The Relationship between Perceived Stress and Cognitive Reappraisal for Flourishers and Non-Flourishers in Daily Life

Antonia Schaffert - s2364735

Positive Clinical Psychology and Technology – Master Thesis

UNIVERSITY OF TWENTE.

Faculty of Behavioural, Management, and Social Sciences

1st supervisor: Dr. J. T. Kraiss

2nd supervisor: Dr. T. R. Vaessen

10.08.2023

Abstract

Background: Stress plays a crucial role in physical and psychological health. Cognitive reappraisal, a method of altering thought patterns about stress, has been linked to improved mental health and serves as a potential safeguard for those with flourishing well-being. Prior studies, often cross-sectional, lack nuance for individual and contextual concepts. This study employs experience sampling to investigate links between stress, cognitive reappraisal, and flourishing, including the moderating effect of flourishing on the perceived stress and cognitive reappraisal connection.

Method: The experience sampling method was used in a one weeklong with a semi-random sampling scheme. Participants ($N = 35$, Mean age = 23.28, % female = 34.2, % male = 62.9) received ten momentary assessments per day within 90-minute intervals. Perceived stress and cognitive reappraisal were assessed using single-item self-report questions. Flourishing was measured using the Mental Health Continuum – Short Form. Analyses were conducted by using Linear Mixed Models.

Results: Three Linear Mixed Model analyses were conducted. There was no significant association between perceived stress and cognitive reappraisal ($\beta = -.02$, $p = .44$). The association between perceived stress and flourishing did show a significant negative correlation ($\beta = -.45$, $p = .04$). Lastly, there was no significant moderation effect of flourishing on the relationship between perceived stress and cognitive reappraisal ($\beta = -.11$, $p = .06$).

Conclusion: The present study found that flourishers experience less stress than non-flourishers. However, there is no apparent association between perceived stress and cognitive reappraisal. Reasons for that may be based on the effectiveness of the immediate utilization of cognitive reappraisal but may also be affected by shortcomings within the study. The main shortcoming concerns the study design, for instance the study duration, limited duration of assessments, but also the participant composition. There are various suggestions for future ESM research, such as the inclusion of age and employment as moderators. Moreover, a closer investigation into the specific factors protecting a flourishing individual from perceiving high levels of stress is recommended.

Introduction

Daily life can be stressful, with the management of professional and personal responsibilities varying among individuals. The impact of stressors largely relies on how individuals perceive the level of stress associated with a particular event (Cohen, Kamarck, & Mermelstein, 1983; Lazarus & Folkman, 1984). Notably, not all situations deemed stressful by some are equally stressful for others, suggesting that individual and contextual factors contribute to this differential response (Cohen, Kamarck, & Mermelstein, 1983).

In response to stress, individuals employ diverse strategies, some of which fall under the umbrella of emotion regulation. Emotion regulation encompasses a range of processes that govern the modulation of emotions (Gross & Thompson, 2007). These processes can operate consciously or unconsciously, occurring at various stages of emotionally charged situations. Strategies can be pre-emptive or reactive, whereby individuals may either avoid stressful situations altogether or later try to cope with their aftermath (Gross, 2001).

Alternatively, individuals may adopt coping mechanisms during the occurrence of stressors. Cognitive reappraisal represents one such emotion regulation process wherein individuals modify the meaning of an event to alter its emotional significance, either by adjusting their thoughts about the situation or their perceived ability to manage it (Gross & Thompson, 2007). The capacity to positively regulate emotions during tense situations, such as altering negative interpretations, is indicative of a flourishing individual (Basson & Rothmann, 2018). Flourishing individuals may be better equipped to handle everyday stressors by using some form of emotion regulation.

In the past, mostly conventional methods have been employed to research stress and emotion regulation. With the emergence of more modern approaches, such as the Experience Sampling Method, new insights into the daily lives of individuals can be investigated. ESM allows for an exploration of how cognitive reappraisal strategies are prompted, how they impact perceived stress levels, and ultimately, how they contribute to an individual's overall state of flourishing.

Cognitive Reappraisal

Actively contemplating a stressful situation enables individuals to re-evaluate the situation's accuracy and initial cognitive reactions. Arnold's theory of appraisal posits that specific stimuli elicit cognitive reactions that subsequently evoke emotions (Shields & Kappas, 2006). These automatic cognitions are not consciously generated and may not necessarily be factual. Therefore, in such scenarios, reappraising the stimuli can lead to more nuanced and balanced responses.

The capacity to re-evaluate one's thoughts and accompanying emotions in response to stress offers significant benefits for various psychological disorders, such as bipolar disorder, anxiety, and depression. Moreover, it aids individuals in effectively managing both negative and positive emotions in healthy populations (Haga, Kraft, & Corby, 2009; Gruber, Hay, & Gross, 2014; Dryman & Heimberg, 2018). In a comprehensive meta-analysis, Aldao et al. (2009) examined the relationship between different emotion regulation strategies and various groups with psychopathology. Their findings demonstrated a significant negative association between cognitive reappraisal and anxiety, depression, eating disorders, and substance disorders. Additionally, Kraiss et al. (2020) reported a significant relationship between reappraisal and well-being, alongside a negative correlation between emotion regulation deficits and well-being. These collective findings indicate that incorporating cognitive reappraisal may not only ameliorate mental illnesses but also enhance mental well-being. Appraisal emerges as a crucial factor in reducing psychopathology levels and fostering acceptance and overall well-being. Consequently, cognitive reappraisal holds promise as a valuable strategy for addressing daily stressors, promoting mental well-being, and potentially serving as a protective factor.

Perceived Stress

Acknowledging stress as a significant contributor to various physical and psychological issues, researchers have explored its impact on health and well-being. For instance, Steptoe and Kivimäki (2012) conducted a study on stress and cardiovascular disease, uncovering both short-term and long-term consequences, including the development of coronary heart disease and acute triggers for cardiac events. Additionally, evidence has surfaced regarding the association between stress and neurodegenerative diseases like Parkinson's (Esch et al., 2002). Furthermore, individuals reporting higher stress levels tend to experience lower levels of happiness compared to their less-stressed counterparts (Schiffrin & Nelson, 2010).

While these studies have shed light on the detrimental effects of stress, they often employed retrospective measures, which may introduce recall biases as individuals may remember situations differently from how they occurred (Woltjes, 2019). The experience of dealing with stressful situations is a common occurrence in daily life, yet it varies significantly among individuals. Previous approaches have primarily focused on quantifying the number of stressful events within a specific timeframe. However, Cohen, Kamarck, and Mermelstein (1983) argue that such objective measures may overlook the role of individual appraisals in shaping the stress response. According to their perspective, stress is more

accurately defined as the subjective evaluation of a situation as threatening or requiring more resources than one can provide (Lazarus, 1990). As a contextual and individualized concept, stress should be measured in a manner that reflects the diverse ways in which different situations affect individuals. Research has suggested that minor daily stressors may exert more significant influence on psychological symptoms than major life events (Myin-Germeys et al., 2009), further underscoring the need for timely and contextually relevant stress assessments.

Flourishing

Traditionally, health was seen as the absence of illness (Keyes, 2007). Today, it's understood that well-being encompasses both physical health and effective coping with life's challenges. Keyes (2002) introduced the Mental Health Continuum, highlighting positive mental functioning beyond the absence of illness. This includes hedonic (emotional) and eudemonic (functional) well-being (Lamers et al., 2010). Studies show flourishing guards against mental health issues (Burns et al., 2022; Keyes et al., 2010; Schotanus-Dijkstra et al., 2017). Flourishing individuals are less susceptible to mental illness. It's worth exploring if this protection extends to daily stressors. Flourishing also predicts reduced concentration problems, irritability, and burnout, mediated by perceived stress (Berend, Vogt, & Brohm-Badry, 2020), suggesting less stress and its symptoms.

