

The Effects of Relaxation and Gratitude Interventions on Stress Outcomes

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## Abstract

Research suggests that positive emotions play an important role in mental and physical health outcomes including combating the effects of stress. Research has also shown that positive emotions decrease autonomic nervous system reactivity and *build* personal resources, initiating an “upward spiral” of well-being (Frederickson, 2003). Two methods discussed in the literature to increase positive emotions are relaxation (e.g., progressive muscle relaxation; PMR) and gratitude interventions. Both are associated with positive physical and mental health outcomes including increased positive outcomes (e.g., quality of life, relaxation, sense of control, happiness) and decreased negative outcomes (e.g., depression, anxiety, health complaints). However, research on both PMR and gratitude interventions is limited in certain respects. Research on PMR focuses primarily on negative physical and mental health outcomes, whereas gratitude research relies heavily on correlational data.

The purpose of this study was to investigate the effects of relaxation and gratitude interventions on physical and mental health outcomes, including reactions to stress. Using a controlled three group experimental, prospective design, 247 college students were randomly assigned to one of three groups (PMR, gratitude, control) for one week. At the end of the intervention, subjects participated in a stress-inducing activity. Baseline, pre-stress induction, post-stress induction and one-month follow up assessments were obtained. Both positive (i.e., life satisfaction, serenity, relaxation, positive affect, perceived control), negative (i.e., depression, anxiety, stress) and health indicators (i.e., physical symptoms) were measured. Results indicated that PMR is an

effective intervention: At post-intervention, those in the PMR condition reported significantly more perceived control and serenity than both the gratitude and control groups. Those in the PMR group also had significantly lower negative affect than the control group. Group differences in stress and physical health symptom ratings, although marginally significant, revealed results again in favor of PMR. At follow up (30 days later) the PMR group maintained significantly lowered negative affect than the control group. There were no effects of the gratitude intervention on any outcomes nor were there group differences in stress reactivity. The role of positive psychology interventions in buffering stress and improving mental health functioning is discussed.

*Keywords: Progressive muscle relaxation, gratitude, stress reactivity*

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## OVERVIEW OF THE DISSERTATION AND LITERATURE REVIEW

### Introduction

Stress, a normal and inevitable part of the human experience, can be provoked by an event or internal experience affecting both mind and body. Although people generally recover from stressful experiences over time on their own, psychological problems such as depression, anxiety, mood disorders, and other mental health problems frequently develop as a result (Bryant, 2010). Mental health problems are an important public health concern for all age groups, but especially for college-aged students. The majority of mental disorders first emerge between the ages of 15-24 (Kessler et al., 2005). Mental health issues can have a profound impact on students' ability to engage fully in their college experience, affecting their physical and emotional well-being, leading to poor academic performance, interpersonal relationships and lower graduation rates (College Student Health Survey Report, 2010). Mental health problems in young adulthood also are associated with substance use, and poorer academic, employment and other social outcomes later in life (Eisenberg, Golberstein, & Gollust, 2007).

Recent studies document an increase in symptom severity among those seeking care at college counseling centers (see Kitzrow, 2009, for a review). For example, in the National Survey of Counseling Center Directors (2009), 93% reported a recent upward trend in the number of students with severe psychological problems. For example, Kitzrow's review reported that the number of students seen with depression had doubled over the last 20 years, whereas the number of suicidal students had tripled. Additionally, an analysis of changes over time in reported symptoms among students seen in counseling centers revealed an increase in most categories of problems, including both

typical developmental concerns (e.g., difficulties in relationships) and more severe problems (e.g., suicidal ideation) (Benton, Robertson, Tseng, Newton & Benton, 2003). In general, students appear to be coming to college feeling more overwhelmed. This increase in the incidence and severity of mental health problems among college students is placing significant demands on university counseling centers (Kitzrow, 2009).

