

THESIS

THE EFFECTS OF ANTICIPATORY COGNITIVE PROCESSES AND RUMINATION ON NEGATIVE AFFECT REACTIVITY TO A LABORATORY CONTROLLED STRESSOR

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ABSTRACT

THE EFFECTS OF ANTICIPATORY COGNITIVE PROCESSES AND RUMINATION ON NEGATIVE AFFECT REACTIVITY TO A LABORATORY CONTROLLED STRESSOR

A growing body of literature on stress reactivity shows mixed findings on the efficacy of anticipatory cognitive processes (ACPs) in reducing negative affect reactivity (NAR). Established stress research highlights the association between high NAR and poor long-term health outcomes. The current study explores cognitive processes that may buffer negative and prolonged reactions to stress and reduce the likelihood of stress contributing to poorer health in the future. This study aims to provide answers as to how the use of anticipatory deliberation (AD), anticipatory appraisals (AA), and rumination differentially predict NAR using a standardized lab stressor. It was predicted that participants who engaged in more frequent AD and more positive AA would experience less NAR, and those reporting high rumination about lab stressors would experience greater NAR. To test these hypotheses, researchers recruited participants from the parent HEADE study. The participants answered a series of daily Ecological Momentary Assessments (EMAs) reporting their engagement use of AD, AA, and rumination. Participants took part in three lab sessions where they completed the Trier Social Stress Test (TSST) and answered questionnaires about their current affect before and during the TSST to measure NAR. Results from the correlation matrix and multiple regressions analyses did not support the hypothesis about AD and AA. AA showed no measurable effect on NAR, and AD exacerbated NAR rather than reduced it. The hypothesis regarding rumination was supported. Results showed rumination and AD were strongly correlated with one another and

both were associated with a significant increase in NAR. Implications of these findings, such as the negative impacts of perseverative thought both before and following a stressor, as well as strengths, limitations and future research directions are also discussed in this paper.

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LITERATURE REVIEW

Individuals differ in their affective responses to threatening events or stressors, with varying levels of increases in negative affect (e.g., anger, sadness, anxiety), and/or decreases in positive affect (e.g., joy, contentment, relaxation; Britton et al., 2017; Luong et al., 2018; Parrish et al., 2011), also referred to as *affective reactivity*. More specifically, negative affect reactivity (NAR), is the magnitude of an individual's negative emotional response to the event and has been linked to poorer longer-term psychological, behavioral, and physiological problems (McIntyre et al., 2019). It is therefore important to understand how people can modify their affective reactivity to stressors to reduce longer-term health problems (Khan et al., 2016).

Effective use of coping strategies, or cognitive and behavioral efforts to manage stressful and taxing demands (Juth et al., 2015), can reduce affective reactivity to stressors and mitigate negative health impacts such as poor cardiovascular and mental health (Brosschot, 2010; Neupert et al., 2016, McIntyre et al., 2019). Much of the previous research in this area has focused on cognitive processes during or after stressful events (such as rumination or perseveration on past events), but substantially less is known about anticipatory cognitive processes that occur prior to the stressor. We distinguish between anticipatory deliberation (AD), which involves the extent to which an individual is thinking about an upcoming stressor, and anticipatory appraisals (AA), which are the evaluations of the upcoming stressor as relatively positive or negative. This study will focus on the extent to which rumination, anticipatory deliberation (AD) and anticipatory appraisals (AA) may predict negative affect reactivity (NAR) to laboratory-controlled psychosocial stressors.

Cognitive Perseverative Thoughts About Past Stressors - Rumination

Previous research points to the importance of the way one thinks about stressors during or after their occurrence and how this perseverative thought plays an integral role in exacerbating negative affect reactivity (NAR; Capobianco et al., 2018). One cognitive process, rumination, has been well-documented as maladaptive for psychological well-being (Capobianco et al., 2018; Aldao et al. 2014). Rumination is defined as repetitively and passively thinking about symptoms of distress and their possible causes and consequences in response to a stressful event (Nolen-Hoeksema et al., 2008; Nasso et al., 2019; Aldao et al. 2014). Other definitions add that rumination includes negative, perseverative, difficult-to-control thoughts or imagery. People who ruminate remain fixated on past problems and fail to take action to actively solve the problems (Nolen-Hoeksema et al., 2008; Kirkegaard Thomsen, 2006; Capobianco et al., 2018). Rumination involves typically little or no motivation to detect, avoid, or deal with the stressor in the present or future, which delays the rate of recovering to baseline emotional states (Capobianco et al., 2018).

Habitual rumination is associated with stronger NAR to stressors (Aldao et al., 2014, Capobianco et al., 2018). NAR is not only more pronounced, but also more challenging to recover from due to difficulties ruminators tend to have re-directing attention away from thoughts about the event (Nolen-Hoeksema et al., 2008; Aldao et al., 2014). Researchers have consistently found that rumination prolongs and exacerbates distress and depressive symptoms as people relive the negative affective experiences while they dwell on past stressors (Nolen-Hoeksema et al., 2008). According to the neurocognitive framework (De Raedt & Hooley, 2016), negative self-referential thinking prevents individuals from engaging in proactive anticipation,

leading to increased amygdala activity and negative affect, resulting in difficulties regulating stress responses (Nasso et al., 2019).

Anticipatory Cognitive Processes: Protective or Maladaptive?

Although the negative health effects of rumination *after* a stressful event are well-established in the field of stress research, it is still unclear whether such cognitive perseverative thought occurring *prior to* the stressor contributes to greater NAR in similar ways to rumination, or if the anticipation acts as a protective factor by creating an opportunity for people to prepare for the upcoming stressor. Anticipatory cognitive processes (ACPs) can involve a range of different thought patterns, such as planning for upcoming stressors, figuring out how to avoid the stressor altogether, and changing how one views or appraises the upcoming threat (Neupert et al., 2016).