Those flourishing use adaptive emotion regulation strategies, while moderate well-being groups lean towards avoidance (Barber, Bagsby, & Munz, 2010). This prompts the question whether flourishers rely more on cognitive reappraisal in daily stressful situations than non-flourishers. Investigating this could unveil distinct emotion regulation tendencies between the two groups. Making use of a timely research method is of essence to discover specific tendencies.

Flourishing individuals possess a set of cognitive and emotional resources that may temper the relationship between cognitive reappraisal and perceived stress. Their enhanced ability to employ cognitive reappraisal and manage emotions can create a buffering effect, leading to a weaker association between cognitive reappraisal and perceived stress. Thus, flourishing could act as a negative moderator, attenuating the impact of cognitive reappraisal on perceived stress levels.

Experience Sampling Method

Perceived stress and cognitive reappraisal are shaped by individual and contextual factors, dependent on personal assessments within specific situations. This emphasizes the suitability of a context-specific approach to assessment, which counters recall bias found in

retrospective measures (Woltjes, 2019). The Experience Sampling Method (ESM) emerges as a promising tool for assessing the previously mentioned factors. ESM excels in understanding daily experiences, identifying patterns, and grasping fluctuations over time, unlike static cross-sectional approaches. In employing ESM, this study aims to explore stress and emotion regulation dynamics in real-time, offering insights into coping strategies, flourishing, and overall well-being amidst daily challenges.

ESM has been relatively underutilized in examining the interplay between stress, emotion regulation and wellbeing. Nonetheless, the studies employing ESM have yielded noteworthy insights. For instance, Socastro et al. (2022) observed that individuals tend to employ reappraisal more when confronted with controllable stressors. Furthermore, Grommisch et al. (2020) underscored the significance of employing diverse active emotion regulation strategies to enhance overall well-being. The utilization of ESM in these investigations facilitated the identification of individualized responses to stressors within the context of daily life, offering a more nuanced understanding of these dynamics.

Present Study

When individuals engage in cognitive reappraisal during stressful moments, they modify their perception of the stressor's significance, which in turn reduces the intensity of perceived stress at that specific moment. This interplay showcases how cognitive reappraisal can act as a real-time coping mechanism, influencing the immediate experience of stress.

Furthermore, flourishing individuals possess cognitive and emotional resources that could mitigate stress and moderate the link between cognitive reappraisal and perceived stress. Thus, flourishing might serve as a stress-protective factor and a potential negative moderator, reducing the influence of cognitive reappraisal on perceived stress.

The goal of this study is to assess whether there is a relation between cognitive reappraisal and perceived stress, whether people who flourish experience less perceived stress, and whether flourishing moderates this relationship.

The following research questions were established.

RQ1: How is momentary cognitive reappraisal associated with momentary perceived stress?

RQ2: Do people who flourish on average experience less momentary perceived stress throughout the week than those who don't?

RQ3: Does flourishing negatively moderate the relationship between cognitive reappraisal and perceived stress in daily life?

Methods

Participants

The present study used a convenience sampling method to gather participants, which mostly consisted of the researchers' acquaintances. Due to the relatively high burden of ESM studies, it is reasonable to do so, as it may increase the intrinsic motivation of participants to fulfil the study. The inclusion criteria consisted of being at least 18 years old, having sufficient English skills, and being in possession of a smartphone that has consistent internet access and is able to download and use the app Ethica. Moreover, participants that did not complete the baseline questionnaire and had a response rate below 30% were excluded. After accounting for these criteria, the sample consisted of 35 individuals. Van Berkel et al. (2017) found that the mean number of participants lies at 53, but the median at 19, therefore the current sample size is considerably larger than in the majority of other ESM studies.

Procedure

The study at hand is a week-long, semi-random experience sampling study. The timeframe is from Monday, the 13th of February 2023 until Sunday, the 19th of February 2023. Even though the length of experience sampling studies can vary greatly, 68% of ESM studies lasted between seven and ten days (Dejonckheere & Erbas, 2022).

The recruited participants received an invitation and a written briefing in the week before the start of the study and after giving active informed consent they were then able to be enrolled in the study on the Ethica app. On the first day of the study, a baseline questionnaire was sent out. Afterwards, ten momentary assessments were administered each day between the hours of 7.30 and 22.30. These assessments were sent out in random 90-minute blocks. Such frequent and mostly unpredictable scheduling schemes ensure that participants do not anticipate the next momentary assessment (Conner & Lehman, 2012). Yet, the fixed time blocks ensure enough time between assessments, allowing new situations to arise. In total, participants received 70 momentary assessments within the study duration. This is rather burdensome but is considered to be feasible as the overall duration consists of only one week (Rintala et al., 2019).

Lastly, momentary assessments expired after 15 minutes. Notification expiry times can be helpful for experience sampling as they ensure that the momentary assessments are completed during the time frame that was expected, which increases data quality (Van Berkel et al., 2017).

Measures

All questionnaires were administered in English. The data needed for this study includes a baseline questionnaire concerning the participants' mental wellbeing as well as the state questionnaires on perceived stress and cognitive reappraisal.

Baseline Questionnaire

The baseline questionnaire is used to measure the participants' traits. First, it consists of a series of questions concerning the participants' demographic data, including age, gender, nationality, occupation, and highest degree obtained.

In order to measure mental wellbeing, i.e., whether participants were flourishing, the Mental Health Continuum – Short Form was used. The questionnaire consists of 14 questions divided into three subscales measuring emotional, social, and psychological wellbeing. The items were rated on a 6-point Likert scale ranging from 0 ("Never") to 5 ("Every day"). For each item, participants were asked to consider the answers using the timeframe of the past month as reflected in the example questions. The Mental Health Continuum – Short Form provides high internal and moderate test-retest reliability (Lamers et al., 2010). Within the present study, the questionnaire provides excellent internal reliability with a Cronbach's alpha of .93.

State Questionnaire

To measure perceived stress and cognitive reappraisal, two questions from the respective trait scales were used. For perceived stress, participants were asked how stressed they felt at the moment on a scale from 1 ("not at all") to 7 ("very much"). This item has previously been used in the study by Heininga et al. (2019). As for cognitive reappraisal, individuals were asked to rate the statement "In the last hour, I tried to look at my problems from a different perspective" on a scale from 1 ("not at all") to 7 ("very much"). A similar item was used in a study conducted by Brans et al. (2013).

In order to test for reliability, a split-half reliability test was conducted by separating every second observed day into a different dataset. The two datasets were analysed by correlating the respective beeps measuring each of the concepts, and an acceptable correlation was found, $r = .68$, $p = <.001$. When checking for validity, the ESM constructs were correlated to their respective trait measures. This showed a non-significant association for both perceived stress ($r = .28$, $p = .07$) and cognitive reappraisal ($r = -.03$, $p = .805$)

Data Analysis

The data is exported from Ethica and the analysis is conducted using SPSS Version 27. For the data preparation, the ESM and baseline questionnaires are merged and participants with a response rate below 30% and missing baseline questionnaire are excluded, leaving 35 participants and 1375 data points. Out of those data points, 35 of them make up the participants' respective baseline questionnaires.

For the Mental Health Continuum, a dummy variable is created with 0 indicating that a participant is not flourishing and 1 indicating a participant to be flourishing. Participants are considered to be flourishing if they report one out of the three hedonic items and six out of the eleven eudemonic items to be experienced "everyday" or "5-6 times a week" (Lamers et al., 2011).

