress).

The Gratitude Questionnaire (GQ-6) is developed by McCullough, Emmons, and Tsang (2002) and is a 6-item self-report questionnaire to assess gratitude as a disposition in

daily life. The primary focus is on the unidimensional emotional component of gratitude (Hudecek, Blabst, Morgan, & Lermer, 2020). Participants endorse each item on a 7-point Likert-type scale (where 1 = *strongly disagree* and 7 = *strongly agree*), with higher scores indicating a higher level of dispositional gratitude. An example item is "I have so much in life to be thankful for". Research suggests that the GQ-6 is a reliable and valid tool for measuring dispositional gratitude (Lambert et al., 2009; Wood et al., 2007). In a study with a German sample where one item was removed, the GQ-5 had acceptable to excellent internal consistencies (Hudecek, Blabst, Morgan, & Lermer, 2020). In the current study, Cronbach's α was moderate with α =.62 at baseline and was higher after deleting item 3 with α =.74. At posttest, Cronbach's α was low with α =.54. and item 3 was kept as there was no substantial difference when deleting it at posttest.

The Oxford Happiness Scale (OHQ) developed by Argyle, Martin, and Crossland (1989), is a 29-item multiple choice instrument intended to measure personal happiness as a trait construct. Each item contains four options, reflecting incremental steps defined as: unhappy or mildly depressed, a low level of happiness, a high level of happiness, and mania. Participants were asked to "pick out the one statement in each group which best describes the way you have been feeling over the past week, including today". Items were rated on a 6-point Likert-type scale (where 1=*Strongly Disagree* and 6=*Strongly Agree*), with higher scores indicating a higher level of personal happiness. An example item is "I have very warm feelings towards almost everyone". According to the study of Hills and Argyle (2002) with undergraduate students of Oxford Brookes University and their friends and relation, the OHQ demonstrated high scale reliability (α =.92) and good construct validity (Hills & Argyle, 2002). In the current study, Cronbach's α was also high with α =.91 at baseline and α =.88 at posttest, respectively.

Daily State Assessments

Morning and Evening assessments contained 5 questions each assessing a different state construct on a daily basis. Assessed state constructs were fear of Covid ("I am afraid of Corona"), stress ("I am stressed"), depression ("I am sad"), anxiety ("I am feeling anxious"), gratitude ("I am feeling grateful") and happiness ("I am feeling happy"). Each item that reflects a different state measurement was chosen from the questionnaires of each trait assessment. All 5 items assess the current state of feeling of participants. Participants

responded on a slider scale from 0 to 100 (where 0=*Strongly Disagree*, *100=Strongly Agree*), with higher scores indicating a higher level of the corresponding state construct.

Grateful mood was additionally assessed once a day using the *Grateful Mood Scale* developed by McCullough et al. (2004), which contains 4 items to assess grateful mood. Answer categories ranged from 1 (*totally disagree*) to 7 (*totally agree*), where higher scores indicate a higher level of grateful mood, from which the mean score of the four items was used. An example item is "I feel grateful". For the current study, the English version was translated into German by the researcher.

Gratitude Exercise

Participants received a gratitude exercise in Ethica twice a week and had four hours to complete it. The exercise and instructions for this exercise were based on Emmons and Mcullough (2003) and translated into German, with the task to write down five things to be grateful about, with the instruction:

> There are many things in our lives, both large and small, that we might be grateful about. Think back over the past week and write down on the lines below up to five things in your life that you are grateful or thankful for.

Procedure

Participants received a link for the study via E-mail or by social media. Following the link, participants had to download the Ethica app from their Google PlayStore or Apple Store and register with a code to the study. Furthermore, participants were clarified about anonymity and confidentiality and agreed to the informed consent (see Appendix C) by registering for the study. After the registration phase, the study started with the daily assessments, including the morning and evening assessments as well as at midday. Additionally, they received the baseline assessment, including four questionnaires, as the pretest of the study. To minimize the burden, three days were given to fill out these questionnaires. Moreover, the gratitude exercise was sent out two times a week, every Wednesday and Saturday, resulting in completing the exercise four times in total. The study continued for 16 days, and participants received reminders on Ethica and via E-mail in between to increase participation. At the end of the study, participants received the posttest and had three days again to fill it out.

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Data Analysis

All analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 25. The datasets for trait and state assessments were merged into a single long format dataset with erroneous data being cleaned. Descriptive statistics on the sociodemographics of the participants including their age, gender, nationality, educational level, and occupation were analyzed. Differences in participant characteristics and trait scores of completers and dropouts at baseline and posttest were tested using independent t-tests and χ^2-tests. Pre-post differences in trait constructs were tested using paired sample t tests. Cohen's within-subjects effect sizes (d) were computed to assess the magnitude of the intervention effect and interpreted as small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) based on benchmarks suggested by Cohen (1988). Pearson correlations were computed to examine the association between the total number of performed gratitude exercises and pre-post change scores on the trait constructs.

Daily ESM data were analyzed using a series of Linear Mixed Model (LMM) analyses with an autoregressive covariance structure (AR1) for the repeated measurements. Because of the intensive nature of data obtained in ESM studies, the LMM is suitable considering its ability to take into account both its longitudinal (hierarchical) nature and missing data by creating an estimate of the maximum probability that an answer will occur based on previous answers of the participants (Scollon, Prieto, & Diener, 2009). First, to check the validity of the daily state measures, separate LMMs with state measures as the dependent variable and trait measures as the fixed covariate were calculated. To obtain standardized regression estimates (β), both dependent (state constructs) and independent (trait constructs) variables were z-transformed. Standardized estimates were examined to interpret the association between state and trait measures. A β between .3 and .7 was considered to show a valid correlation between state and trait constructs assessing similar yet distinct constructs.

To test for the significance of the overall effect of time on the different state constructs, new LMMs were conducted with measurement day (0 - 16) as a fixed covariate and averaged daily state measures as the dependent variables. To visually support the results, Excel was used to create line graphs to depict the estimated marginal means of the state constructs over the measurement days. Pairwise least squares difference (LSD) comparisons tests between the days of the study were used to determine the exact days where statistical differences occurred.

To specifically test for the effect of the frequency of performing the gratitude exercise in relation to the state constructs, LMMs with the daily average of state constructs as the

dependent variable and the frequency of gratitude exercises performed as the fixed covariate was conducted. The association between frequency of gratitude exercises and state constructs of interest was visually illustrated by bar charts setting the frequency gratitude exercise as the independent variable on the x-axis and the daily average of state measures on the y-axis.

Results

Baseline Characteristics

The baseline characteristics of the sample are displayed in Table 1. Results revealed a statistically significant difference between dropouts and completers for employment, showing that full time employed participants dropped out more frequently ($p = .004$). Furthermore, males tended to almost significantly dropout more frequently than females ($p = .067$). For the other demographic variables, including age, marital status, and education, there was no significant difference between completers and non-completers. Table 2 shows that there were no significant differences in baseline trait scores between completers and non-completers.

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Table 1
Baseline characteristics of participants

	Dropout (N = 27)	Completers (N = 41)	*p*
Gender, n (%)			.067
Female	12 (44.4%)	27 (65.9%)	
Male	15 (55.6%)	14 (34.1%)	
Age			.314
18-21	1 (3.7%)	5 (12.2%)	
22-30	19 (70.4%)	24 (58.5%)	
31-39	3 (11.1%)	1 (2.4%)	
40-49	3 (11.1%)	5 (12.2%)	
50-59	1 (3.7%)	4 (9.8%)	
60 and above	0	2 (4.9%)	
Marital status			.228
Married	7 (25.9%)	9 (22.0%)	
Single	20 (74.1%)	32 (78.0.%)	
Education			.744
Low	16 (59.3%)	22 (53.7%)	
Intermediate	9 (33.3%)	12 (29.3%)	
High	2 (7.4%)	7 (17.1%)	
Employment			.004
Part-time 39h	9 (33.3%)	26 (63.4%)	
Full-time 40h	13 (48.1%)	7 (17.1%)	
Unemployed	0	5 (12.2%)	
Self-employed	5 (18.5%)	2 (4.9%)	
Retired	0 (50,0%)	1 (2.4%)	

Note. Education: "low" consists of lower school leaving certificate and general qualification for university entrance, "intermediate" consists of university without degree and bachelor's degree, "high" consists of Master and PhD. *p*-Values were calculated using Chi-Square tests for gender, education and employment and Mann-Whitney Test for age.

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Pre-posttest differences in trait constructs and Dropout

Results indicated that there was no statistically significant change in trait constructs for completers at pre-and posttest. Only happiness scores tended to be slightly higher with almost moderate effects after two weeks, but this increase was not statistically significant (p = .093). Scores on depression, anxiety, and stress showed mild to moderate levels. All changes represented a small effect with all Cohen's d values below 0.2.