One ACP, anticipatory coping, involves thinking about and preparing for forecasted stressful events (Folkman & Lazarus, 1985; Neupert et al., 2019). To engage in this strategy, people must first predict that a stressor will occur in the future (Luong et al., 2018). Anticipatory coping focuses on preparing for the stressor to occur and reducing the likelihood of negative emotional responses if/when the anticipated stressor occurs (Aspinwall & Taylor, 1997; Neupert & Bellingtier, 2019). Much of the previous literature focusing on anticipatory cognitive processes leading up to the stressor has generally referred to these processes as “anticipatory coping” (Folkman & Lazarus, 1985; Neupert et al., 2019; Neubauer et al., 2018). It is important, however, to distinguish between different facets of anticipatory coping, such as anticipatory deliberation (AD) and anticipatory appraisal (AA), given that they may uniquely predict NAR. AD refers to the extent to which an individual is thinking about the upcoming stressor, and AA refers to the appraisals or evaluations of the forecasted stressor as relatively positive or negative.

Studies focusing on anticipatory cognitive process have yielded mixed results on the effectiveness of these anticipatory processes on reducing NAR (Neupert & Bellinger, 2018; Neupert et al., 2016). Past research on cognitive perseverative thought and worry about upcoming stressful events shows that similar to rumination, excessive worry can lead to activation of psychological and physiological stress responses associated with greater depressive symptoms and anxiety, and consequently, increased negative affect (Scott et al., 2019; Zoccola et al., 2010). For example, one study found that NAR was significantly *greater* for individuals after reporting that they were anticipating a stressor than when participants reported no anticipation of stressors (Neubauer et al., 2018). Neubauer and colleagues (2018) offer the possible explanation that simply anticipating an event leads to highly arousing physiological and emotional effects similar to actually experiencing the event. This research also points to the role of perseverative thought and how regardless of timing, this could lead to exacerbated NAR (Neubauer et al., 2018). The perseverative thought of AD overlaps with similar perseverative cognitive processes of rumination, which could suggest that AD is not more adaptive than rumination in reducing NAR. If people are not also using proactive strategies to change the outcome or how they respond to and prepare for the stressor, AD is not a promising positive strategy for coping with stress.

In contrast, there are other studies that suggest anticipatory cognitive processes and perseverative thought, such as worrying about upcoming events, could be related to *better* well-being by allowing people to prepare or brace themselves for the upcoming stressor (Neupert et al., 2016; Sweeny & Dooley, 2017; Luong et al., 2018; Feldman & Hayes, 2005). ACPs such as positive anticipatory appraisal (AA), which involves perceptions of the stressors as less threatening, and anticipatory deliberation (AD), which involves thinking and possibly planning

for the upcoming event, could also be effective in reducing NAR during or after the stressor occurs (Charles & Luong, 2013; Feldman & Hayes, 2005).

Although worry is typically thought of as a negative experience, Sweeny and Dooley (2017) describe how it can be motivating and related to positive outcomes. Worry, much like rumination, involves repetitive self-focused thoughts about negative stimuli (Sweeny & Dooley, 2017). Worry and rumination appear to be similar processes, with the important distinction that worry typically involves a *future* focus on potential stressors, and rumination is characterized by continued dwelling thoughts about a *past* negative experience. Sweeny and Dooley (2017) suggest in their research that this temporal difference allows individuals engaging in worry to draw attention to and prepare for, or avoid, upcoming aversive events, providing a sense of control over the situation. Although too much worry can be detrimental and exacerbate negative affect, this study found that the “right amount” of naturally-induced worry was motivating to individuals and deepened their thoughts and planning about the upcoming situation, and allowed them to brace for the various possible outcomes (Sweeny & Dooley, 2017.) Worry showed an inverted “U” shaped association with positive outcomes, implying that too little worrying did not spark motivation to plan or prepare for the upcoming event and too much worrying was overwhelming and paralyzing with regard to productive coping efforts (Sweeny & Dooley, 2017). These findings shed light on the potential for AD or AA to buffer NAR, if the participants think about and appraise the situation as appropriately stressful. Yet, still another study by Neupert and colleagues (2016) found no association between anticipatory cognitive processes and NAR.

Thus, it is important to resolve the contradictory findings in the literature to better understand the circumstances in which anticipatory cognitive processes like AD and AA may be

associated with either greater or reduced NAR. One reason why the literature may be unequivocal is that previous studies did not account for the individual differences in the stressors experienced and reported on. In past studies, the frequency, severity, and domains of the stressors were not controlled for across participants (Neubauer et al., 2018). Because the stressor characteristics were not held constant across participants in these ways, different participants may have been anticipating stressors of different frequencies, severities, and domains, leading to different levels of negative affect reactivity. That is, variation in the findings of previous research may also indicate that the differences in how people anticipated or reacted to those stressors may reflect the nature of the particular stressors they were dealing with, rather than in the anticipatory cognitive processes themselves.

CURRENT STUDY

For the current study, it is important that participants experience standardized psychosocial stressors with the same schedule rather than reporting on everyday life stressors as previous studies have done to be able to draw stronger conclusions about how anticipatory cognitive processes may predict NAR (Neubauer et al., 2018; Neupert & Bellinger 2019; Feldman & Hayes, 2005). First and foremost, using a standardized stressor is a way to equalize the experience of upcoming stressors for all participants, such as in their predictability, timing, and severity. This experimental control makes it clearer whether AD and/or AA predict negative affect reactivity in the lab. Many studies in the literature have also not examined both the anticipatory processes of frequency of thinking (anticipatory deliberation; AD) and valence of the thoughts (anticipatory appraisals; AA) as predictors of NAR. This oversight may be another explanation for the inconsistent findings in the literature, because there is a theoretical difference between *how often* and *how positively* participants are thinking about upcoming stressors. Separating these constructs will allow researchers to better understand how each may differentially contribute to NAR.

Research Questions and Hypothesis

The primary research question is: How does the use of anticipatory deliberation and anticipatory appraisal differentially predict negative affect reactivity to standardized lab stressors? The first hypothesis is that participants who engaged in more frequent AD (i.e., think more often about the upcoming stressor) and more positive AA would experience less negative affect reactivity (i.e., change in negative affect from baseline to stressor task periods). The secondary research question is: Does rumination reduce the effect of AD on NAR to lab

stressors? This research question allows us to differentiate anticipatory and post-stressor cognitive processes in their effects on NAR. It is hypothesized for this second question that participants reporting more rumination about the lab stressors would experience greater NAR. The third hypothesis in the study is that with all of the main predictor variables (rumination, AA, and AD) in one model, rumination would be the strongest predictor of participants' NAR over the other main predictors. Because of the consistency within the literature in regard to rumination and its effects on NAR, and the lack of consistency in the literature about anticipatory cognitive processes, we predict that rumination will be a stronger and more consistent predictor of NAR.