Afterwards, person-mean scores are calculated for the respective state variables. A Shapiro-Wilk test shows that the data is not normally distributed ($p<.05$), but as the sample size is above 30, one may continue with analyses (Ghasemi & Zahediasl, 2012).

Linear Mixed Models (LMMs) are used to answer the research questions. These models are suitable for analysing multilevel data from longitudinal studies (Viechtbauer, 2021). Moreover, LMMs are capable of handling missing data points using maximum likelihood estimation (Black et al., 2012). For the LMMs, the participant ID is used as subject variable and the timepoint (measurement point) is used as repeated measure. A first-order autoregressive covariance structure (AR1) is used to analyse nested repeated measures. All analyses are conducted using both standardized and unstandardized scores.

The first research question is answered by conducting a LMM using perceived stress as dependent variable and cognitive reappraisal as fixed covariate. For the second research question once again a LMM is conducted but the fixed effect is the dummy variable "flourishing". To answer the last research question, the variables cognitive reappraisal and flourishing are added as an interaction effect, once again with perceived stress as dependent variable. For all analyses the cut-off point for the alpha level lies at $p < .05$. Lastly, to get an overview of the data at hand a line graph, as well as a boxplot, are created that illustrate the individual fluctuations of perceived stress and cognitive reappraisal, as well as the difference in perceived stress for flourishers and non-flourishers. Four individual cases are investigated more closely. In addition to a visual exploration of the scores, a Pearson correlation including perceived stress and cognitive reappraisal is computed for each of the cases.

Results

In total, the analysis makes use of 1375 data points, of which 35 consist of the individuals' baseline questionnaire. That leaves an average of 38.5 completed ESM questionnaires (range 23-70) per participant, resulting in an average response rate of 55%.

Sample Characteristics

Table 1 displays the sample characteristics of the participants. There are 22 male and 12 female participants, as well as one participant identifying as another gender. Almost all of the participants are aged 18 to 35, with only one participant, aged 53, being outside of that range. The mean age of the younger population lies at 22.41, with a standard deviation of 2.99. Moreover, there are 22 German, 11 Dutch, and 2 participants from another nationality. As for employment, 20 participants are currently students, seven are working, and one is self-employed. Eight participants are both student and working. The highest level of education was one each in the categories Middle school, Master, and Other. 18 participants obtained a high school degree and 14 a bachelor's degree as highest degree.

Table 1

Sample Characteristics of the participants

Variable		n	%	M(SD)
Gender	Female	12	34.2	
	Male	22	62.9	
	Other	1	2.9	
Age	18-35	34	97.1	22.41 (2.99)
	35+	1	2.9	
Nationality	Dutch	11	31.4	
	German	22	62.9	
	Other	2	5.7	
Employment	Working	7	20	
	Self-employed	1	2.9	
	Student	20	57.1	
	Student and working	8	22.9	
Highest level of education	Middle school	1	2.9	
	High school	18	51.4	
	Bachelor	14	40	
	Master	1	2.9	
	Other	1	2.9	

Figure 1 shows the person mean scores of perceived stress and cognitive reappraisal throughout the study period for the individual participants. The overall mean for perceived stress lies at 2.73 with a standard deviation of 1.5, while the overall mean for cognitive reappraisal is 2.56, also with a standard deviation of 1.5. Therefore, the participants generally display slightly higher perceived stress than cognitive reappraisal levels.
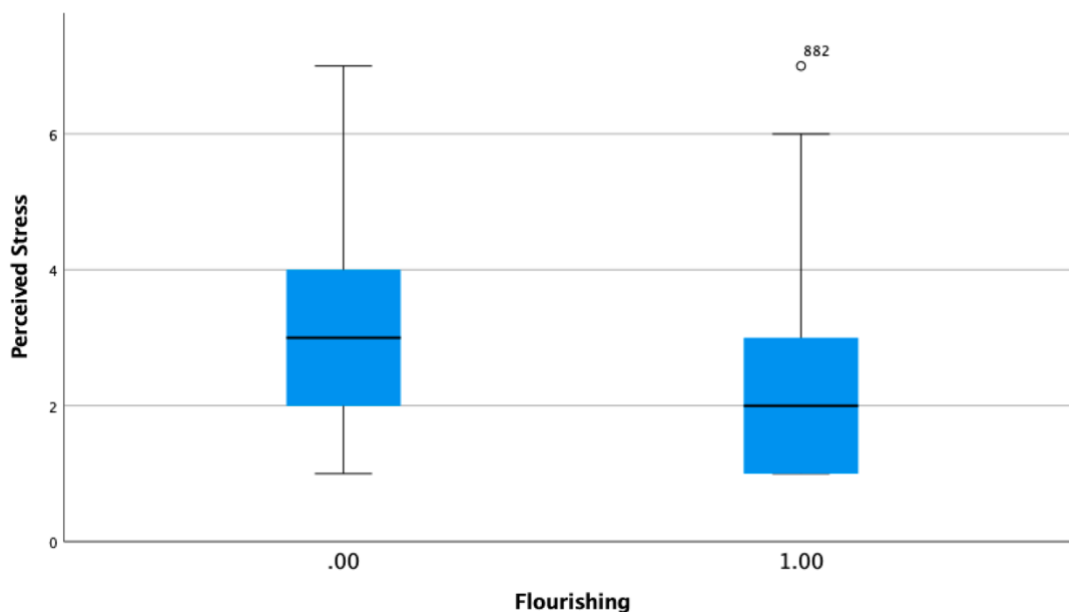
Figure 1

Person mean scores of Perceived Stress and Cognitive Reappraisal during the 7-day study period.
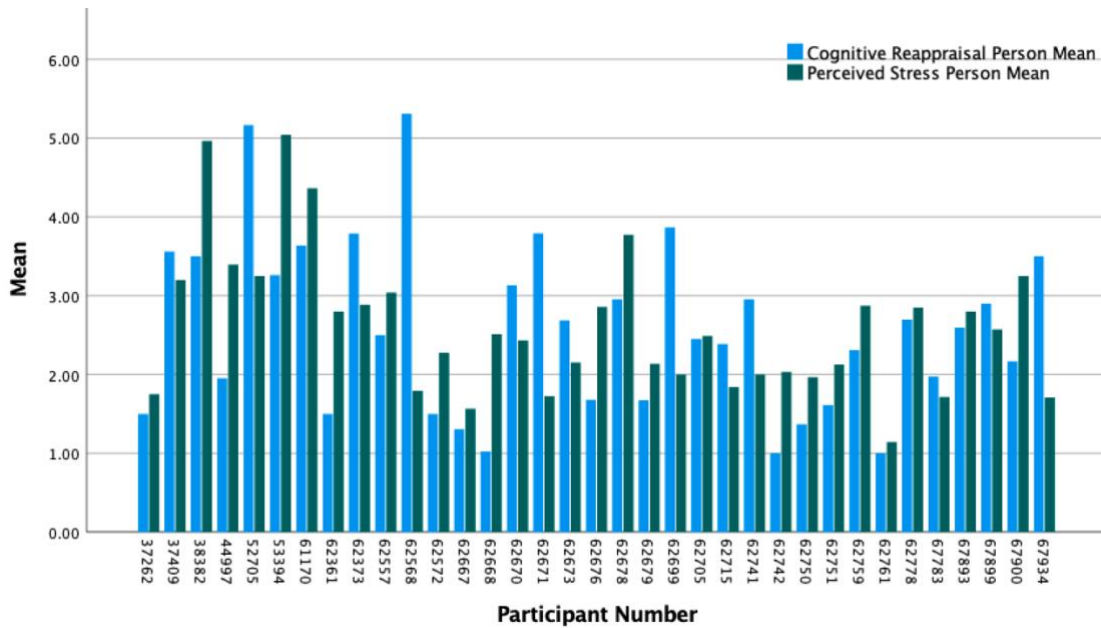
Out of the 35 participants, 9 (26%) of them are considered to be flourishing. The second figure shows the levels of perceived stress for flourishers and non-flourishers as a boxplot. Overall, the flourishers seem to mostly show lower levels of perceived stress than the non-flourishers. With the exception of one outlier, they also do not reach the same maximum levels of perceived stress as non-flourishers do.