Table 2
Means and standard deviations (in parentheses) of trait constructs and dropout rates

Trait constructs	Dropouts	Completers		p dropout	p prepost	Cohen's d
	Pre-test	Pre-test	Post-test			
Fear of Covid-19	1.92 (0.65)	1.93 (0.76)	1.85 (0.87)	.957	.286	0.155
Depression	11.26 (4.06)	11.49 (3.36)	11.02 (3.56)	.801	.623	0.179
Anxiety	13.15 (4.22)	12.73 (4.66)	13.00 (4.63)	.710	.348	0.078
Stress	11.41 (4.63)	10.83 (4.24)	10.34 (3.89)	.597	.901	0.149
Gratitude	4.23 (0.72)	4.16 (0.91)	4.17 (0.82)	.736	.901	0.019
Happiness	4.14 (0.80)	4.29 (0.72)	4.37 (0.59)	.435	.093	0.196

Correlations between trait constructs and frequency of gratitude exercise

Results of the Pearson bivariate correlation revealed a significant negative association between pre-post changes on the depression subscale and the frequency of the gratitude exercise (r (41) = -.332, p = .034), indicating that levels of depression are decreasing when the frequency of the gratitude exercise increases. A trend towards a significant negative association was also found between fear of Covid and the frequency of the gratitude exercise (r (41) = -.278, p = .079). Results revelated no significant association for trait gratitude (r (41) = .219, p=.169), happiness (r (41) = -.034, p = .835), anxiety subscale (r (41) = -.196, p = .219) and stress subscale (r (41) = -.092, p = .569).

Validity check: State-trait correlations

Associations between state and trait measures for fear of Covid, happiness and gratitude and anxiety were of the expected magnitude, for both pre-and posttest trait scores,

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supporting the validity of state assessments for these constructs (Table 3). Correlations

between state and trait measures for depression and stress were within the expected

magnitude for the baseline trait scores, but were slightly lower than expected for the posttest

trait scores.

Table 3
Standardized associations between state and trait measures

Trait Constructs	State Constructs	β	95% CI
Happiness pretest	Morning happiness	.53**	.39 - .67
	Evening happiness	.51**	.38 - .64
Happiness posttest	Morning happiness	.61**	.50 - .74
	Evening happiness	.61**	.50 - .71
Depression pretest	Morning sadness	.33**	.18 - .45
Anxiety pretest	Morning anxious	.55**	.43 - .68
Stress pretest	Morning stressed	.39**	.24 - .54
Depression pretest	Evening sadness	.36**	.21 - .51
Anxiety pretest	Evening anxious	.55**	.43 - .66
Stress pretest	Evening stressed	.35**	.21 - .50
Depression posstest	Morning sadness	.27**	.11 - .43
Anxiety posttest	Morning anxious	.51**	.37 - .64
Stress posttest	Morning stressed	.23*	.01 - .39
Depression posttest	Evening sadness	.22*	.06 - .39
Anxiety posttest	Evening anxious	.42**	.28 - .55
Stress posttest	Evening stressed	.18*	.02 - .34
Fear of Covid pretest	Morning fear of Covid	.54**	.39 - .69
	Evening fear of Covid	.54**	.39 - .69
Fear of Covid posttest	Morning fear of Covid	.59**	.46 - .73
	Evening fear of Covid	.60**	.46 - .73
Gratitude pretest	Morning gratitude	.40**	.24 - .55
	Evening gratitude	.37**	.19 - .54
	grateful mood	.44**	.27 - .61
Gratitude posttest	Morning gratitude	.40**	.24 - .56
	Evening gratitude	.35**	.18 - .53
	grateful mood	.43**	.26 - .60

Note. CI= Confidence Interval. * p<.05. **p<.01.

Fear of Covid over time

For fear of Covid, results revealed a statistically significant effect of time (F (1,

204.57) = 4.88, p = .028) and a negative direction towards the daily average of fear of Covid

(B = -0.65, SEB = 0.29), meaning that state feelings of fear of Covid weakly, but significantly,

decreased over time (see *Figure 2*). Post-hoc pairwise comparisons suggested that this effect of time was mostly due to the relatively high average fear of Covid score on day 1 and that scores remained relatively stable after day 2. A more detailed visual representation of fear of Covid over time can be found in Appendix D.
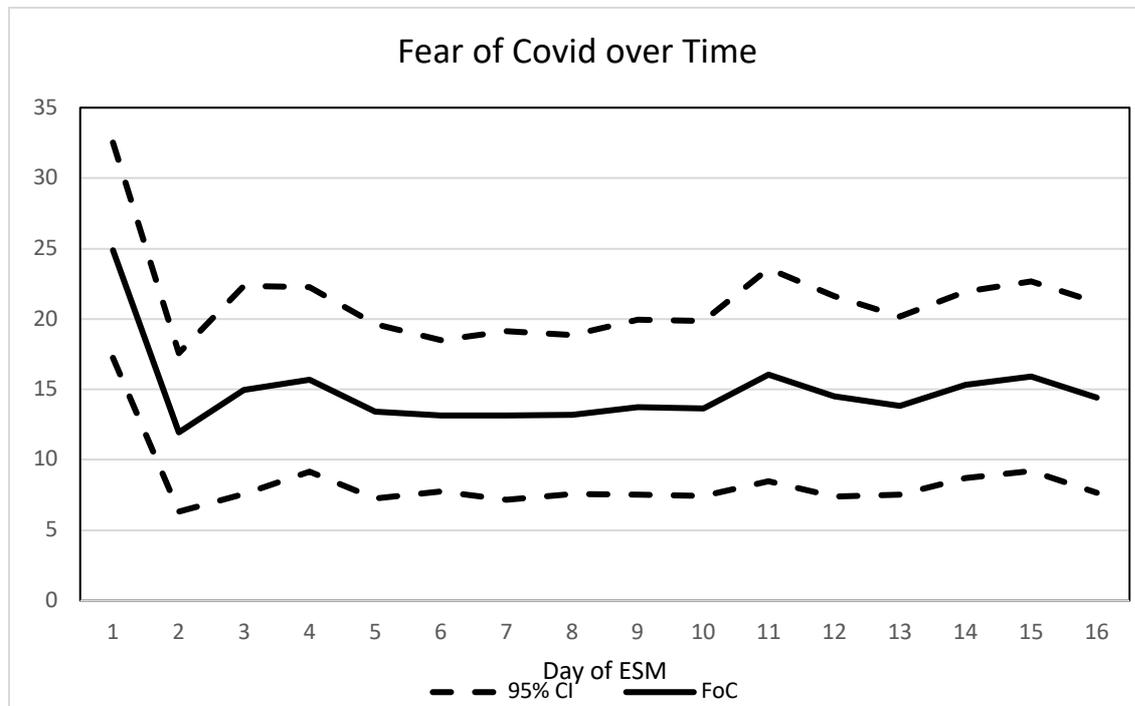

Figure 2. Line graph illustrating fear of Covid over time with 95% Confidence Interval.
Pairwise comparisons between the days of the study revealed that until day 4, there was a statistically significant decrease of fear of Covid compared to the first day (Day 2 B =12.04, p < .01, Day 3 B=10.84, p < .01, Day 4 B= 9.75, p = .04). Day 5 showed a trend towards a statistically significant decrease compared to Day 1 (B = 10.14, p = .098). On Day 6 there is a significant decrease of fear of Covid compared to the first day (B = 11.99, p=.032). On Day 7 there tend to be a significant decrease (B = 11.73, p = .086). After Day 8 until Day 16, there is no significant decrease of fear of Covid anymore, indicating that only in the first half of the study fear of Covid significantly decreased over time.

Effect of Gratitude Exercise frequency. The Linear Mixed Model with the daily average of fear of Covid as the dependent variable and gratitude exercise as the covariate was used to test for the effect of frequency of performing the gratitude exercise. Results revealed that there was no overall linear effect of gratitude exercise on daily fear of Covid *(Figure 3*; F (1, 612) = 0.30, p = .582). Pairwise LSD comparisons, however, showed that doing the exercise once (B = 22.81, p < .01), twice (B= 20.07, p < .01) or four times (B=1 8.88, p < .01) had a statistically significant effect on less daily fear of Covid compared to not doing the gratitude exercise. Doing the exercise three (B= 7.56, p = .27) or five times (B= -1.96, p=1.00) was not statistically significant in reducing daily fear of Covid compared to not doing the exercise.