METHOD

Participants

Participants were part of a larger project called the Health and Daily Experiences (HEADE) study, which was conducted with the aim of examining age and cultural differences in stress responses and the link that these have to health outcomes. Participants were recruited through convenience sampling using community flyers at various local events and businesses, newspapers and advertisements, and word of mouth. To be eligible for participation in the larger HEADE study, participants were required to meet specific criteria: Identify as European American or Hispanic/LatinX and identify as a younger adult (18-35 years old) or an older adult (60+ years old). Older adults also must pass a Mini Mental State Examination (MMSE) to ensure that individuals with cognitive impairments were not included in the study. Individuals with heart arrhythmia or other heart conditions, as well as individuals diagnosed with a psychological disorder were excluded from participating. For the current study, 224 participants were included in the analyses: 55% younger adults and 45% older adults, 42.5% male, and 57.5% female, 80.2% European American, 15.8% Hispanic/LatinX, and 4% of participants selected something other than these two options.

Procedures

Study Overview

This study involved two major protocols: lab sessions and ecological momentary assessment (EMA) surveys, which are explained in greater detail below. Over the approximately 1.5 weeks of their participation in the study, participants visited the lab a total of five times, two of which were for logistical, non-experimental purposes and three for lab sessions in which the

standardized psychosocial lab stressors were administered (See Figure 1). In the first non-experimental lab visit participants were briefed on what participation in the study consists of, leaving out the true intentions of the three lab sessions, keeping them blind to the stress tasks described below. At this initial session the participants were also presented with and signed the informed consent read to them by the lab assistant conducting the overview session. In this initial visit participants were also given their study equipment consisting of their Empatica E4 wrist-device, and their lab-issued smartphone with which they completed the Ecological Momentary Assessments described in greater detail below. The other non-experimental lab visit was the debrief session after participation was complete, which is explained in greater detail below.

On the following Monday, Wednesday, and Friday, participants completed their three respective lab sessions in which they experienced standardized stressors and completed questionnaires pertaining to their affect prior to and following the lab stressors as an assessment of their negative affect reactivity. For seven consecutive days of participation (Sunday-Saturday), which overlapped with the week of the lab sessions, participants also responded to the ecological momentary assessment (EMA) surveys in daily life. Finally, the participants' last visit to the lab was to return equipment and be debriefed about the true purposes of the study. At this visit, participants were un-blinded and told the purposes of the various tasks and surveys they completed and the intentions and objectives of the study, such as studying stress and reactivity and the implications for health in later life. At this final visit, participants were also able to ask any questions they had about their participation and the study as a whole. Additionally, if participants wanted to withdraw their data from the study after learning the purpose of the study, they were able to do so at this visit. This final session took place the Tuesday following their lab sessions, which concluded their participation in the study (Figure 1).

Lab Sessions

The lab sessions were designed with the aim of exposing the participants to stressors in a controlled setting using a standardized psychosocial stressor paradigm, Trier Social Stress Test (TSST; which will be described in further detail below), and to assess participants' affective reactivity to the task.

Trier Social Stress Test (TSST).

At the beginning of each lab session, participants completed baseline (pre-task) questionnaires of their current affective experiences and other information not relevant to the current study (e.g., personality traits, health conditions). Next, the participant was informed they would complete a cognitive task, which is actually a standardized psychosocial stressor called the Trier Social Stress Test (TSST; Allen et al., 2017). The purpose of using the TSST was to expose the participants to the stressors in a standardized way to create the most accuracy in measuring negative affective reactivity to the stressors between subjects. The TSST consists of two tasks: A public speaking task and a mental math task. These tasks have both been shown to reliably elicit psychological stress responses among participants (Allen et al., 2017).

The participants were first faced with the spontaneous public speaking task. For this task, the participant was assigned to one of three speech prompts, including describing an embarrassing or shameful experience, pretending they are at a job interview and having to defend why they are the best candidate, or describing a negative trait or bad habit they recognize in themselves. Each participant completed all three speech prompts across the course of the week (one speech each lab session), with the order of the speech prompts counterbalanced across participants. After receiving the prompt, the participant was given five minutes and a paper and pencil to prepare a speech. After the five-minute preparation period is over, the evaluator for the

lab session entered the room and took the participant's notes. The participant was then directed to speak about their assigned topic for five minutes. Participants were asked to continue speaking for the entirety of the five minutes and if they finished early or stopped talking, they were asked to continue speaking. During the speech, the evaluator remained stoic and took notes throughout the task. The evaluators were trained not to provide any positive feedback to the participants, such as nodding or smiling in response to their speech. After the speech task concluded, the evaluator moved to the math task of the TSST.

The TSST math task involved mentally subtracting from a large number by a subtrahend; for example: starting with the number 1,059 and subtracting sevens. For each lab session, participants were given a different starting number and subtrahend. If the participant misspoke or gave an incorrect answer at any point during the task before reaching zero (or as close to zero as possible given the subtrahend), the evaluator marked down where they misspoke and prompted them to stop and start from the beginning again. If the participant took too long to give an answer, the evaluator also told the participant that they must go faster. After five minutes of attempting this task, the participant was prompted to discontinue the task if they had not yet been successful. Just like in the speech task, each participant faced each of the three conditions in a randomly assigned order by the end of their week of lab sessions. Following the second task of the TSST, participants completed various questionnaires, which included reporting on their affective experiences while they worked on the cognitive tasks. These questionnaires were used to measure the experience of the participant and their affect reactivity (difference in affective experiences from the pre- to post- task periods).