Figure 2

Boxplots showing the levels of perceived stress for non-flourishers (0) and flourishers (1).

In an effort to gain more insight into the data at hand, additional graphs are created. In Figure 3, the mean scores of perceived stress and cognitive reappraisal are visualized in contrast to the hours of the observed days. One can see three peaks for perceived stress throughout the day, once at 10:00, then at 12:00, and lastly at 16:00. Moreover, cognitive reappraisal peaks at 13:00, and at 18:00.

Figure 3

Observed scores of perceived stress and cognitive reappraisal throughout the hours of the observed days.
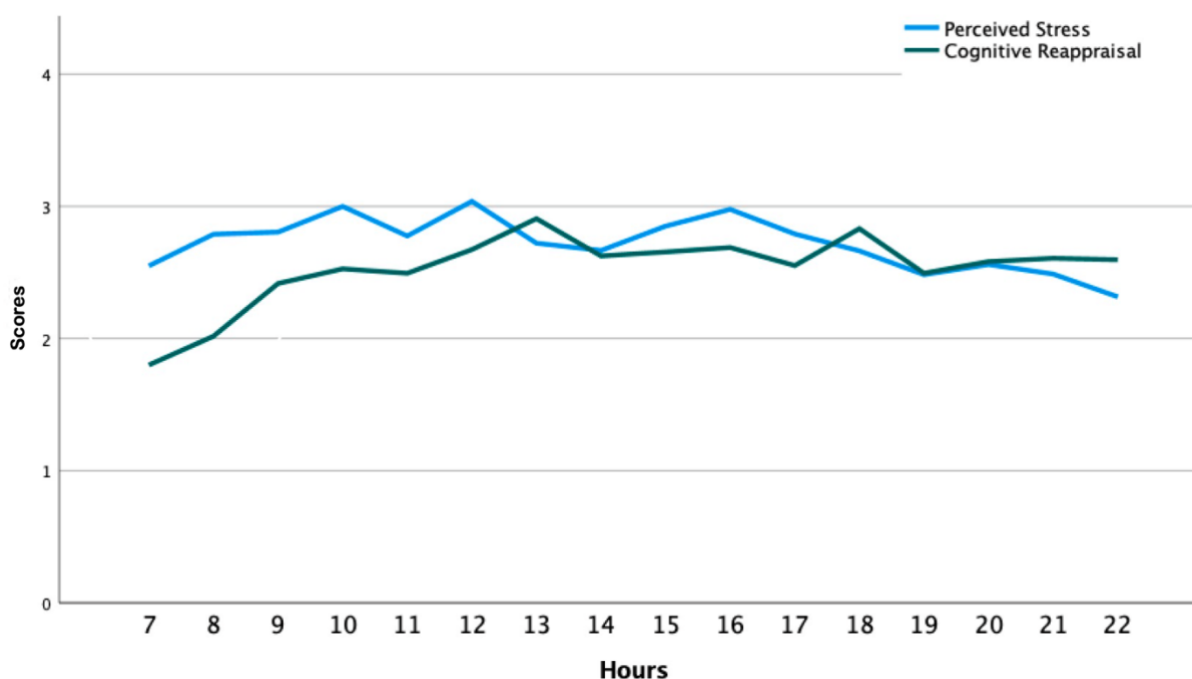
Associations between Perceived Stress, Cognitive Reappraisal, and Flourishing

Coming to the results of the LMM analyses, Table 2 displays the outcomes for the individual Linear Mixed Model analyses of perceived stress, cognitive reappraisal, and flourishing as well as the interaction effect. Both standardized and unstandardized scores are presented.

The association between cognitive reappraisal and perceived stress was not significant ($\beta = -.02$, $p = .44$). Flourishing, on the other hand, shows a significant negative association to perceived stress ($\beta = -.45$, $p = .04$).

When investigating the interaction effect between cognitive reappraisal and flourishing in association to perceived stress, the main effect of cognitive reappraisal is once again not significant ($\beta = -.02$, $p = .12$). There also appears to be no significant main effect of

flourishing (β = -.44, p = .26). Lastly, the moderation effect of flourishing on the association of perceived stress and cognitive reappraisal was not significant (β = -.11, p = .06).

Table 2

Linear Mixed Model Analyses of Perceived Stress, Cognitive Reappraisal, and Flourishing

	IV	B [SE]	β [SE]	df	t	p	CI
RQ 1	Cognitive Reappraisal	.02 [.03]	-.02 [.03]	1246.16	0.78	.44	[-.03 ; .07]
RQ 2	Flourishing	-.71 [.33]	-.45 [.21]	33.75	-2.12	.04	[-.02 ; -.88]
RQ 3	Cognitive Reappraisal	.05 [.03]	.07 [.06]	1260.34	1.58	.12	[-.01 ; .11]
	Flourishing	-.42 [.37]	-.44 [.21]	47.72	-1.15	.26	[-1.12 ; .31]
	Cognitive Reappraisal * Flourishing	-.12 [.06]	-.11 [.06]	1195.99	-1.91	.06	[-.25 ; .00]

Note. IV indicates the independent variable. *β* indicates the standardized estimate, while B indicates the unstandardized estimate. *CI* indicates the 95% confidence interval.

Individual visualizations

Flourishing participants

Four individual cases are explored, two of which are flourishing. In Figure 4, the flourishing participant 62699 displays extremely fluctuating levels of perceived stress and cognitive reappraisal. Perceived stress peaks within the first measurements and later remains at relatively low levels. Cognitive reappraisal is observed at maximum levels multiple times throughout the week and only reaches minimum levels five times. Mostly, when perceived stress levels are at their lowest, cognitive reappraisal levels are quite high. At medium stress

levels, reappraisal levels are around the same score. The Pearson correlation shows a significant, negative correlation between the two concepts, $r(50) = -.40$, $p = .003$. This correlation seems to be visible within the visualization as stress levels seem to decrease when cognitive reappraisal is used more and vice versa.