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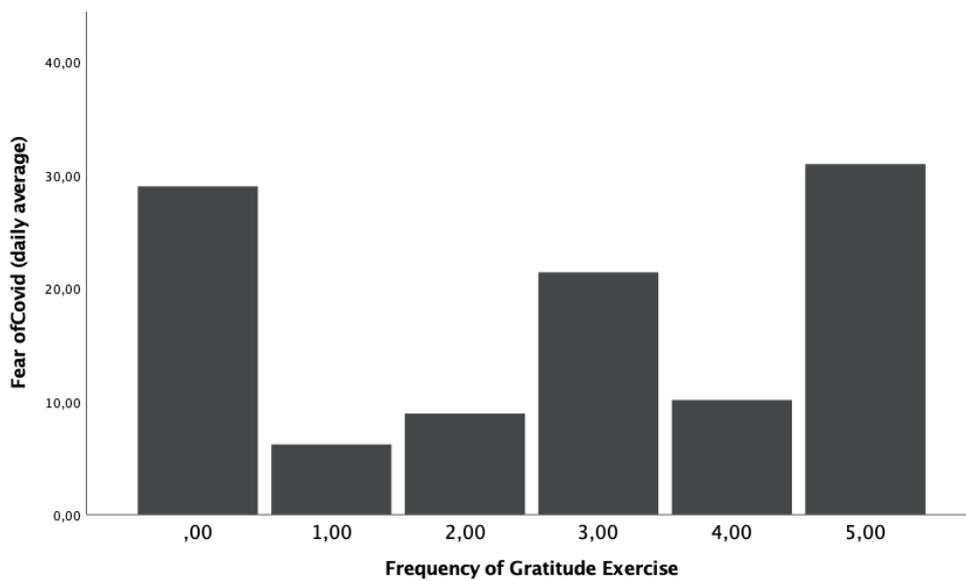

Figure 3. Frequency of Gratitude Exercise on fear of Covid.

State Constructs over time

The Linear Mixed Models with the daily average of the state constructs and time as fixed factor was used to test for the effect over time on the other outcomes of interest (see *Figure 4* below). Results revealed no statistically significant effect of time for sadness, anxiety, stress, gratitude, grateful mood, and happiness.
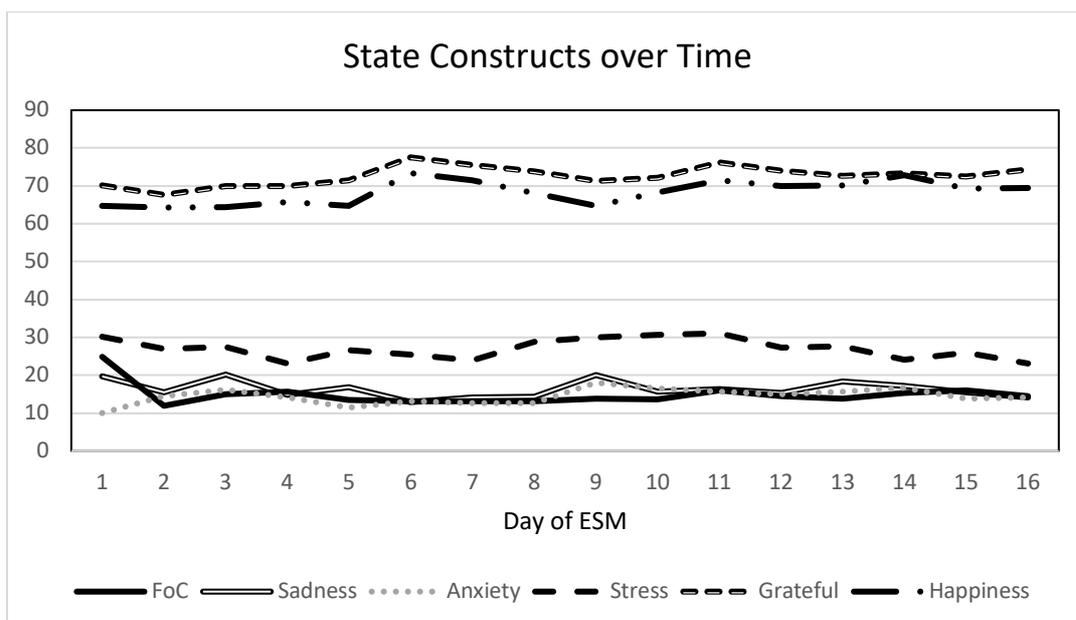
Figure 4. State constructs over time.

FoC = Fear of Covid. Results revealed that there is no statistically significant effect of time for sadness (F (1, 168,29) = 0.68, B = -0,25, SEB = 0.30, p = .411), anxiety (F (1, 192,38) = 0.87, B = 0.26, SEB = 0.28, p = .35),

stress (F (1, 177,50) = 0,87, B = -0.35, SEB = 0,38, p = .352), gratitude (F (1, 177,02) = 0.94, B = 0.36, SEB = 0.38, p = .43) grateful mood (F (1, 172,74) =, 0.29 B = -0.12, SEB =0.22, p = .59) and happiness (F (1, 171,26) = 1.596, B = 0.48, SEB=0.38, p = .208).

Gratitude Exercise

The Linear Mixed Model with the daily average of state measurements (sadness, anxiety, stress, happiness, grateful mood, and gratitude) as the dependent variable and gratitude exercises as the covariate was used to test for the effect of frequency of performing the gratitude exercise.

Results revealed that there was an overall effect of gratitude exercise on daily anxiety (F (1, 611) = 5.44, p = .02), which displayed a negative direction towards the daily average of anxiety (B = -1.41, SEB = 0.60) in *Figure 5*, and grateful mood (F (1, 357) = 6.15, p = .01) *in Figure 6*, which displayed a positive direction towards the daily average of grateful mood (B = 0.13, SEB = 0.54), indicating that increased gratitude exercise frequency was associated with decreasing feelings of anxiety and increasing feelings of grateful mood over time.
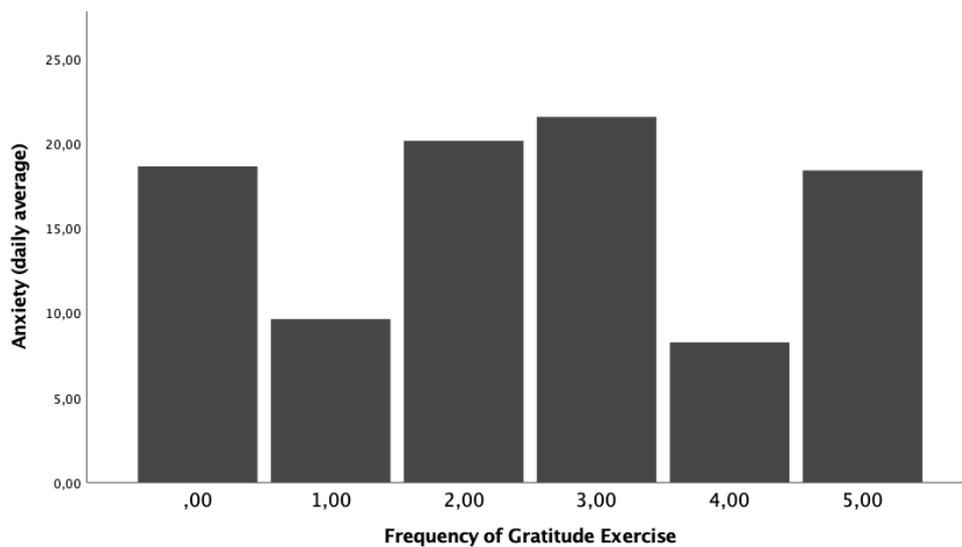

Figure 5. Frequency of Gratitude Exercise on anxiety.

Pairwise comparisons showed that doing the exercise four times (B = 10.34, p= .02) had a statistically significant effect on daily anxiety compared to not doing the gratitude exercise.
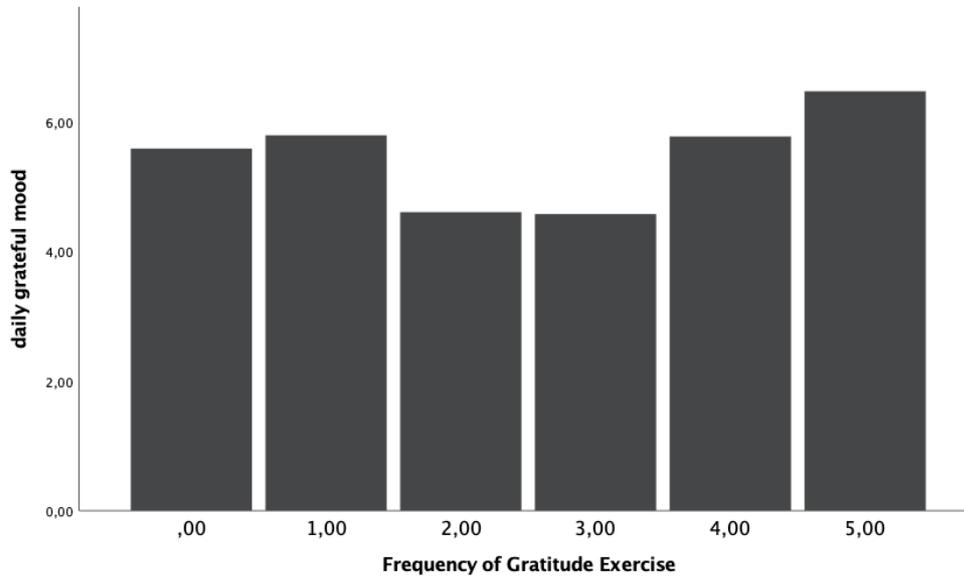
Figure 6. Frequency of Gratitude Exercise on grateful mood.