Ecological Momentary Assessments (EMA)

The second major protocol involved in this study was ecological momentary assessment (EMA) daily life surveys. The purpose of the EMA surveys were to assess participants' use of anticipatory cognitive processes and rumination about the lab sessions throughout the study week. At the Study Overview/Informed Consent meeting participants were loaned equipment for EMA monitoring of physical activity (via a wrist-worn Empatica E4 device, similar to a FitBit) as well as administration of daily life surveys (via mobile smart phones). For seven consecutive days, six times each day, an electronic survey was set to appear on a mobile smart phone loaned to the participant. These surveys occurred during their normal waking hours and the time intervals between the surveys were no less than 30 minutes nor greater than four hours. These surveys asked Likert scale-style questions about the participants current thoughts and mood at the time the survey pinged. The survey also asked questions about their feelings and internal experiences in regard to their previous and the upcoming lab sessions. The current study focused on the questions from the EMA surveys about the use of anticipatory deliberation and appraisal regarding the upcoming lab sessions and rumination about the past lab sessions for each participant.

Measures

Demographic Predictor Variables

This study included the demographic predictor variables of gender, age group, highest level of education, annual income, and ethnicity. All demographic information was provided by participants through self-report questionnaires administered during the lab sessions. These demographic predictor variables were chosen to identify potential group differences between participants of varying demographic backgrounds to provide information about how some groups

may engage with these cognitive processes more often. Leading to further research questions and hypotheses about why these participants are led to engage more in certain cognitive processes, whether adaptive or not.

Participants self-reported their gender as either male, female, or “other.” In order to perform the analyses, gender was coded as Male = “0” and Female = “1”; no participants in the study selected “other” when reporting their gender. Age was self-reported by participants and based on this self-reported age they were categorized into two age groups: Younger adults (18-35 years) and older adults (60+ years). Gender was also coded for the data analysis with “0” representing the younger cohort and “1” representing the older cohort. Participants reported their highest level of education completed and were coded for analysis as follows: “1” = Elementary School- grades 1-6; “2” = Junior High School- grades 7-8; “3” = Some High School, but no degree; “4” = High School- grades 9-12; “5” = Some college, but no degree; “6” = Junior College- Associate’s Degree; “7” = College- Bachelor’s Degree; “8” = Some graduate school, but no degree; “9” = Master’s degree; “10” = Doctorate degree. Participants also selected their range of annual income, which was coded as “1” = Less than \$10,000; “2” = \$10,000 - \$19,999; “3” = \$20,000 - \$29,999; “4” = \$30,000 - \$39,999; “5” = \$40,000 - \$49,999; “6” = \$50,000 - \$59,999; “7” = \$60,000 - \$69,999; “8” = \$70,000 - \$79,999; “9” = \$80,000 - \$89,999; “10” = \$90,000 - \$99,999; “11” = Over \$100,000. To measure ethnicity, participants reported whether they identified as European-American, Hispanic/LatinX, or “other.” Participants who identified as European-American, are referred to as white and coded “0” in this study, and those who selected any ethnicities other than only European-American are a part of the Black, Indigenous, People of Color (BIPoC) group, coded “1”.

Main Predictor Variables

The main predictor variables in this study, anticipatory deliberation, anticipatory appraisal and rumination were measured by data collected from the self-report EMA surveys that were sent to the participants' lab phones during the week-long study period. Although participants received a total of 42 EMA surveys across the week, the questions on AD, AA, and rumination were only assessed during the morning and in the evening surveys (twice daily) for a total of 14 surveys assessing these cognitive processes in their daily life. The reason these questions were only asked twice a day, rather than in every survey, was with the intention of not priming participants think about the past or upcoming lab sessions more than they would in everyday life. If participants were asked about the past and upcoming lab sessions with every survey, they would likely be primed to think they *should* be thinking about the upcoming or past lab sessions and this could compromise the integrity of the study report measures.

Anticipatory Deliberation (AD) and Anticipatory Appraisal (AA). Anticipatory deliberation was measured by the participants' averaged responses to the EMA question, "To what extent are you currently thinking about your upcoming lab visit?" (0 = *Not at all*, to 6 = *Very Much*) and anticipatory appraisal was measured with averaged responses to the EMA question, "How are you feeling about your upcoming lab visit?" (0 = *Very Positive*, to 6 = *Very Negative*). The first question addressed the frequency of AD, and the second question addressed the valence, or the appraisal, of the upcoming lab session.

Rumination. To measure rumination, each morning and evening of the seven EMA survey days the survey prompted: "To what extent are you currently thinking about your most recent lab visit?" (0 = *Not at all*, to 6 = *Very Much*). Similar to the anticipatory measures,

rumination was measured by averaging the EMA survey responses across the week for each participant.

Dependent Variable

Negative Affect Reactivity (NAR). This study measured negative affect reactivity (NAR) using in-lab questionnaires prior to and immediately following the TSST. Questions pertaining to affective measures on these pre- and post-TSST questionnaires were based on an adapted version of the Daily Emotion Sampler by Laura Carstensen and colleagues' (2011) Daily Diary Study. At the pre-TSST assessment, momentary negative affect was assessed with the average of seven negative emotional states, including: anger, sadness, fear, anxiety, frustration, embarrassment, and boredom. These were measured on a Likert scale from 1 = *Not at all*, to 7 = *Extremely*. Immediately after the TSST, participants were asked to report on their affective experiences while they worked on the lab tasks, using the same measure of seven emotional states.

The negative affect reactivity measure was derived from calculating the difference, or change, in negative affect from the pre- to post-TSST questionnaires by subtracting the pre-TSST negative affect score from the post-TSST negative affect score. Higher (more positive) values denoted greater increases in negative affect from the baseline to task period (greater NAR). Because participants partook in the TSST lab sessions three times throughout their week of participation (see Figure 1), they each had three measures of NAR by the end of participation. All three of these difference scores were averaged together for each participant. This approach provided information at the person-level, so we were able to measure how individual differences in average levels of AD, AA, and rumination predicted person's average NAR to lab stressors.

RESULTS

Descriptive statistics

As a first step in analyzing our data and examining the associations between the demographic predictor variables, main predictor variables, and dependent variables, we ran a correlation matrix, which included all study variables in order to identify any individual main effects. We first examined how the demographic predictors were individually related to the main predictors (rumination, AD, and AA) and dependent (NAR) variables to assess whether these demographic variables are significantly associated with any of the main study variables, when not taking into account all other variables. These analyses established the plausibility of examining these demographic predictor variables in the study.