Figure 4

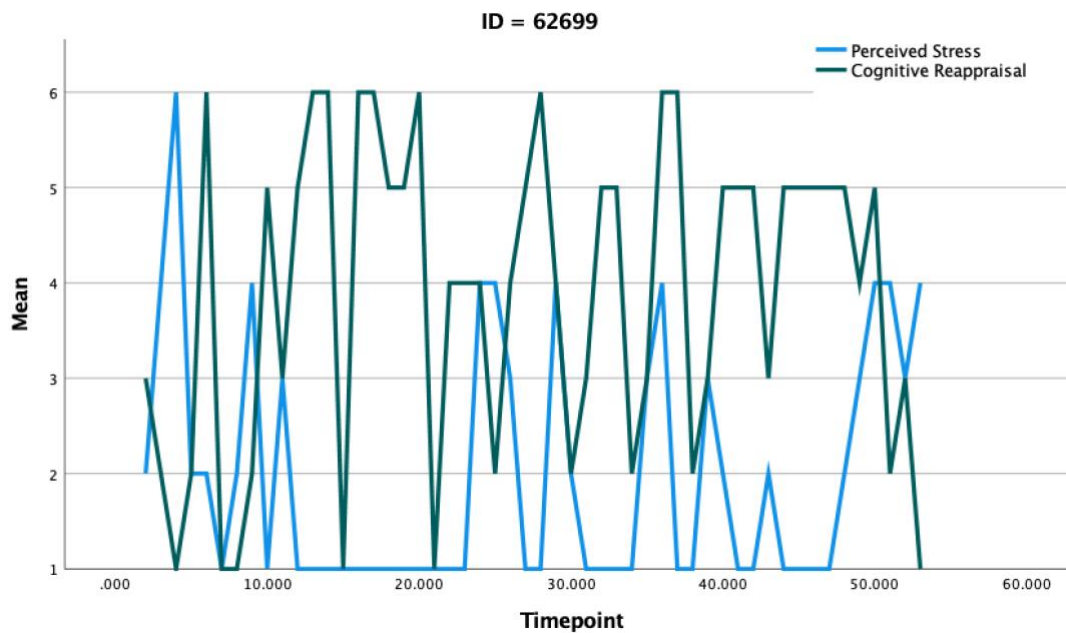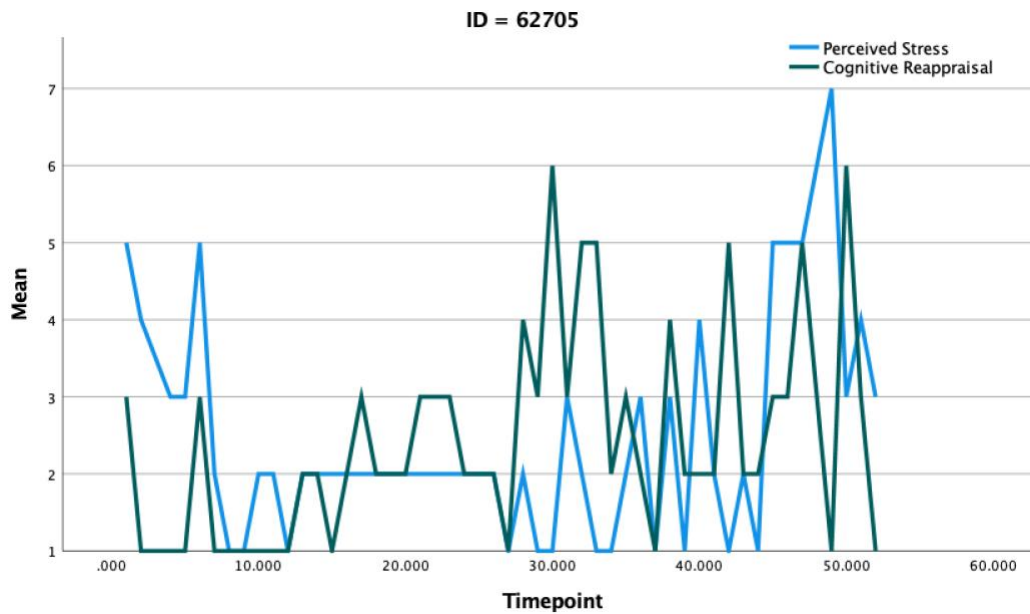*Observed scores of perceived stress and cognitive reappraisal for participant 62699.*

Figure 5 displays another flourishing participant. Participant 62705 portrays higher perceived stress than cognitive reappraisal scores in the beginning of the measured week. Throughout the week, both perceived stress and cognitive reappraisal levels fluctuate around a score of 3. The two scales do not seem to show consistencies in their interaction. At the end of the week, perceived stress levels peak at a score of 7, while cognitive reappraisal peaks at the score 6 twice. The Pearson correlation was not significant for this flourishing participant, $r(49) = .07$, $p = .634$.

Figure 5

Observed scores of perceived stress and cognitive reappraisal for participant 62705.

Non-flourishing participants

In the following figures, two non-flourishing participants are portrayed. In Figure 6, participant 38382 displays almost consistently higher levels of perceived stress than cognitive reappraisal. Perceived stress reaches maximum levels multiple times, while cognitive reappraisal peaks once at a score of 6. Stress levels are lowest in the beginning and end of the observed week. As can be expected from the visualization, the Pearson correlation shows no significant relationship between the two concepts, $r(26) = -.08$, $p = .67$.

Figure 6

Observed scores of perceived stress and cognitive reappraisal for participant 38382.
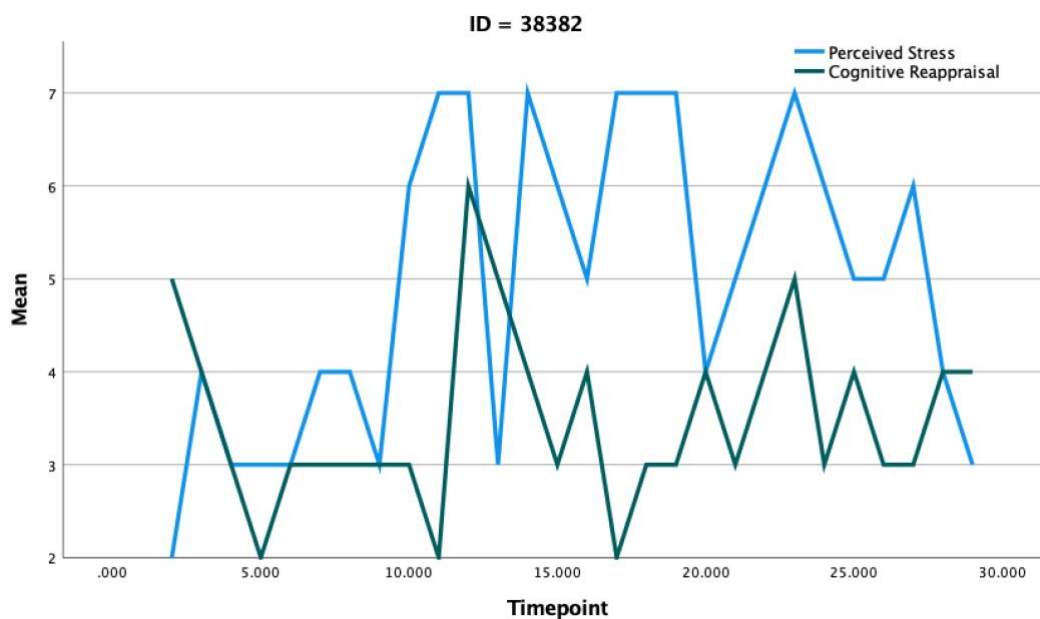
Figure 7 portrays participant 62568. Their scores are quite a contrast to the scores of the previous participant. In the beginning of the week, both perceived stress and cognitive reappraisal fluctuate around medium levels. Later throughout the week cognitive reappraisal portrays consistently high levels while perceived stress levels are extremely low. Overall, perceived stress peaks once at a score of 5 while cognitive reappraisal reaches the maximum score three times. For around ten measurements in a row, perceived stress is at a minimum while cognitive reappraisal fluctuates slightly. The Pearson correlation indicates a strong, significant relation between perceived stress and cognitive reappraisal, $r(37) = -.65$, $p = <.001$.