Pairwise comparisons showed that doing the exercise two times ($B = 1.19$, $p = .003$) and three times ($B = 1.21$, $p < .01$) had a statistically significant effect on daily grateful mood compared to not doing the gratitude exercise.

There was no overall linear effect of gratitude exercise on the other daily state constructs such as sadness ($F(1, 611)= 1.64$, $B = -0.81$, $SEB= 0.63$, $p = .20$), stress ($F (1, 612) = 0.004$, $B = -0.05$, $SEB=0.78$, $p = .95$) happiness ($F (1, 612) = 0.75$, $B = 0.68$, $SEB= 0.78$, $p = .39$) and gratitude ($F (1, 612) = 1.20$, $B = 0.84$, $SEB = 0.77$, $p = .27$).

Discussion

The purpose of the present study was to explore if a gratitude EMI can reduce daily feelings of fear of Covid, depression, anxiety, and stress and increase gratefulness and happiness in individuals during the pandemic. The effectiveness of performing the gratitude exercises was explored by combining an ESM with a traditional pre-and posttest design to assess changes in both trait- and state-level constructs. Results revealed that the gratitude EMI was not associated with reduced fear of Covid, depression, anxiety and stress or increased gratitude or happiness over time as trait constructs. Of the state constructs, fear of Covid did significantly, but weakly, decrease over time. However, post-hoc analyses showed no overall linear effect of the frequency of performing gratitude exercises on daily fear of Covid. The other state constructs of sadness, anxiety, stress, gratitude, and happiness did not significantly change over time. Additional analyses indicated an overall effect of gratitude exercises frequency on daily anxiety and grateful mood, supporting that increased gratitude exercise frequency was associated with decreasing feelings of anxiety and increasing grateful mood over time.

However, the non-linear dose-response relation between the frequency of performing the gratitude exercise and daily anxiety and grateful mood needs to be considered which suggests that the effects for the outcomes are not the same when frequency of exercise is increasing.

The unexpected spread of the coronavirus and the resulting social restrictions in the lockdowns had a worldwide impact on mental health in society. These uncertain times with the pressure to limit personal contact with each other outlined the need for easy-to-administer and low-intensity intervention in the context of public mental health, especially in an online environment. Considering that the impact on mental health in society can be expected to even last longer than the pandemic itself (Bakioğlu et al., 2020; Wang et al., 2020), it becomes even more essential to develop and explore the effectiveness of such interventions. Regarding the current study, the ecological momentary intervention allowed to investigate changes in how people feel during a pandemic, while administering an intervention simultaneously, facilitating measurements in a real-life setting.

Previous research on gratitude interventions mainly focused on changes in trait-like assessments over time and found significant changes for trait outcomes before and after the intervention (Davis et al., 2016; Dickens, 2017). These findings are not in line with the results of the current study, as the trait constructs did not change significantly and changes were all of small magnitude with effect sizes below 0.2. Possible reasons for this might be the variation of the intervention setting and intensity between previous studies and the current study. Although a brief intervention has the advantage of being applicable in a variety of situations and settings, a more intensive intervention with a longer duration might be more effective in changing trait and state constructs (Lyubomirsky & Layous, 2013). Previous studies have shown that intensifying the gratitude intervention for example from a weekly to a daily basis has the potential for a more sustained effect (Emmons & McCullough, 2003). The study of Bohlmeijer et al. (2021) indicated that extending gratitude interventions to six weeks, and including various gratitude activities, may enhance their impact as well. Based on this, increasing the dosage and variation of the current study to a daily gratitude exercise and extending the duration to six weeks may contribute to larger effects on mental health outcomes. Furthermore, potential publication bias of previous studies needs to be considered when evaluating results, as studies with a statistically significant result for the main outcome of interest may have been more likely to be submitted for publication and more likely to be published than studies with null results (Easterbrook, Gopalan, Berlin, & Matthews, 1991).

In contrast to trait constructs, that reflect rather stable dispositions, state measures of the respective outcomes were expected to be more prone to fluctuations and ESM offered a

potential research tool to explore such effects as they occur in participants' everyday lives. Results revealed a statistically significant decrease of fear of Covid over time, which shows the potential usefulness of ESM to detect changes in state feelings in these studies (Heron & Smyth, 2011). However, post-hoc pairwise comparisons suggested that this change was mainly due to relatively high fear scores on the first day of the study. Other state measures were expected to statistically change over time as well, but this was not confirmed. A possible explanation can be based on the findings of Dickens (2017), that gratitude interventions can lead to improvements for numerous outcomes, however, the unique benefits of a gratitude intervention may be overemphasized in the literature. Moreover, due to lack of a control group in the current study, it cannot be ruled out that the scores could potentially have increased over time without the intervention. Therefore, future studies should integrate a control group in their study design to check if scores potentially have increased over time without an intervention. Based on this, future studies should also consider the importance of the quality of the control group, for example when including a hassle condition, referring to experiencing irritants in various domains of life, that might increase stress, as they can affect the results (Davis et al., 2016). Besides, potential benefits of the intervention might also be minimized due to a ceiling effect of the sample. Although the study was conducted during the second lockdown of the pandemic, participants experienced rather low levels of fear of Covid, which could indicate that participants already habituated to a great extent to the circumstances of the pandemic.

Next, it is important to consider the non-linear dose-response relation observed between the frequency of performing the gratitude exercise and daily anxiety and grateful mood. This association appeared quadratic with higher anxiety scores and lower grateful mood scores associated with both completers and non-completers of the gratitude exercise. While results revealed an overall effect of frequency of exercises on anxiety and grateful mood over time, this effect was not found for fear of Covid. Related to this, it is important that no causal relationship can be drawn in which direction the quadratic association between the frequency of gratitude exercise and state constructs is. Considering the prevalence of common mental health disorders in the general population (Whiteford et al., 2013) it might be the case that non-completers of the gratitude exercise struggled to find five things to be grateful for due to low levels of gratitude from the beginning of the pandemic, leading to higher levels of anxiety and fear of Covid, demotivating participants even more when not being able to list five things. In contrast, frequent completers of the gratitude exercise could

have a more grateful disposition, so that the exercise was not powerful enough to make an addition to participants with already high levels of gratitude.

Strengths

A major strength of the current study is the mixed-methods design setting. While previous research was mainly focused on retrospective assessments on trait-like constructs only, this study combined a pre-and posttest design within an ecological momentary intervention, including the intensive assessment of state constructs in the participants' daily lives. These measures represent states as they occur in individual's everyday lives and reduce the effect of recall biases known from cross-sectional or retrospective studies (Dickens, 2017). In addition, because the study was conducted during the second lockdown, outcomes represent both trait and state constructs during a pandemic, on which no previous research can be found.

Previous research showed that trait and state measures are positively related to each other, which is also in line with the results of the validity checks. Correlations in the current study showed that trait and state assessment were generally moderately to strongly related to each other for all outcomes, but still distinct constructs. This also suggests that the used state assessments, which were not previously tested, are valid in measuring the intended constructs.

In addition to the strength that the current study results were obtained through robust statistical analysis, results illustrated the importance of visualizing the rich ESM data as well. For example, *Figures 8 ,9, 10* and *11* in Appendix D illustrate detailed individual differences in fluctuations of fear of Covid over time. Also, *Figures 5* and *6* clearly demonstrate the non-linear association between state constructs and the frequency of the gratitude exercise, especially between people that did not do the exercise at all and those that did it five times. Additional curve estimation statistically supported this quadratic association (data not shown).

Limitations and future implications

Although the mixed-methods study design is a unique asset of the current study, the lack of a control group limits the conclusions that can be drawn based on the obtained results. For example, a control group in a neutral condition would have allowed to examine if scores changed naturally over time or if the intervention gave rise to changes in mental health compared with controls. Future studies can incorporate a control group in addition to the current study design, which could be in the form of a sham group to draw a more precise conclusion on the efficacy of such EMI.

Furthermore, the direction of causality could also not be investigated between the frequency of gratitude exercise and state and trait constructs, impairing a clear explanation for the non-linear dose-response relationship. As EMI's have the advantage of modifying the intervention in real-time, future studies can use the full potential of an EMI by integrating a *just-in-time adaptive intervention*, which is an intervention design aiming to provide the right type and amount of support at the right time. In this way, the intervention can be adapted to an individual's changing internal and contextual state (Nahum-Shani et al., 2017) which in turn can help to reach the intended effects of the intervention (Klasnja et al., 2015).

Another limitation was due to technical issues at the beginning of the study by repeatedly sending out already completed surveys, resulting in confusion and probably demotivation for some participants. It can be presumed that this had an impact on the high dropout rate, especially for those participants who are full-time working. This highlights the importance of pilot testing, especially for technological interventions. Pilot studies are a crucial element of a good study design because they increase a successful administration and provide valuable insight for other researchers (Edwin, van Teijlingen, & Hundley, 2001. Therefore, future studies should not underestimate the importance of pilot testing and integrate it into the study design.