The correlation matrix identified two of the demographic predictors to be significantly associated with negative affect reactivity (NAR). First, a significant association between gender and NAR was found, such that women experienced greater NAR than men (Table 1). The correlational analysis also showed that level of education was a potential protective factor, such that higher levels of education were related to less NAR (Table 1). Another significant association revealed that ethnicity was related to rumination (one of the main predictor variables), such that the Black, Indigenous, People of Color (BIPoC) group of participants were found to ruminate more often than White identifying participants (Table 1). Interestingly, neither age group nor income level were found to be significantly correlated with the independent or dependent variables at the bivariate level.

Next, we examined how the three main predictors (rumination, AD, and AA) were associated with one another in the correlation matrix to understand how these cognitive

processes are related. These analyses are based on bivariate correlations and do not account for the shared variance with demographic predictor variables, rather, they are a first step in revealing the associations between the main predictor variables. There was a strong correlation between rumination and anticipatory deliberation ($r = .87$). Correlations of absolute values greater than or equal to .50 are considered large effects (Cohen, 1988). The large correlation between rumination and AD suggests that people who tend to perseverate on stressful events are more likely to engage in this cognitive process both pre-emptively and following the stressful event. In the correlation matrix, we identified two significant associations pertaining to the main predictor variables and the dependent variable, NAR. NAR was found to be significantly correlated to both AD and rumination in the same direction. There was a positive association between both AD and rumination with the dependent variable NAR, which shows that those who report higher rumination and AD have *greater* NAR to the lab stressors.

Testing the Effect of Anticipatory Cognitive Processes and Rumination on Negative Affect Reactivity

Data Analysis Plan

To better understand how the main predictor variables are related to one another, this study used multiple regression models to test the main hypotheses that anticipatory cognitive processes, such as anticipatory deliberation and anticipatory appraisal, would be related to lower negative affect reactivity, and that rumination exacerbates NAR to controlled stressors. All multiple regression models included the demographic predictor variables of gender, age group, level of education, annual income, and ethnicity, as predictors of NAR, the dependent variable. The inclusion of the demographic predictors allowed researchers to see the effects of the main predictor variables on NAR, adjusting for the effects of the demographic predictors.

Model 1 was the baseline model, which included only the demographic predictor variables and the dependent variable, NAR. The baseline model provided researchers with information about how much the demographic predictors, collectively on their own, were predictors of the dependent variable before taking into consideration the main predictor variables. Starting with a baseline model with only demographic variables showed researchers how much of the variance in NAR could be explained by the main predictor variables with each successive model building on the last by adding in the other main predictors and comparing the additional variance explained by the models. Model 2 built upon Model 1 by adding both AD and AA as main predictor variables; Model 3 included rumination as the only main predictor variable in the model to examine the unique effects of rumination on NAR. Finally, Model 4 included all three of the main predictor variables (AD, AA, and rumination) together. This showed which predicted NAR when adjusting for the influence of the other predictor variables, and which variables were the strongest predictors.

Research Question 1: Do Anticipatory Cognitive Processes Predict Lower Negative Affect Reactivity?

Prior to testing the main aims of the study, Model 1 examined how the set of demographic predictor variables were related to NAR. The only significant association found was between age group and NAR. This association revealed that the older age group showed greater NAR than the younger age group, adjusting for the other demographic predictor variables included in the model (Table 2, Model 1). The first aim of the study was to test the extent to which anticipatory deliberation (AD) and appraisal (AA) predict lower negative affect reactivity (NAR) during the lab sessions, adjusting for the demographic predictor variables. To test this aim, Model 2 added to Model 1 by including the main predictor variables, AD and AA, in the

multiple regressions (Table 2, Model 2). The findings did not support the hypotheses. Participants who reported more AD actually experienced *greater* NAR and there was no significant association between the reported anticipatory appraisals of the upcoming lab sessions and NAR (Table 2, Model 2).

Research Question 2: Does Rumination Predict Greater Negative Affect Reactivity?

The second aim of the study was to examine the degree to which rumination predicts greater NAR to lab stressors. To test this prediction, Model 3 included the demographic predictor variables and rumination as a main predictor variable in the multiple regression model (Table 2, Model 3), but not the ACPs as main predictor variables. In line with the hypothesis, participants who reported more frequent rumination showed greater NAR (Table 2, Model 3).

Research Question 3: Which Cognitive Processes are the Strongest Predictors of Negative Affect Reactivity?

It was also hypothesized that in the same model, rumination would be the strongest predictor of participants' NAR over both AD and AA. Because of the strong correlation between AD and rumination found in the bi-variate correlation analysis, we ran collinearity diagnostics and found that rumination and AD. Variance Inflation Factor (VIF) greater than 10 indicate multicollinearity, but in a study with fewer variables, such as this one, values over 2.5 are cause for concern for multicollinearity. We found that both rumination and AD show VIFs over 2.5 (rumination = 4.155; AD = 3.98). However, we still ran model 4 of the analysis in order to test the third hypothesis. Thus, we examined whether any of the three main predictor variables independently predicted NAR above and beyond the effects of the others in the same regression model. In Model 4 of Table 2, when all three main predictor variables were included, none of the main predictor variables remained strong predictors of NAR. In this Model, the only significant

finding that remained was that the older age group showed greater NAR than the younger age group (Table 2, Model 4).

DISCUSSION

Implications of the Results

The primary research question of this study asked how the use of anticipatory cognitive processes (ACPs) such as anticipatory deliberation (AD) and anticipatory appraisal (AA) differentially predict negative affect reactivity to standardized lab stressors. It was hypothesized that participants who engaged in more frequent AD and more positive AA would experience less negative affect reactivity. This hypothesis was not supported. Participants who reported more AD actually experienced *greater* NAR. This finding aligns with some of the previous literature that compares the perseverative nature of ACPs to that of rumination, which has been shown to enhance NAR. These findings suggest that regardless of timing, these perseverative processes (i.e., more frequent thinking about stressors) are maladaptive in preparing for or dealing with a stressor (Scott et al., 2019; Zoccola et al., 2010; Neubauer et al., 2018). These findings do not, however, reflect the findings in the anticipatory cognitive processes literature that focuses on worry and its protective factors in preparing for upcoming stressors (Sweeny & Dooley, 2017). One possibility for this discrepancy is that Sweeny and Dooley (2017) focused more on the preparation and planning aspects of worry and ACPs, while many of the other studies focused more generally on ACPs and didn't necessarily separate the different facets of them such as preparation and planning.