Figure 7

Observed scores of perceived stress and cognitive reappraisal for participant 62568.
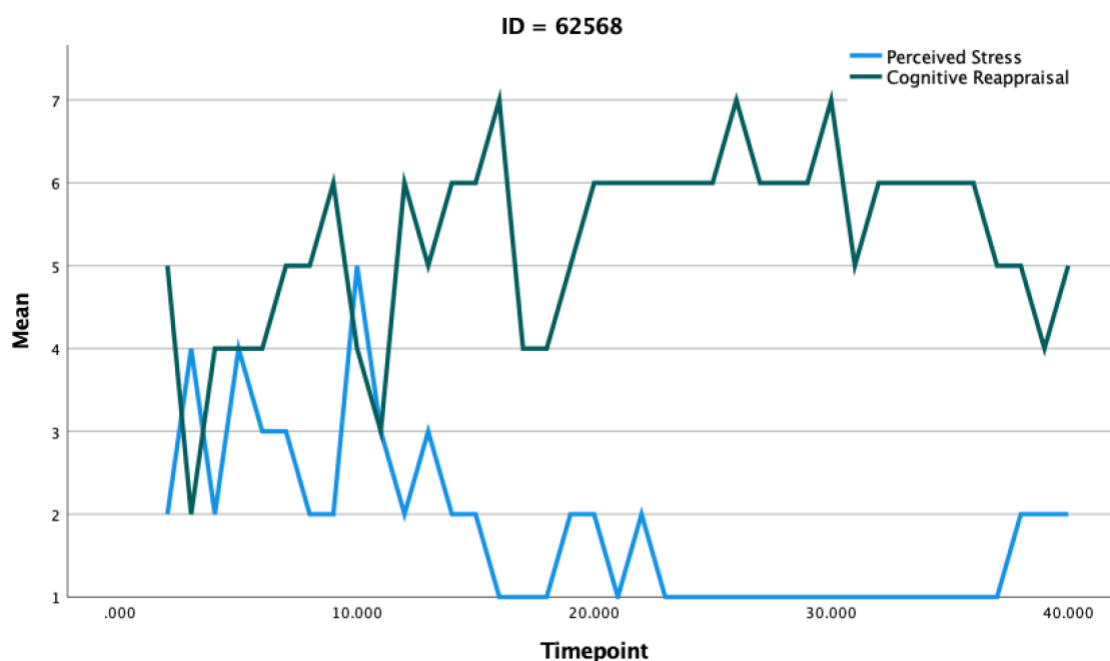
Altogether, the respective participants portray varying levels of perceived stress and cognitive reappraisal throughout the week. Both of the flourishing participants display mostly higher cognitive reappraisal than perceived stress scores, though only one of them portrays a significant, negative Pearson correlation. While one of the non-flourishing participants reaches maximum levels of perceived stress regularly, the second non-flourisher portrays consistently high cognitive reappraisal levels with very low perceived stress scores. The latter participant also displays a strong, negative correlation between perceived stress and cognitive reappraisal.

Discussion

The aim of this study was to assess the association between perceived stress and cognitive reappraisal, as well as whether flourishing acts as a moderator in the association. Moreover, it was explored whether flourishers perceive to experience less stress. Overall, the outcomes show that there is no association between perceived stress and cognitive reappraisal. With flourishing as an added interaction effect, no significant results were found either. Yet, flourishing is significantly, negatively correlated with perceived stress. That is, flourishers appear to experience less perceived stress than non-flourishers. This result is consistent with the findings of Berend, Vogt, and Brohm-Badry (2020) which state that flourishing may lead to lower levels of perceived stress.

Main findings

The association between cognitive reappraisal and perceived stress was non-significant and the effect size was close to zero. This indicates that there is no association between the two concepts. One explanation for this outcome might be that emotion regulation is not necessarily adaptive and useful in stressful situations. While cognitive reappraisal is mostly considered an adaptive approach to regulate emotions, as it refocuses one's thoughts on more positive aspects, some findings may present a different view.

Troy, Shallcrosss, and Mauss (2013) found that cognitive reappraisal's impact depends on context. When stress was controllable, using cognitive reappraisal led to higher depression levels; if stress was uncontrollable, reappraisal reduced depression. This suggests that when one's stress could be controlled, it is maladaptive to re-evaluate it instead of acting upon it. In the future, it's therefore important to consider whether participants perceived stress as controllable or uncontrollable to understand cognitive reappraisal's effectiveness.

Another insight is that cognitive reappraisal's effectiveness diminishes when intense negative emotions are present (Sheppes & Meiran, 2007). Hence, during high perceived stress, cognitive reappraisal might not be helpful, leading individuals to employ alternative stress management strategies. This has implications for our study, suggesting a potential delayed relationship between cognitive reappraisal and perceived stress. People might use reappraisal more effectively in later, calmer moments, as it requires cognitive resources not readily available in stressful situations. Future research could explore cognitive reappraisal and perceived stress as a lagged relationship.

Further, the study revealed that individuals who flourish perceive less stress compared to those who do not. Flourishing acts as a protective factor against stress, facilitated by a sense of purpose and meaning in life. Research suggests that a clear life direction enhances

stress resilience (Kashdan & Steger, 2007), buffering against stress's negative effects (Ryff, 1989). Flourishers also benefit from strong social support networks, shown to predict well-being (Taylor, 2011) and reduce health issues from chronic stress (Uchino et al., 2012). Flourishing shields against mental illnesses, aiding recovery (Iasiello et al., 2019; Schotanus-Dijkstra et al., 2017). These findings underscore how flourishers handle both mental health and daily challenges better, likely due to the advantages conferred by positive mental health, rendering them more resilient to everyday stressors. In future studies it may be of interest to focus on more specific mediating factors for flourishers, such as social support.

Regarding the moderation effect, similar explanations as mentioned earlier could apply. While perceived stress lacks a direct association with cognitive reappraisal, and although the connection with flourishing is robust, it does not function as a moderator. However, the association approaches significance, with a p-value of .06. Given the limited sample size of 35 valid participants, it raises questions about the study's statistical power in yielding low significance. Thus, caution is needed in interpreting the estimated association's implications. The observed negative moderation effect suggests that the link between perceived stress and cognitive reappraisal might weaken among flourishing individuals. Multiple factors could explain this pattern. Flourishers might employ distinct coping mechanisms during stress, including their strong social support networks. Additionally, flourishing individuals could engage in cognitive reappraisal later, when its effectiveness is higher, particularly during lower stress levels (Sheppes & Meiran, 2007). Furthermore, Troy, Shallcrosss, and Mauss (2013) propose that cognitive reappraisal might be maladaptive when stress is perceived as controllable. Flourishers' enhanced capability to handle challenges and resilience to stress could lead them to believe they can manage the stressor without reevaluating its meaning (Kashdan & Steger, 2007). However, these interpretations require cautious consideration, given the moderation effect's lack of significance.

Further explanation for the lack of significant associations may be the demographic composition of participants. As these were mostly young and educated, an idea for future research would be to focus on how age and current employment affects perceived stress and cognitive reappraisal. For example, Brockman et al. (2017) found that age is a moderator in the relationship of cognitive reappraisal and daily negative affect. Individuals aged 17 to 19 experience more negative affect with the use of cognitive reappraisal, but the relationship weakens with increasing age. Therefore, younger participants within this study may not benefit from using cognitive reappraisal as much as older participants.

Moreover, students and employed individuals have quite different daily schedules, responsibilities, and social contacts. Exploring how these elements influence individuals' perceived stress levels could offer valuable insights.

Additional Visualizations

The visualized data reveals distinct patterns in perceived stress and cognitive reappraisal throughout the day, with peaks of stress coinciding with class and work times. Cognitive reappraisal is most prominent during break times, allowing for reflection. Flourishing participants generally exhibit low stress and engage consistently in cognitive reappraisal, while non-flourishing participants also show varied coping strategies. A negative correlation between cognitive reappraisal and stress suggests its adaptive use, though its effectiveness varies individually. These findings underscore the role of cognitive reappraisal in stress management and emphasize individual differences in coping strategies. Future studies may focus on potential explanations for the intra-individual variability for both flourishers and non-flourishers. Further, a closer investigation into the times of day that are particularly stressful or that allow for reflections of previous situations could bring valuable insights into how and when individuals experience stress and reappraisal.