Conclusion

The current study demonstrated that it is feasible to apply a gratitude EMI to assess both state and trait constructs in daily life in times of corona, but that such an intervention may need to be longer and more intensive. Combining a traditional pre-and posttest design with a gratitude EMI allowed a real-time longitudinal assessment during a pandemic, showing how the society feels during the lockdown and how these states fluctuate over time. Future studies can adjust the current research by intensifying the duration of the intervention to obtain more beneficial effects of gratitude and include a control group to assess the effectiveness of the intervention. A pilot testing should be conducted beforehand, and to optimally use the potential of an EMI, an adaptive system can be integrated to tailor the intervention based on the current state of the participants.

References

Acquadro, C., Conway, K., Hareendran, A., & Aaronson, N. (2008). Literature Review of Methods to Translate Health-Related Quality of Life Questionnaires for Use in Multinational Clinical Trials. *Value in Health, 11 (3)*, pp: 509-521. doi: 10.1111/j.1524-4733.2007. 00292.x

Ahorsu, D.W, Lin, C.Y., Imani, V., Saffari, M., Griffiths, M.D., & Pakpur, A.H. (2020). The Fear of COVID-19 Scale: Development and Initial Validation. *International Journal of Mental Health and Addiction*. doi:10.1007/s11469-020-00270-8

Alliger, G.M., & Williams, K.J. (1993). Using signal-contingent experience sampling methodology to study work in the field: A discussion and illustration examining task perceptions and mood. *Personnel Psychology, 46(3),* pp:525–549, doi: 10.1111/J.1744-6570. 1993.TB00883.X

Argyle, M., Martin, M., & Crossland, J. (1989). Happiness as a function of personality and social encounters. Recent advances in social psychology: *An international perspective. Psychology, 5 (18)*, pp. 189- 203

Bakioğlu, F., Korkmaz, & O., Ercan, H. (2020). Fear of COVID-19 and Positivity: Mediating Role of Intolerance of Uncertainty, Depression, Anxiety, and Stress. *International Journal Mental Health Addiction.* doi: 10.1007/s11469-020-00331-y

Bäuerle, A., Teufel, M., Musche, V., Weismüller, B., Kohler, H., Hetkamp, M., . . . Skoda, E.A. (2020). Increased generalized anxiety, depression and distress during the COVID-19 pandemic: a cross-sectional study in Germany. *Journal Public Health*. doi: 10.1093/pubmed/fdaa106

Bendau, A., Petzold, M.B., Pyrkosch, L., Maricic, L.M., Betzler, F., Rogoll, J., . . . Plag, J. (2020). Associations between COVID-19 related media consumption and

symptoms of anxiety, depression, and COVID-19 related fear in the general population in Germany, *European archives of psychiatry and clinical neuroscience*, *271*(2), pp: 283–291.

doi: 10.1007/s00406-020-01171-6

Bibi, A., Lin, M., Zhang, X.C., & Margraf, J. (2020). Psychometric Properties and measurement invariance of Depression, Anxiety and Stress Scales (DASS-21) across cultures. *International Journal of Psychology (55), 6*, pp: 916-925.

doi: 10.1002/ijop.12671

Bohlmeijer, E. T., Kraiss, J. T., Watkins, P., & Schotanus-Dijkstra, M. (2021). Promoting gratitude as a resource for sustainable mental health: results of a 3-armed randomized controlled trial up to 6 months follow-up. *Journal of happiness studies*, *22*(3), 1011-1032.

Bolger, N., & Laurenceau, JP. (2013). Intensive longitudinal methods: An introduction to diary and experience sampling research. *Guilford.*

doi: 10.1590/1516-4446-2020-0008

Carleton, R. N., Mulvogue, M. K., & Thibodeau, M. A., McCabe, R. E., Antony, M. M., Asmundson, G. J. (2012). Increasingly certain about uncertainty: Intolerance of uncertainty across anxiety and depression. *Journal of Anxiety Disorders, 26,* 468–479. doi: 10.1016/j.janxdis.2012.01.011

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. New York, NY: Routledge Academic.

Davis, D. E., Choe, E., Meyers, J., Wade, N., Varjas, K., Gifford, . . .Worthington, E. L., Jr. (2016). Thankful for the little things: A meta-analysis of gratitude interventions. *Journal of Counseling Psychology, 63*(1), 20–31.

Dickens, L. R. (2017). Using Gratitude to Promote Positive Change: A Series of Meta-Analyses Investigating the Effectiveness of Gratitude Interventions. *Basic and*

Applied Social Psychology, 39(4), pp:193-208.

doi:10.1080/01973533.2017.1323638

Easterbrook, P.J., Gopalan, R., Berlin, J.A, & Matthews, D.R. (1991). Publication bias

in clinical research. *The Lancet (337)*, pp: 867-872,

doi: 10.1016/0140-6736(91)90201-Y

Edwin R. van Teijlingen, E.R., & Hundley, V. (2001). Social Research Update.

Guildford (35).

doi:10.1093/acprof:oso/9780195373585.003.0016

Emmons, R.A., & McCullough M.E. (2003). Counting Blessings Versus Burdens: An

Experimental Investigation of Gratitude and Subjective Well-Being in Daily

Life. *Journal of Personality and Social Psychology* (84), 2, p:377-389.

doi: 10.1037/0022-3514.84.2.377

Fishman, M. (2020). The Silver Linings Journal: Gratitude During a Pandemic. *Journal

of radiology nursing*, *39*(3), pp:149–150.

doi: 10.1016/j.jradnu.2020.05.005

Hartanto, A., Lee, S. T. H., & Yong, J. C. (2019). Dispositional gratitude moderates the

association between socioeconomic status and Interleukin-6. *Scientific Reports,

9(1).* doi:10.1038/s41598-018-37109-1

Heron, K.E., & Smyth, J.M. (2010). Ecological momentary interventions: Incorporating

mobile technology into psychosocial and health behaviour treatments. *British

Journal of Health Psychology*, 15 (1), pp: 1-39 doi:10.1348/135910709X466063

Hetkamp, M., Schweda, A., Bäurerle, A., Weismüller, B., Kohler, H., Musche, V.,

Dörrie, . . . Skoda, E.A. (2020), *Sleep Med* (75), p:350-353.

doi: 10.1016/j.sleep.2020.08.033

Hills, P., & Argyle, M. (2002). The Oxford Happiness Questionnaire: a compact scale

for the measurement of psychological well-being. *Personality and Individual Differences* (33), pp: 1073-1082

Hudecek, M.F.C., Blabst, N., Morgan, B., & Lermer, E. (2020). Measuring Gratitude in

Germany: Validation Study of the German Version of the Gratitude

Questionnaire-Six Item Form (GQ-6-G9 and the Multi-Component Gratitude

Measure (MCGM-G). *Front Psychol (11)*. doi: 10.3389/fpsyg.2020.590108

Klasnja, P., Hekler, E. B., Shiffman, S., Boruvka, A., Almirall, D., Tewari, A., &

Murphy, S. A. (2015). Microrandomized trials: An experimental design for

developing just-in-time adaptive interventions. *Health psychology: official

journal of the Division of Health Psychology, American Psychological

Association*, *34*(0), pp:1220–1228. doi: 10.1037/hea0000305

Lambert, N. M., Fincham, F. D., Stillman, T. F., & Dean, L. R. (2009). More gratitude,

less materialism: the mediating role of life satisfaction. *J. Posit. Psychol.* 4, 32–

42. doi: 10.1080/17439760802216311

Lambert, N. M., Graham, S. M., & Fincham, F. D. (2009). A prototype analysis of

gratitude: Varieties of gratitude experiences. *Personality and Social Psychology

Bulletin*, 35(9), 1193–1207. doi:10.1177/0146167209338071

Landry, M.D., Geddes, L., Moseman, A.P., Lefler, J.P., Raman, S.R., & Wijchen, J.

(2020). Early reflection on the global impact of COVID19, and implications for

physiotherapy. *Physiotherapy (107)*,1-3, doi: 10.1016/j.physio.2020.03.0003

Lau, R., & Cheng, S. T. (2011). Gratitude lessens death anxiety. *European journal of

ageing*, *8*(3), p:169. doi:10.1007/s10433-011-0195-3

Lau, R. W., & Cheng, S. T. (2013). Gratitude orientation reduces death anxiety but not positive and negative affect. *OMEGA-Journal of Death and Dying*, *66*(1), pp:79-88. doi:10.2190/OM.66.1. e

Lovibond, S.H. & Lovibond, P.F. (1995). Manual for the Depression Anxiety & Stress Scales. (2nd Ed.) Sydney: Psychology Foundation.

Lyubomirsky, S., & Layous, K. (2013). How do simple positive activities increase well-being? *Current Directions in Psychological Science, 22*(1), 57–62, doi: 10.1177/0963721412469809

McCullough, M. E., Kilpatrick, S. D., Emmons, R. A., & Larson, D. B. (2001, Mar). Is gratitude a moral affect? *Psychological Bulletin, 127*(2), pp:249-266. doi:10.1037/0033-2909.127.2.249

McCullough, M. E., Emmons, R. A., & Tsang, J. (2002). The grateful disposition: A conceptual and empirical topography. *Journal of Personality and Social Psychology, 82,* pp:112-127.