Counter to our expectations, there was no significant association between the reported anticipatory appraisals of the upcoming lab sessions and NAR (Table 2, Model 2). This result suggests that thinking about the upcoming event as more positive or more negative does not make a measurable difference in swaying whether or not the predictive perseverative thought is

adaptive in buffering NAR. This finding is unlike that of Neupert and colleagues (2016), who found that the *ways* in which we think about the upcoming stressor made a difference in whether the anticipation was adaptive for stress responses. As mentioned in the literature review, Sweeny and Dooley (2017) discuss in their research the potential benefits of worry and anticipating stressors. They discuss the inverted “U” shape that represents the motivation that worry in anticipation of an upcoming stressor can provide. While not worrying or anticipating enough fails to be motivating for most people, worrying too much in advance can also be paralyzing and disallowing of any planning or preparation for the forecasted stressor. They suggest that the right amount of worry can be motivating and allow individuals to anticipate, prepare, and make a plan for the upcoming stressor, leading to buffered negative affect reactivity (Sweeny & Dooley, 2017). Thus, it is possible that anticipatory appraisals show an inverted “U” shaped pattern with NAR, but that could not be detected with the multiple regression analyses we conducted in this study.

The secondary research question asked to what extent rumination following lab stressors predicts NAR to lab stressors. We hypothesized that participants who ruminated more often about the lab stressors would experience greater NAR in general. This hypothesis was supported, and the analysis showed that individuals who reported more rumination did report significantly more NAR in the lab session. This finding is in line with the literature already published on rumination showing that it is linked to pronounced affect reactivity (Aldao et al., 2014, Capobianco et al., 2018).

Finally, it was hypothesized that with all of the main predictor variables in one model, rumination would remain the strongest predictor of participants’ NAR over the other variables, given how consistent the current literature is on rumination and affect reactivity. As stated

earlier, we ran collinearity diagnostics to find multicollinearity between AD and ruminations and found the two have strong overlap. By still running the analysis, even after finding collinearity, we were able to find further support in the results of Model 4 to support the idea that AD and rumination share variance in their prediction of NAR. This hypothesis was not supported. It was found that when analyzed in the same model, none of the main predictor variables (rumination, AD, or AA) remained statistically significant predictors of NAR. This finding suggests that there may be a lot of overlap between the two cognitive processes, AD and rumination, and participants who do one more often, also engage in the other at high rates. Because both of these measures were so similar, and when analyzed in the same model none remained statistically significant, this adds to support for the literature that views anticipatory cognitive processes as maladaptive, similar to rumination (Scott et al., 2019; Zoccola et al., 2010).

Across each of the 4 models of our multiple regressions analysis, the older adults consistently showed greater NAR than the younger adults. This finding was not a primary aim of the study, but is in line with the predictions of the Strength and Vulnerability Integration (SAVI) model (Charles & Luong, 2013). This model explains that older adults will show greater NAR to a stressor when exposed to repeated or chronic stressors (Charles & Luong, 2013). While older adults typically are better with emotion regulation strategies in stressful situations, the negative impacts of the repeated and sustained stress exposure can be costly for their health and well-being. Our findings are consistent with SAVI's predictions given that older adults reported more NAR on average throughout their week-long participation in the study compared to younger adults.

Strengths

One major strength of the proposed study is its strong internal validity due to the use of lab-controlled stressors. Internal validity is the degree of confidence that any relationships tested are not influenced by confounding factors. High internal validity can be achieved by using standardized study procedures across participants, such as having all participants complete the Trier Social Stress Test (TSST) and controlling for the time intervals between lab sessions. Using the same lab-controlled TSST for all participants contributes to the internal validity of the study by ensuring there is no variance in the objective severity or type of stressors that each participant is experiencing throughout their participation week. Controlling for the time intervals between lab sessions increases the internal validity by removing the variable of different recovery times and preparation periods between stressors.

Another strength of the proposed study is the study design. The combination of lab stressors and in-the-moment affect lab questionnaires, along with the ecological momentary assessment (EMA) surveys, incorporates a mix of both controlled lab setting components along with an everyday-life setting to measure how perseverative cognitive processes unfold in daily life. Because this study spans over more than a week, the participants are reporting daily on their cognitive processes in real-time. Even though the stressors themselves are lab-controlled, their anticipatory cognitive processes for upcoming lab sessions and rumination of past lab sessions are assessed with the EMA smart phone surveys, which contributes to the external validity (ecological validity) of the study. The external validity refers to extent to which the results can be generalized to other contexts, such as the real-world applicability of anticipating upcoming stressors and continuing to think about past stressors in everyday life.

Additionally, one major strength of the study was the ability to examine two domains of ACPs: appraisal and deliberation. This distinction of the constructs showed us that the two cognitive processes had different associations with NAR. This aspect of separating the anticipatory processes opens the door for researchers in the future to understand and separate how certain cognitive processes may be differentially related to NAR. Understanding different facets of ACPs can also inform us about which aspects can be modified and may be good targets for intervention in future studies.

Limitations and Future Directions

The current study has limitations that could be addressed in future studies. One limitation is the demographics of our sample. This study used data from the HEADE study, which sampled participants from extreme age groups (younger vs. older adults) and specific racial demographics. In future research of this topic, it would be beneficial to look at the demographic predictor variables of age, race, and gender, but middle aged (36-59 years old) participants should also be included. It would also help to increase the generalizability of the findings by recruiting more Black, Indigenous, and People of Color (BIPoC) participants to reflect better the demographic breakdown of the population of the area in which the study is conducted. More diverse sample representations would give the researchers a better view of how these cognitive processes operate within a wider population than just those included in this study.

Another limitation to the current study is with the relatively small number of questions assessing ACPs and rumination in daily life. The majority of the EMA survey questions were more relevant to the central aims of the parent HEADE study. In future studies focused on anticipatory cognitive processes more specifically, it would be beneficial to have questions that address more facets of ACPs. In this study, we focused primarily on the frequency and appraisal

of the ACPs, but future studies would benefit by also adding questions that would capture the planning and proactive anticipatory coping mechanisms participants are using to prepare themselves for the upcoming stressor. Questions could be included to address the content of the anticipatory thought, the coping strategies used, and how the individuals plan for upcoming stressors. Surveying these other facets of ACPs would allow researchers to measure whether those mechanisms are better predictors or buffers for NAR.