Strengths and Limitations

The study has several strengths that contribute to the reliability of the results. Firstly, it adopts a week-long semi-random experience sampling methodology, which aligns with the common duration of ESM studies (Vachon et al, 2019). The scheduling scheme of random 90-minute blocks for administering the assessments prevent participants from anticipating the next assessment, ensuring data integrity. Additionally, fixed time blocks allow for sufficient time intervals between assessments, accommodating the emergence of new situations. In terms of measurement, the study employs valid and reliable questionnaires. Overall, the study demonstrates robust methodological considerations, including comprehensive recruitment and consent procedures, effective scheduling of momentary assessments, and the use of reliable and valid measurement instruments. These strengths enhance the study's credibility and contribute to the meaningful interpretation of the results.

While the study has notable strengths, it is important to consider its potential shortcomings that may impact the interpretation of the results. Firstly, the study design itself may present limitations. The high burden placed on participants with up to ten momentary assessments per day could have contributed to a low response rate. This raises concerns about participant fatigue or overload, which may have influenced their engagement and response quality, in that some questionnaires may have been filled out rather quickly than accurately.

A more balanced distribution of assessments across a longer duration, such as two weeks, could have alleviated this issue and provided a more comprehensive understanding of the concepts over time.

Additionally, the study's sample composition may limit the generalizability of the findings. The inclusion of mostly young and educated participants, with a mean age of 22 years old and a majority being students or working students, may introduce selection bias and restrict the variability of experiences and coping mechanisms related to perceived stress and cognitive reappraisal. It remains unclear whether these findings would hold true for older individuals or those with different educational backgrounds and occupational statuses.

Furthermore, the study's reliance on self-report measures introduces the possibility of response bias and subjective interpretation, as individuals may prefer to report favorable outcomes about their behaviour (Althubaiti, 2016). Participants' ratings of perceived stress and cognitive reappraisal may be influenced by their individual understanding and interpretation of these constructs, leading to variations in response patterns and potentially affecting the reliability and validity of the data.

Lastly, the limited duration of momentary assessments, with a 15-minute expiry time, may have posed challenges for participants during particularly stressful or busy periods. Completing a questionnaire within a short timeframe might have been difficult, potentially resulting in missing data and incomplete assessments (Fuller-Tyszkiewicz et al, 2013). This could have introduced biases and affected the accuracy and representativeness of the collected data.

In summary, future research in this field should aim to address the limitations identified in the current study while capitalizing on its strengths. By extending the duration of the study, diversifying the sample composition, incorporating additional measures or methodologies, and adjusting the duration and expiry time of momentary assessments, researchers can further enhance the methodological rigor and reliability of their findings. These improvements will contribute to a more comprehensive and accurate understanding of individuals' experiences, stress levels, and coping mechanisms in various contexts.

Conclusion

The study's findings offer valuable insights into perceived stress, cognitive reappraisal, and flourishing. The non-significant link between reappraisal and stress highlights context-dependent adaptiveness. While not significant, the moderation effect of flourishing suggests individual coping influences. Flourishing individuals experience lower stress, emphasizing its protective role via purpose, social support, and positive mental health.

Despite the study's limitations, its strengths in methodology and measurement provide valuable insights that pave the way for more robust research in understanding stress management, coping strategies, and flourishing in daily life.

References

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review 30*, 217-237. DOI: 10.1016/j.cpr.2009.11.004

Althubaiti A. (2016). Information bias in health research: definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare 9*, 211-217. DOI: 10.2147/JMDH.S104807.

Barber, L. K., Bagsby, P. G., & Munz, D. C. (2010). Affect regulation strategies for promoting (or preventing) flourishing emotional health. *Personality and Individual Differences 49*(6), 663-666. DOI: 10.1016/j.paid.2010.06.002.

Basson, M. J., & Rothmann, S. (2018). Flourishing: positive emotion regulation strategies of pharmacy students. *International Journal of Pharmacy Practice 26*(5), 458–464. DOI: 10.1111/ijpp.12420

Berend, B., Vogt, D., & Brohm-Badry, M. (2020). Positive Emotions and Flourishing are Resilience Factors for Stress Symptoms. *International Journal of Stress Prevention and Wellbeing 4*(5). 1-11. Retreived from https://www.stressprevention.net/wp-content/uploads/2020/11/IJSPW-4-5R.pdf.

Black, A. C., Harel, O., & Matthews, G. (2012). Techniques for analyzing intensive longitudinal data with missing values. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 339–356). The Guilford Press.

Brans, Karen & Koval, Peter & Verduyn, Philippe & Lim, Yan & Kuppens, Peter. (2013). The Regulation of Negative and Positive Affect in Daily Life. *Emotion 13*(5). DOI: 10.1037/a0032400.

Burns, R. A., Windsor, T., Butterworth, P., & Anstey, K. J. (2022). The protective effects of wellbeing and flourishing on long-term mental health risk. *SSM – Mental Health 2*. DOI: 10.1016/j.ssmmh.2021.100052

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A Global Measure of Perceived Stress. *Journal of Health and Social Behaviour 24*(4), 385-396. DOI: 10.2307/2136404

Conner, T. S., & Lehman, B. (2012). Getting Started: Launching a Study in Daily Life. In M. R. Mehl & T. S. Conner (Eds.), Handbook of research methods for studying daily life (pp. 89–107). The Guilford Press.

Dejonckeere, E., & Erbas, Y. (2022). Designing an Experience Sampling study. In Myin-Germeys, I., & Kuppens, P. (Eds.). The open handbook of experience sampling methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies

(2nd ed.). (pp. 33-70). Leuven: Center for Research on Experience Sampling and Ambulatory Methods Leuven.

Dryman, M. T., & Heimberg R. G. (2018). Emotion regulation in social anxiety and depression: a systematic review of expressive suppression and cognitive reappraisal. *Clinical Psychology Review 65*, 17-42. DOI: 10.1016/j.cpr.2018.07.004

Esch, T., Stefano, G. B., Fricchione, G. L., & Benson, H. (2002). The role of stress in neurodegenerative diseases and mental disorders. *Neuroendocrinology Letters 23*, 199-208. pii: NEL230302R02

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist, 56*(3), 218–226. DOI: 10.1037/0003-066X.56.3.218

Fuller-Tyszkiewicz M., Skouteris H., Richardson B., Blore J., Holmes M., Mills J. (2013). Does the burden of the experience sampling method undermine data quality in state body image research?. *Body Image 10*(4), 607-613. DOI: 10.1016/j.bodyim.2013.06.003.

Ghasemi, A. & Zahediasl, S. (2012). Normality Tests for Statistical Analysis: A Guide for Non-Statisticians. *International Journal of Endocrinology and Metabolism 10*(2), 486-489. DOI: 10.5812/ijem.3505

Grommisch, G., Koval, P., Hinton, J. D. X., Gleeson, J., Hollenstein, T., Kuppens, P., & Lischetzke, T. (2020). Modeling individual differences in emotion regulation repertoire in daily life with multilevel latent profile analysis. *Emotion 20*(8), 1462–1474. DOI: 10.1037/emo0000669

Gross, J. J. (2001). Emotion Regulation in Adulthood: Timing Is Everything. *Current Directions in Psychological Science, 10*(6), 214–219. DOI: 10.1111/1467-8721.00152

Gross, J. J., & Thompson, R. A. (2007). Emotion Regulation: Conceptual Foundations. In J. J. Gross (Ed.), Handbook of Emotion Regulation (pp. 3-24). New York: Guilford Press.