McCullough, M. E., Tsang, J.A., & Emmons, R. A. (2004). Gratitude in intermediate affective terrain: links of grateful moods to individual differences and daily emotional experience. *Journal of Personality and Social Psychology*, 86(2), 295.

Mehl, M. R., & Conner, T. S. (2012). Handbook of research methods for studying daily life. *Guilford.*

Mogg, K., & Bradley, B.P. Attentional Bias in Generalized Anxiety Disorder Versus Depressive Disorder. (2005) *Cognitive Therapy Research,* 29, pp: 29–45 doi:10.1007/s10608-005-1646-y

Nahum-Shani, I., Smith, S.N., Spring, B.J., Collins, L.M., Witkiewitz, K., Tewari, A., & Murphy S.A. (2017). Just-in-Time Adaptive Interventions (JITAIs) in Mobile Health: Key Components and Design Principles for Ongoing Health Behavior Support. *Annals of Behavioral Medicine,* pp: 446–462,

Fear of COVID-19: Exploring the effectiveness of an ecological momentary gratitude
intervention in daily life in times of Corona

doi: 10.1007/s12160-016-9830-8

Ornell, F., Schuch, J. B., Sordi, A.O., & Kessler, F.H.P. (2020). "Pandemic fear" and
COVID-19: mental health burden and strategies. *Brazilian Journal of
Psychiatry*, *42*(3), pp:232-235.

Otsuka, Y., Hori, M., & Kawahito, J. (2012). Improving well-being with a gratitude
exercise in Japanese works: A randomized-controlled trial. *International Journal
of Psychology and Counselling 4(7*), pp: 86-91, doi: 10.5897/IJPC11.031

Otto, A. K., Szczesny, E. C., Soriano, E. C., Laurenceau, J. P., & Siegel, S. D. (2016).
Effects of a randomized gratitude intervention on death-related fear of
recurrence in breast cancer survivors. *Health psychology: official journal of the
Division of Health Psychology, American Psychological Association*, *35*(12),
pp:1320–1328. doi:10.1037/hea0000400

Peckham, A. D., McHugh, R. K., & Otto, M. W. (2010). A meta-analysis of the
magnitude of biased attention in depression. *Depression and
Anxiety, 27,* pp:1135–1142. doi:10.1002/da.20755

Petrocchi, N., & Couyoumdjian, A. (2016). The impact of gratitude on depression and
anxiety: The mediating role of criticizing, attacking, and reassuring the self. *Self
and Identity, 15,* 191–205. doi: 10.1080/15298868.2015.1095794

Sansone, R. A., & Sansone, L. A. (2010). Gratitude and well-being: the benefits of
appreciation. *Psychiatry (Edgmont (Pa.: Township),* 7(11), pp: 18–22

Scollon, C. N., Prieto, C. K., & Diener, E. (2009). Experience sampling: Promises and
Pitfalls, Strength and Weaknesses. Assessing well-being, *Springer, Dordrecht
(39),* pp:157-180. doi:10.1007/978-90-481-2354-4_8

Schlichtiger, J., Brunner, S., Steffen, J. & Huber B.C. (2020). Mental health impairment
triggered by COVID-19 pandemic in a sample population of German students. *J
Investig Med (68)*, pp: 1394-1396, doi:10.1136/jim-2020-001553

Seligman, M. E. P., Steen, T. A., Park, N., & Peterson, C. (2005). Positive Psychology Progress: Empirical Validation of Interventions. *American Psychologist, 60* (5), pp: 410–421. doi: 10.1037/0003-066X.60.5.410

Shah, K., Kamrai, D., Mekala, H., Mann, B., Desai, K., & Patel, R. S. (2020). Focus on Mental Health During the Coronavirus (COVID-19) Pandemic: Applying Learnings from the Past Outbreaks. *Cureus*, *12*(3), doi:10.7759/cureus.7405

Versluis, A., Verkuil, B., Spinhoven, P., van der Ploeg, M. M., & Brosschot, J. F. (2016). Changing Mental Health and Positive Psychological Well-Being Using Ecological Momentary Interventions: A Systematic Review and Meta-analysis. *Journal of medical Internet research*, *18*(6), doi: 10.2196/jmir.5642

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho,C.S., & Ho R.C.(2020). Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *International Journal of Environmental Research and Public Health*17(5):1729. doi:10.3390/ijerph17051729

Whiteford, H. A., Degenhardt, L., Rehm, J., Baxter, A. J., Ferrari, A. J., & Erskine, H. E. (2013). Global burden of disease attributable to mental and substance use disorders: Findings from the global burden of disease study 2010. *Lancet*, doi: 10.1016/s0140-6736(13)61611-6

Wood, A. M., Maltby, J., Stewart, N., Linley, P. A., & Joseph, S. (2008). A Social-Cognitive Model of Trait and State Levels of Gratitude. *Emotion, 8*(2), pp:281-290. doi:10.1037/1528-3542.8.2.281

Wood A.M; Maltby J., Gillett R., Linley P.A, & Joseph, S. (2008). The role of gratitude

in the development of social support, stress, and depression: Two longitudinal

studies. *Journal of Research in Personality*, 42, 854–871.

doi: 10.1016/j.jrp.2007.11.003

Wood, A. M., Joseph, S., & Linley, P. A. (2007). Coping style as a psychological

resource of grateful people. *J. Soc. Clin. Psychol.* 26, pp:1076–1093.

doi: 10.1521/jscp.2007.26.9.1076

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Appendix A

Fear of Covid-19 Translation

Original Version:

Fear of COVID-19 Scale

Please respond to each item by ticking (√) one of the five (5) responses that reflects how you feel, think or act toward COVID-19.

	Fear of COVID-19 Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I am most afraid of Corona					
2	It makes me uncomfortable to think about Corona					
3	My hands become clammy when I think about Corona					
4	I am afraid of losing my life because of Corona					
5	When I watch news and stories about Corona on social media, I become nervous or anxious.					
6	I cannot sleep because I'm worrying about getting Corona.					
7	My heart races or palpitates when I think about getting Corona.					

Response Option Translation:

Bitte antworten Sie auf jede Frage, indem Sie eine der fünf Antworten anklicken, die widerspiegeln, wie Sie sich gegenüber Covid19 fühlen, denken oder handeln

- Stimme völlig zu
- Stimme zu
- Stimme weder zu noch nicht zu
- Stimme nicht zu
- Stimme überhaupt nicht zu

Translation from Person A:
1. Ich habe größte Angst vor Corona.
2. Es ist mir unangenehm/unwohl über Corona nachzudenken.
3. Ich bekomme feuchte/nasse Hände, wenn ich an/über Corona (nach)denke.
4. Ich habe Angst mein Leben zu verlieren durch Corona.
5. Wenn ich mir die Nachrichten und Stories über Corona auf Social Media ansehe, werde ich nervös oder ängstlich.
6. Ich kann nicht schlafen, weil ich mir Sorgen mache, dass ich Corona bekomme.
7. Mein Herz rast oder palpiert, wenn ich an Corona denke.

Translation from Person B:
1. Am meisten habe ich Angst vor Corona
2. Ich fühle mich unwohl, wenn ich über Corona nachdenke
3. Ich bekomme feuchte Hände, wenn ich über Corona nachdenke

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4.   Ich habe Angst durch Corona zu sterben
5.   Wenn ich Nachrichten über Corona höre, dann werde ich ängstlich und nervös
6.   Ich kann nachts nicht schlafen, weil ich über Corona nachdenke
7.   Ich bekomme Herzrasen, wenn ich über Corona nachdenke

Consensus of Person A and B:
1.   Am meisten habe ich Angst vor Corona
2.   Ich fühle mich unwohl, wenn ich über Corona nachdenke
3.   Ich bekomme feuchte Hände, wenn ich über Corona nachdenke
4.   Ich habe Angst durch Corona zu sterben
5.   Wenn ich Nachrichten über Corona höre, dann werde ich ängstlich oder nervös.
6.   Ich kann nicht schlafen, weil ich besorgt bin, Corona zu bekommen.
7.   Ich bekomme Herzrasen, wenn ich daran denke, Corona zu bekommen.

Translation back into English from Person C:

1. My biggest fear is corona
2. I feel uncomfortable when thinking about Corona
3. My hands become sweaty when I think about corona
4. I fear dying of a corona infection
5. When I hear news related to corona I become anxious and/or nervous
6. I cannot sleep because I fear that I will be infected by the corona virus
7. My heart starts to race (heart palpitations) when I think about getting corona

Appendix B

Recommended cut-off scores for conventional severity labels based on Lovibond and
Lovibond (1995)

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

Appendix C

Informed Consent in German and English

Herzlich willkommen zur Dankbarkeitsstudie!

Dankbarkeit ist der Schlüssel zum Glücklichsein. Ist das so?