Now that we know more about how ACPs work with lab-controlled stressors, a next step for future researchers could be to look at how ACPs apply to daily life stressors. It would be beneficial for researchers to also consider the extent to which the tendency to ruminate and use ACPs is dispositional but may be modified across contexts. That is, do people who report engaging in anticipatory cognitive processes in studies such as this one with controlled lab stressors, also engage in ACPs with daily life stressors, or are people flexible in their ACP use across contexts? Future researchers would benefit from knowing whether ACPs are situational or dispositional because it would provide more clarity about how and when individuals use ACPs and distinguish further the situations where ACPs may be more adaptive in buffering NAR.

Conclusion

Stressors are unavoidable in most people's everyday lives. The importance of stress and stress reactivity research is integral to learning about mental and physical health and well-being throughout the lifespan. Current literature on the anticipation for, and worry about, upcoming stressors is mixed in its findings of whether there are adaptive ways to react to foreseeable stressors. Some of the current literature suggests that worrying about and perseverating on upcoming stressors is just as maladaptive as rumination, in that it does not allow people to move on from the stressor or escape the experience of the stressor, but rather prolongs the

physiological and emotional experiences of stress. Other research on the topic highlights anticipatory cognitive processes such as worry and anticipatory deliberation as ways to prepare for and adapt to potential upcoming stressors.

This study adds to the literature that by showing ACPs such as anticipatory deliberation are maladaptive, similar to rumination, and exacerbate negative affect reactivity following a stressor. This study also draws attention to the parallels between the cognitive processes of anticipatory deliberation and rumination, which gives insight about why ACPs are not found to be effective in reducing NAR. We found that there were no significant associations between AA and any of the other variables, inferring that regardless of the appraisal of the stressor at more positive or negative, this does not show to impact how we react to the stressor when it does occur. All of these findings contribute to a more nuanced understanding of how ACPs are both similar to, and different from rumination. The separation of AD and AA as two separate facets of ACPs gives insight into understanding how people are thinking about stressful situations and when they might be associated with more affect reactivity. If we had linked both ACPs together we might not have had such a clear finding that AD is very reflective of rumination and that AA was not. This research provides a foundation for further anticipatory cognitive processes research to further identify the potential benefits and downfalls of using different ACPs.

FIGURES AND TABLES

PARTICIPANT SCHEDULE ▼	MON ▼	TUE ▼	WED ▼	THU ▼	FRI ▼	SAT ▼	SUN
Week 1				Study Overview & Informed Consent		EMAs	EMAs
Week 2	Lab Session #1 + EMAs	EMAs	Lab Session #2 + EMAs	EMAs	Lab Session #3 + EMAs	EMAs	
Week 3		Equipment Return & Debrief					

Figure 1

Participation Schedule

Purple= Non-experimental lab visits; Green= Participation days with EMAs only; Red= Participation days with EMAs and Lab Sessions; Navy=No active data collection or study protocols

Table 1

Correlation Matrix Showing p-values for Variables of Interest.

	Gender	Age	Education	Income	Ethnicity	AD	AA	Rumination	Average NAR
Gender	-								
Age	-.02	-							
Education	-.10	.48**	-						
Income	-.16*	.30**	.35**	-					
Ethnicity	.13*	-.27**	-.13	-.08	-				
AD	.09	-.08	-.06	-.05	.17*	-			
AA	.09	.04	.16	-.06	-.07	.04	-		
Rumination	.10	-.04	-.13	-.03	.19*	.87**	.14	-	
Average NAR	.16*	.04	-.18**	-.08	-.01	.20*	-.01	.23**	-

* $p < .05$, two-tailed. ** $p < .01$, two-tailed

Gender: Male = 0; Female = 1

Age Group: Younger Adults = 0; Older Adults = 1

Ethnicity: White = 0; Black, Indigenous, People of Color (BIPoC) = 1

AD = Anticipatory Deliberation

AA = Anticipatory Appraisals

NAR = Negative Affect Reactivity

Table 2

Multiple Regressions Matrix Showing the Standardized Coefficients for Each of the 4 Models

	<u>Model 1: Baseline</u>		<u>Model 2: AD and AA</u>		<u>Model 3: Rumination</u>		<u>Model 4: All 3 IVs</u>	
Main predictor variables	β	<i>SE</i>	β	<i>SE</i>	β	<i>SE</i>	β	<i>SE</i>
Intercept	.388	.248	.217	.268	.168	.255	.193	.268
Gender	.142	.110	.115	.109	.114	.108	.114	.109
Age Group	.243**	.127	.264**	.126	.256**	.124	.258**	.126
Education	-.096	.031	-.095	.031	-.078	.030	-.074	.031
Income	-.037	.006	-.037	.006	-.046	.006	-.047	.006
Ethnicity	.017	.156	.006	.154	-.006	.153	-.007	.155
AD	-	-	.211*	.055	-	-	.032	.106
AA	-	-	-.002	.055	-	-	-.029	.056
Rumination	-	-	-	-	.234**	.063	.212	.126
Adjusted R ²	.065		.095		.112		.099	

Note: All reported coefficients are standardized betas, with the exception of the unstandardized intercepts