Gruber, J., Hay, A. C., & Gross, J. J. (2014). Rethinking emotion: Cognitive reappraisal is an effective positive and negative emotion regulation strategy in bipolar disorder. *Emotion 14*(2), 388-396. DOI: 10.1037/a0035249

Haga, S. M., Kraft, P. & Corby, E. K. (2009). Emotion Regulation: Antecedents and Well-Being Outcomes of Cognitive Reappraisal and Expressive Suppression in Cross-Cultural Samples. *Journal of Happiness Studies 10*, 271–291. DOI: 10.1007/s10902-007-9080-3

Heininga, V. E., Dejonckheere, E., Houben, M., Obbels, J., Sienaert, P., Leroy, B.,

van Roy, J., & Kuppens, P. (2019). The dynamical signature of anhedonia in major depressive disorder: positive emotion dynamics, reactivity, and recovery. *BMC Psychiatry 19*(59). DOI: 10.1186/s12888-018-1983-5

Iasiello, M., van Agteren, J., Keyes, C. L., & Cochrane, E. M. (2019). Positive mental health as a predictor of recovery from mental illness. *Journal of Affective Disorders 251*, 227-230. DOI: 10.1016/j.jad.2019.03.065

Keyes, C. M. L. (1998). Social Well-Being. *Social Psychology Quarterly, 61*(2), 121–140. DOI: 10.2307/2787065

Keyes, C. L. M. (2002). The Mental Health Continuum: From Languishing to Flourishing in Life. *Journal of Health and Social Behaviour 43*(2), 207-222. DOI: 10.2307/3090197

Keyes, C. L. M. (2007). Promoting and protecting mental health as flourishing: a complementary strategy for improving national mental health. *American Psychologist 62*(2), 95-108. DOI: 10.1037/0003-066X.62.2.95

Keyes, C. L. M., Dhingra, S. S., & Simoes, E. J. (2011). Change in Level of Positive Mental Health as a Predictor of Future Risk of Mental Illness. *American Journal of Public Health 100*(12), 2366-2371. DOI: 10.2105/AJPH.2010.192245

Lamers, S.M.A., Westerhof, G.J., Bohlmeijer, E.T., ten Klooster, P.M. and Keyes, C.L.M. (2011), Evaluating the psychometric properties of the mental health Continuum-Short Form (MHC-SF). *Journal of Clinical Psychology 67*, 99-110. DOI: 10.1002/jclp.20741

Lamers, S. M. A., Westerhof, G. J., Bohlmeijer, E. T., ten Klooster, P. M. and Keyes, C. L. M. (2011). Evaluating the psychometric properties of the mental health Continuum-Short Form (MHC-SF). *Journal of Clinical Psychology 67*, 99-110. DOI: 10.1002/jclp.20741

Lang, P. J., Cuthbert, B. N., & Bradley, M. M. (1998). Measuring emotion in therapy: Imagery, activation, and feeling. *Behavior Therapy 29*(4), 655-674. DOI: 10.1016/S0005-7894(98)80024-5

Lazarus, R. S. (1982). Thoughts on the relations between emotion and cognition. *American Psychologist, 37*(9), 1019-1024. DOI: 10.1037/0003-066X.37.9.1019

Lazarus, R. S., & Folkman, S. (1984). Stress, Appraisal, and Coping. Springer Publishing Company.

Lazarus, R. S. (1990) Theory-Based Stress Measurement, *Psychological Inquiry 1*(1), 3-13, DOI: 10.1207/s15327965pli0101_1

McMahon, T.P., & Naragon-Gainey, K. (2018). The Moderating Effect of Maladaptive Emotion Regulation Strategies on Reappraisal: A Daily Diary Study. *Cognitive*

Therapy Research 42, 552–564. DOI: 10.1007/s10608-018-9913-x

Myin-Germeys, I., Oorschot, M., Collip, D., Lataster, J., Delespaul, P., & Van Os, J. (2009). Experience sampling research in psychopathology: Opening the black box of daily life. *Psychological Medicine, 39*(9), 1533-1547. DOI: 10.1017/S0033291708004947

Riepenhausen, A., Wackerhagen, C., Reppmann, Z. C., Deter, H. C., Kalisch, R., Veer, I. M., & Walter, H. (2022). Positive Cognitive Reappraisal in Stress Resilience, Mental Health, and Well-Being: A Comprehensive Systematic Review. *Emotion Review 14*(4), 310-331. DOI: 10.1177/17540739221114642

Rintala A, Wampers M, Myin-Germeys I, Viechtbauer W. (2019). Response compliance and predictors thereof in studies using the experience sampling method. *Psychological Assessment* (2), 226-235. DOI: 10.1037/pas0000662

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*(6), 1069–1081. DOI: 10.1037/0022-3514.57.6.1069

Schiffrin, H. H., & Nelson, S. K. (2010). Stressed and Happy? Investigating the Relationship Between Happiness and Perceived Stress. *Journal of Happiness Studies 11*, 33–39. DOI: 10.1007/s10902-008-9104-7

Schotanus-Dijkstra M., Ten Have, M., Lamers, S. M. A., de Graaf, R., & Bohlmeijer, E. T. (2016). The longitudinal relationship between flourishing mental health and incident mood, anxiety and substance use disorders. *The European Journal of Public Health 27*(3), 563-568. DOI: 10.1093/eurpub/ckw202

Schotanus-Dijkstra, M., Ten Have, M., Lamers, S. M. A, de Graaf, R., & Bohlmeijer, E. T. (2017). The longitudinal relationship between flourishing mental health and incident mood, anxiety and substance use disorders. *The European Journal of Public Health 27*(3), 563-568. DOI: 10.1093/eurpub/ckw202

Shields, S. A., & Kappas, A. (2006). Magda B. Arnold's contributions to emotions research. *Cognition and Emotion 20*(7), 898-901. DOI: 10.1080/02699930600615736

Socastro, A., Everaert, J., Boemo, T., Blanco, I., Rodríguez-Carvajal, R., & Sanchez-Lopez, A. (2022). Moment-to-Moment Interplay Among Stress Appraisals and Emotion Regulation Flexibility in Daily Life. *Affective Science 3*, 628–640. DOI: 10.1007/s42761-022-00122-9

Steptoe, A., Kivimäki, M. (2012). Stress and cardiovascular disease. *Nature Reviews Cardiology 9*, 360–370. DOI: 10.1038/nrcardio.2012.45

Troy, A. S., Shallcross, A. J., & Mauss, I. B. (2013). A person-by-situation approach

to emotion regulation: Cognitive reappraisal can either help or hurt, depending on the context. *Psychological Science 24*, 2505–2514. DOI: 10.1177/0956797613496434

Uchino BN, Bowen K, Carlisle M, Birmingham W. (2012). Psychological pathways linking social support to health outcomes: a visit with the "ghosts" of research past, present, and future. *Social Science & Medicine 74*(7), 949-57. DOI: 10.1016/j.socscimed.2011.11.023.

Vachon H., Viechtbauer W., Rintala A., Myin-Germeys I. (2019). Compliance and Retention With the Experience Sampling Method Over the Continuum of Severe Mental Disorders: Meta-Analysis and Recommendations. *Journal of Medical Internet Research 21*(12). DOI: 10.2196/14475

Van Berkel, N., Ferreira, D., & Kostakos, V. (2018). The Experience Sampling Method on Mobile Devices. *ACM Computing Surveys 50*(6), 1-40. DOI: 10.1145/3123988

Viechtbauer, W. (2022). Statistical methods for ESM Data. In Myin-Germeys, I., & Kuppens, P. (Eds.). The open handbook of experience sampling methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies (2nd ed.). (pp. 153-183). Leuven: Center for Research on Experience Sampling and Ambulatory Methods Leuven.

Woltjes, S. (2019). Ecological Momentary Assessment Versus Cross-Sectional Survey [Wageningen University & Research Centre].