Das Ziel dieser Studie ist zu untersuchen, ob Dankbarkeitsübungen unser Gefühl von Angst und Bedrängnis während der aktuellen Corona-Krise reduzieren und uns tatsächlich glücklicher machen. Dafür beantworten Sie täglich Fragen über Ihr Wohlergehen und machen in der Woche zwei Dankbarkeitsübungen. Dies wird täglich nur 5-10 Minuten dauern. Die Studie dauert insgesamt 14 Tage.

Ihre Daten werden ausschließlich online erfasst und vertraulich behandelt. **Ihr Name und Ihre E-Mail-Adresse werden lediglich zum Versenden der Einladung zur Studie genutzt. Alle Ihre Daten werden durch eine Teilnehmernummer identifiziert, um Ihre Anonymität sicherzustellen.** Ihre Daten unterliegen dem Datenschutzgesetz.

Die Teilnahme an dieser Studie ist freiwillig. Wenn Sie sich dazu entscheiden teilzunehmen, werden Sie gebeten, dieser Einverständniserklärung zuzustimmen. Auch danach steht Ihnen jederzeit die Möglichkeit offen, diese Studie ohne Angabe eines Grundes zu beenden.

Wenn Sie Fragen oder Anmerkungen zu der Studie haben, kontaktieren Sie bitte Sare Danaci (s.danaci@student.utwente.nl).

Einverständniserklärung

Ich habe die oben genannten Informationen gelesen und zur Kenntnis genommen. Ich weiß, dass meine Teilnahme freiwillig ist und dass ich die Studie jederzeit ohne die Angabe von Gründen beenden kann. Ich stimme freiwillig zu, an dieser Studie teilzunehmen.

English Translation

Welcome to the gratitude research!

Gratitude is the key to happiness. Is that true?

The goal of the study is to investigate whether gratitude exercises can reduce our feelings of fear and distress during the current Corona crisis and actually make us happier. To do this, you answer questions about your well-being every day and do two gratitude exercises a week. This will only take 5-10 minutes a day. The study will last a total of 14 days.

Your data will be collected entirely online and treated confidentially. Therefore, we use your name and email address only to send you the invitation to the study. To ensure anonymity, all materials will be identified by an assigned participant number, not by your name. Your individual privacy will be maintained in all published and written data resulting from this study.

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Participation in this study is voluntary. If you decide to participate, you will be asked to agree to the informed consent. After that, you are still free to withdraw at any time and without giving a reason for your withdrawal.

If you have any comments or questions regarding this study, please contact Sare Danaci (s.danaci@student.utwente.nl).

Informed Consent

I have read and I understand the provided information. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason. I voluntarily agree to take part in this study.

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Appendix D

Visual representations of fear of covid over time divided into four categories
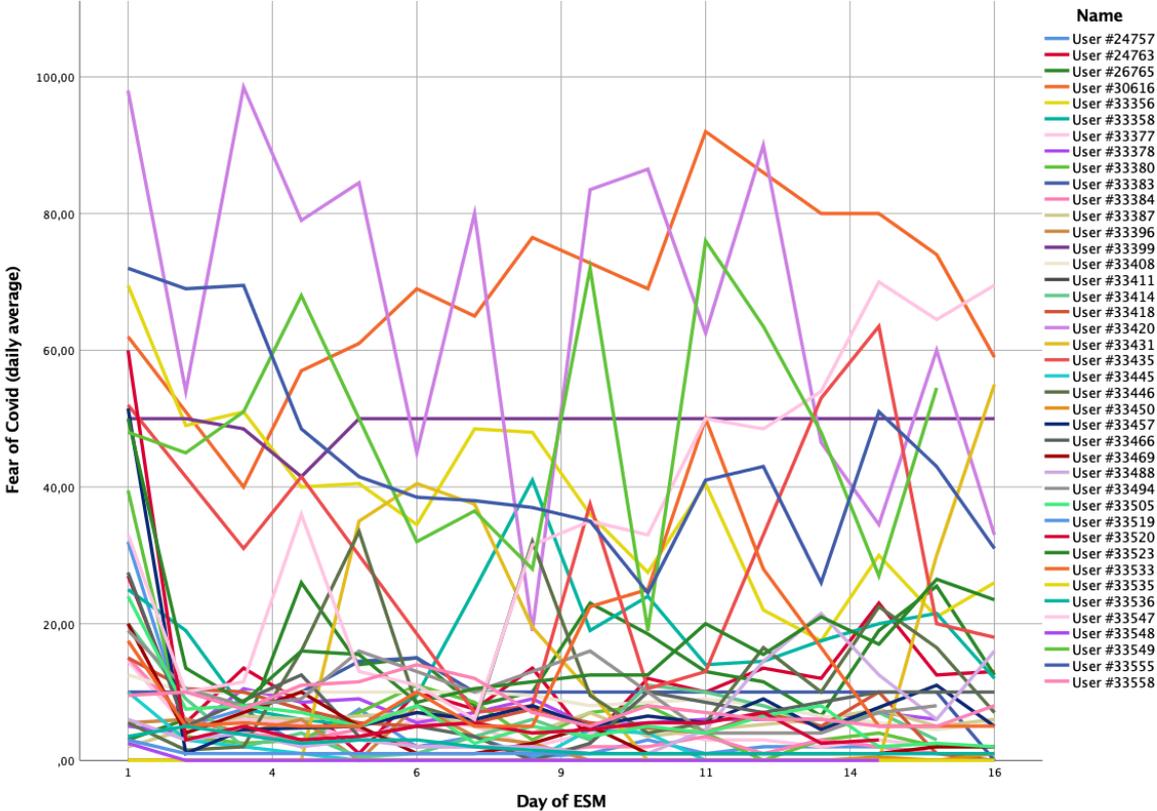

Figure 7. Visual trajectories for fear of covid over time for all users.

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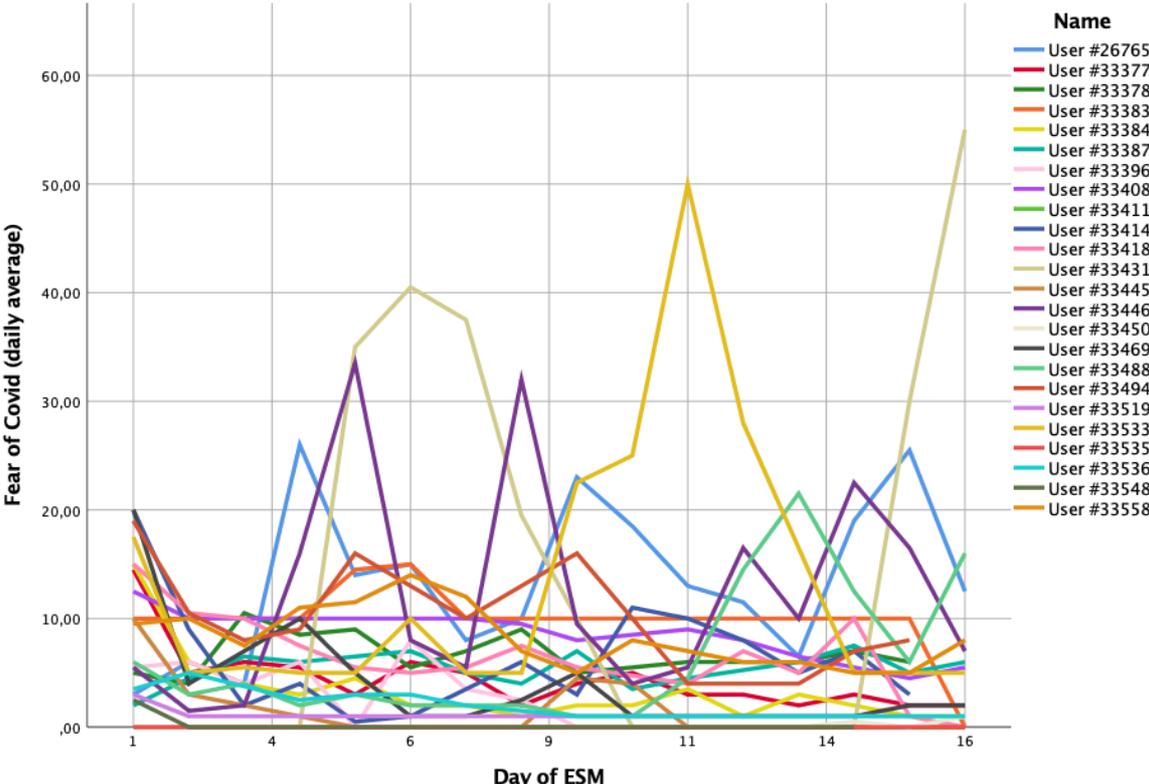

Figure 8. Visual trajectories for fear of covid over time for users representing the lowest levels of fear of covid (scores ranging from 0 to 20).