** $p < .05$; ** $p < .01$*

Gender: Male = 0; Female = 1

Age Group: Younger Adults = 0; Older Adults = 1

Ethnicity: White = 0; Black, Indigenous, People of Color (BIPoC) = 1

AD = Anticipatory Deliberation

AA = Anticipatory Appraisals

REFERENCES

- Aldao, A., McLaughlin, K., Hatzenbuehler, M., & Sheridan, M. (2014). The relationship between rumination and affective, cognitive, and physiological responses to stress in adolescents. *Journal of Experimental Psychopathology*, 5(3), 272–288.
<https://doi.org/10.5127/jep.039113>
- Allen, A., Kennedy, P., Dockray, S., Cryan, J., Dinan, T., & Clarke, G. (2017). The Trier Social Stress Test: Principles and practice. *Neurobiology of Stress*, 6, 113–126.
<https://doi.org/10.1016/j.ynstr.2016.11.001>
- Aspinwall, L. G., & Taylor, S. E. (1997). A stitch in time: Self-regulation and proactive coping. *Psychological Bulletin*, 121, 417–436. doi:10.1037/0033-2909.121.3.417
- Britton, D., Kavanagh, E., & Polman, R. (2017). The Perceived Stress Reactivity Scale for adolescent athletes. *Personality and Individual Differences*, 116, 301–308.
<https://doi.org/10.1016/j.paid.2017.05.008>
- Brosschot, J. F. (2010). Markers of chronic stress: Prolonged physiological activation and (un)conscious perseverative cognition. *Neuroscience and Biobehavioral Reviews*, 35(1), 46–50. <https://doi.org/10.1016/j.neubiorev.2010.01.004>
- Capobianco, L., Morris, J., & Wells, A. (2018). Worry and rumination: Do they prolong physiological and affective recovery from stress? *Anxiety, Stress, and Coping*, 31, 291–303. <https://doi.org/10.1080/10615806.2018.1438723>
- Carstensen, L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G.,

- Brooks, K., & Nesselroade, J. (2011). Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging, 26*(1), 21–33.
<https://doi.org/10.1037/a0021285>
- Charles, S. T., & Luong, G. (2013). Emotional experience across adulthood: The theoretical model of strength and vulnerability integration. *Current Directions in Psychological Science: a Journal of the American Psychological Society, 22*(6), 443–448.
<https://doi.org/10.1177/0963721413497013>
- Cohen J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. New York, NY: Routledge Academic
- De Raedt, R., & Hooley, J. (2016). The role of expectancy and proactive control in stress regulation: A neurocognitive framework for regulation expectation. *Clinical Psychology Review, 45*, 45–55. <https://doi.org/10.1016/j.cpr.2016.03.005>
- Feldman, G., & Hayes, A. (2005). Preparing for problems: A measure of mental anticipatory processes. *Journal of Research in Personality, 39*(5), 487–516.
<https://doi.org/10.1016/j.jrp.2004.05.005>
- Folkman, S., & Lazarus, R. S. (1985). If it changes it must be a process: Study of emotion and coping during three stages of a college examination. *Journal of Personality and Social Psychology, 48*, 150–170.
- Juth, V., Dickerson, S., Zoccola, P., & Lam, S. (2015). Understanding the utility of emotional approach coping: Evidence from a laboratory stressor and daily life. *Anxiety, Stress, and Coping, 28*(1), 50–70. <https://doi.org/10.1080/10615806.2014.921912>
- Khan, M., Ahmed, F., Yasir, I., Asghar, A. A., Jahangir, M. h., Khan, A., Ali, F., & Tipu, H. H.

- A. (2016). Sources of stress and various coping strategies among MBBS students of a Medical College. *Isra Medical Journal*, 8(2), 83-88.
- Kirkegaard Thomsen, D. (2006). The association between rumination and negative affect: A review. *Cognition and Emotion*, 20(8), 1216–1235.
<https://doi.org/10.1080/02699930500473533>
- Luong, G., Arredondo, C. M., & Wrzus, C. (2018). Age differences in emotion regulation dynamics: Anticipatory, reactivity, and recovery processes. *Frontiers in Developmental Science*, 226-249.
- McIntyre, K., Mogle, J., Scodes, J., Pavlicova, M., Shapiro, P., Gorenstein, E., Tager, F., Monk, C., Almeida, D., & Sloan, R. (2019). Anger-reduction treatment reduces negative affect reactivity to daily stressors. *Journal of Consulting and Clinical Psychology*, 87(2), 141–150. <https://doi.org/10.1037/ccp0000359>
- Nasso, S., Vanderhasselt, M., Demeyer, I., & De Raedt, R. (2019). Autonomic regulation in response to stress: The influence of anticipatory emotion regulation strategies and trait rumination. *Emotion*, 19, 443–454. <https://doi.org/10.1037/emo0000448>
- Neubauer, A., Smyth, J., & Sliwinski, M. (2018). When you see it coming: Stressor anticipation modulates stress effects on negative affect. *Emotion*, 18, 342–354.
<https://doi.org/10.1037/emo0000381>
- Neupert, S., & Bellingtier, J. (2019). Daily stressor forecasts and anticipatory coping: Age differences in dynamic, domain-specific processes. *The Journals of Gerontology: Series B*, 74, 17–28. <https://doi.org/10.1093/geronb/gby043>
- Neupert, S., Neubauer, A., Scott, S., Hyun, J., & Sliwinski, M. (2019). Back to the future:

- Examining age differences in processes before stressor exposure. *The Journals of Gerontology: Series B*, 74, 1–6. <https://doi.org/10.1093/geronb/gby074>
- Neupert, S. D., Ennis, G. E., Ramsey, J. L., & Gall, A. A. (2016). Solving tomorrow's problems today? Daily anticipatory coping and reactivity to daily stressors. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 71, 650–660. doi:10.1093/geronb/gbv003
- Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination *Perspectives on Psychological Science*, 3(5), 400–424. <https://doi.org/10.1111/j.1745-6924.2008.00088.x>
- Parrish, B., Cohen, L., & Laurenceau, J. (2011). Prospective relationship between negative affective reactivity to daily stress and depressive symptoms. *Journal Of Social And Clinical Psychology*, 30(3), 270–296. <https://doi.org/10.1521/jscp.2011.30.3.270>
- Scott, S., Kim, J., Smyth, J., Almeida, D., & Sliwinski, M. (2019). Additive effects of forecasted and reported stressors on negative affect. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 74(1), 29–37. <https://doi.org/10.1093/geronb/gby068>
- Sweeny, K., & Dooley, M. D. (2017). The surprising upsides of worry. *Social and Personality Psychology Compass*, 11(4), e12311–n/a. <https://doi.org/10.1111/spc3.12311>
- Zoccola, P. M., Dickerson, S. S., & Yim, I. S. (2010). Trait and state perseverative cognition and the cortisol awakening response. *Psychoneuroendocrinology*, 36(4), 592–595. <https://doi.org/10.1016/j.psyneuen.2010.10.004>