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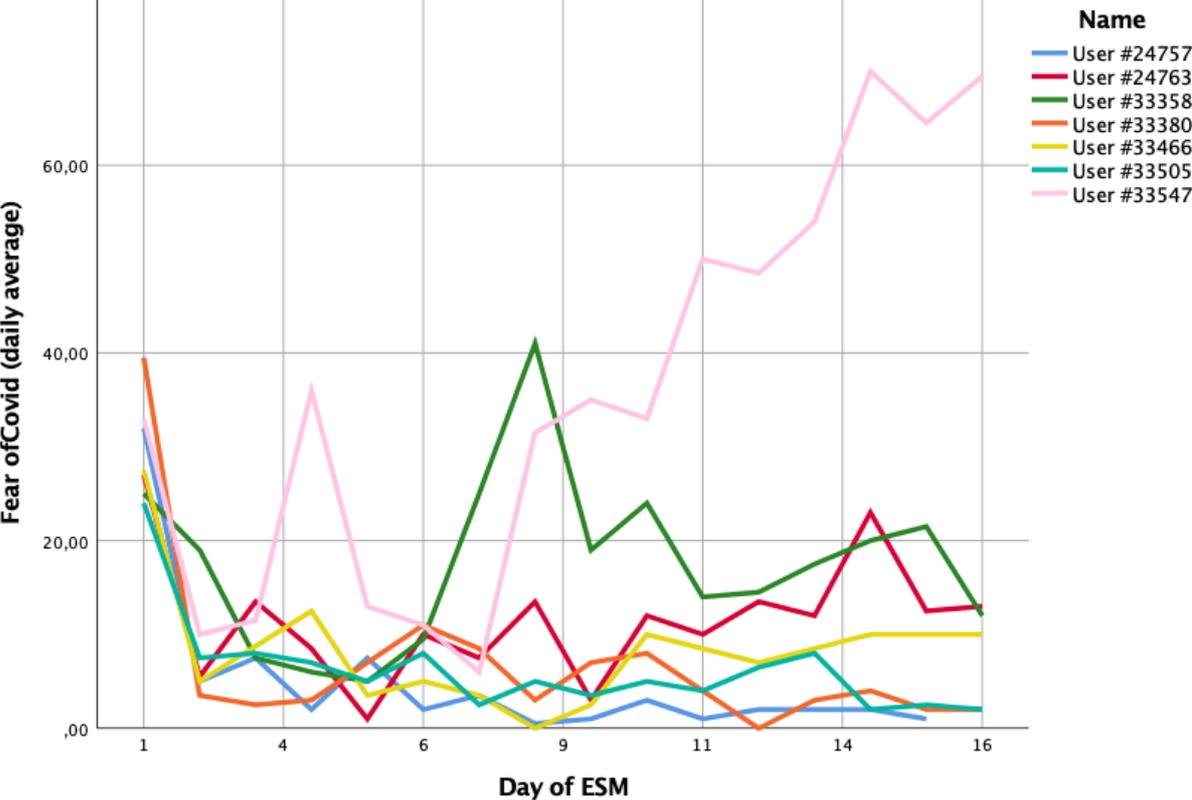

Figure 9. Visual trajectories for fear of covid over time for users representing lower intermediate levels of fear of covid (scores ranging from 21 to 40).

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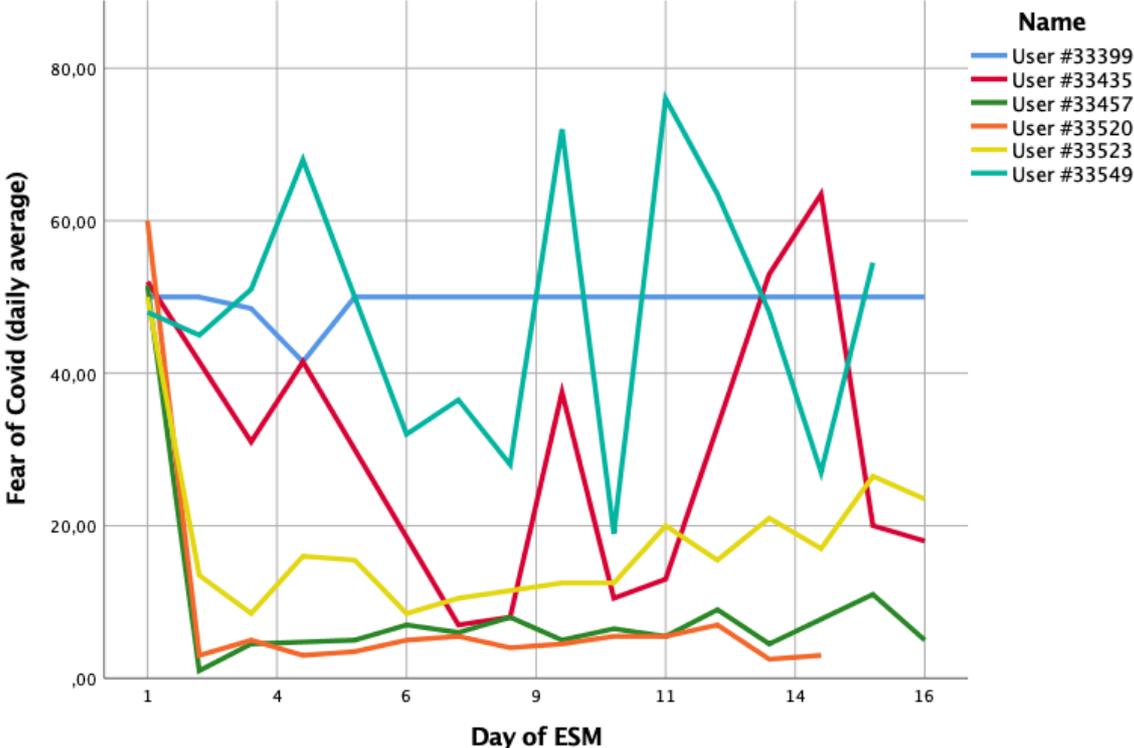

Figure 10. Visual trajectories for fear of covid over time for users representing intermediate levels of fear of covid (scores ranging from 41 to 60).

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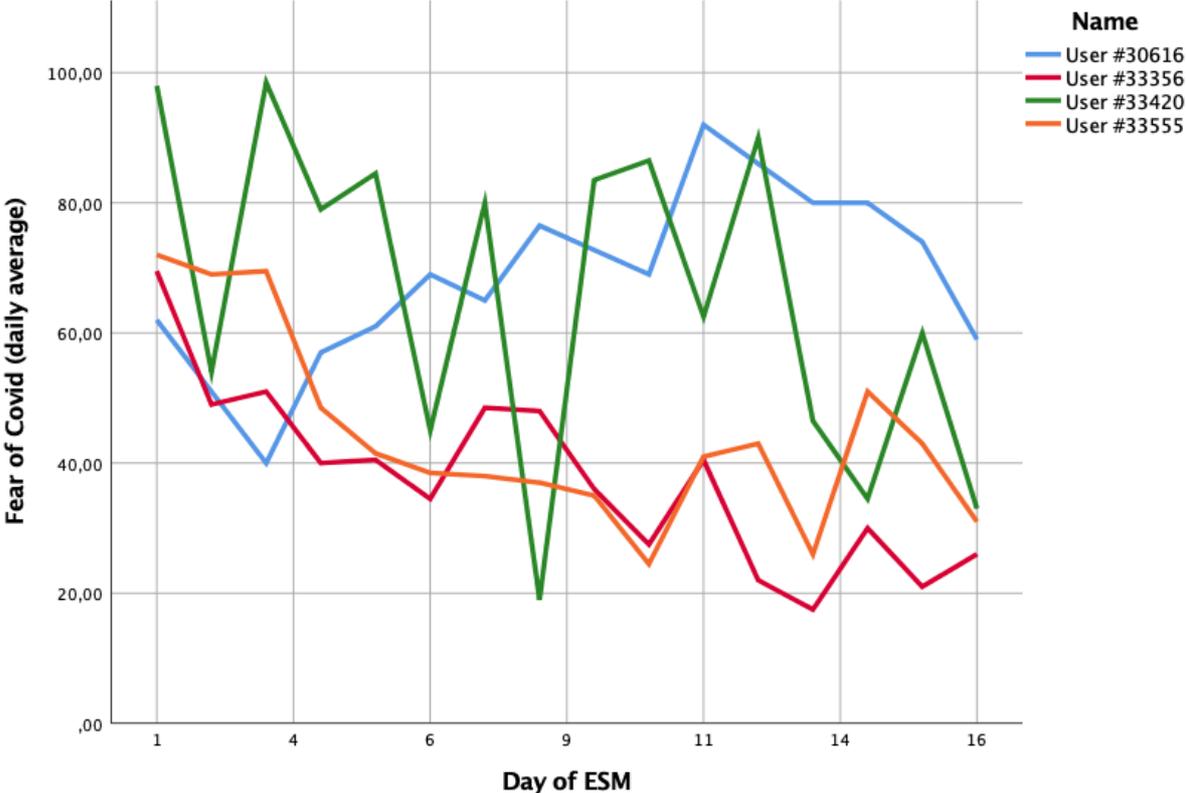

Figure 11. Visual trajectories for fear of covid over time for users representing the highest levels of fear of covid (scores ranging from 61 to 100).