Despite the documented need for care, college students' mental health needs are often unmet. In a recent study at a large Midwestern university, of the over 2,700 students surveyed, 30% reported needing help with their emotional and mental health, but only 15% received any sort of services (Eisenberg et al., 2007). Of those that screened positive for depression, less than half (45%) sought care. Common barriers to care included lack of time (32%), feeling no one would understand their problems (20%), worry about what others would think (20%), and believing stress was normal while in school (51%). Despite being in an environment with access to free care, most students with mental health problems did not receive treatment (Eisenberg et al., 2007), highlighting a critical gap between those who need services and those who receive them.

Mental health, however, is not merely the absence of disorders. Rather, being mentally *healthy* refers to successful functioning, having fulfilling relationships, and having the ability to adapt and cope with adversity (DHHS, 1999). Although we know a great deal about how people survive adversity, and how mental health problems are treated, far less is known about the prevention of these problems or about how people remain healthy in spite of stress (Gable & Haidt, 2005; Seligman & Csikszentmihalyi, 2000). The gap between mental health and illness raises important questions: What contributes to a person's ability to maintain his or her mental health? And what

contributes to more negative outcomes (i.e., psychopathology) following stressful experiences? Factors that contribute to psychopathology may be very different than those that contribute to successful functioning. A relatively new field, positive psychology, emerged in the 1990's out of the recognition of this disparity. Positive psychology seeks to go beyond addressing *problems*, and instead focuses on the variables related to living a full and satisfied life (Seligman, Parks & Steen, 2004).

Positive psychology advocates the use of brief and simple strategies individuals can use on their own to enhance well-being and decrease mental health symptoms. These preventive strategies are a way of addressing mental health concerns for those who do not access care. Within this risk-reduction focus, the goal of prevention strategies is to reduce the incidence of disorders and psychological distress while increasing functioning (Albee & Ryan-Finn, 1993). Although most mental health approaches are based on after-the-fact treatments, a preventative approach aims to enhance well-being and eliminate problems before they occur (Hage et al., 2007). Preventive interventions have been shown to limit the chronicity and severity of symptoms, as well as improve functioning. Expanding preventative efforts can reduce the cost associated with mental health care and is essential to furthering the health and well-being of the U.S. population at large (Hage et al., 2007).

Interventions that cultivate positive emotions may be one way to treat and prevent mental health problems such as anxiety, depression, and stress-related health symptoms (Fredrickson, 2000). Ten years of research has documented the benefits of positive emotion. (Please see Appendix A for more information on theories and research on positive emotions). Results of a recent meta-analysis of studies of positive psychology interventions conducted in nonclinical samples found that positive psychology

interventions were more effective than comparison conditions in increasing well-being ( $r=.29$ ) and decreasing depressive symptoms (mean  $r=.31$ ) (Sin & Lyubomirsky, 2009).

Relaxation and gratitude interventions are two approaches that increase positive emotions, enhance well-being and have been associated with positive mental and physical health outcomes. Research on the efficacy of these two interventions is reviewed below.

Within the section on relaxation, I will focus particularly on Progressive Muscle Relaxation.

### *Relaxation Therapies*

Relaxation is theorized to be one of the most important skills to learn and implement in daily life (Sultanoff & Zalaquett, 2000) and is used widely by people to cope with stress-related problems, including decreasing tension and anxiety.

Additionally, because many people have negative attitudes toward medications and psychotherapy, relaxation may be a more acceptable and less stigmatizing psychological intervention (Jorm, Morgan & Hetrick, 2008). The benefits of relaxation have been documented over the last 30 years, with research demonstrating consistent and significant efficacy for relaxation interventions (Manzoni, Pagnini, Castelnovo & Molinari, 2008).

Reviews and meta-analytic findings suggest that relaxation training provides mental health benefits in general (Manzoni et al., 2008) and for college students in particular (Gruezelier, 2002). Relaxation has been found to be effective in reducing symptoms in a variety of populations including those with anxiety, panic disorder, generalized anxiety symptoms, test anxiety, social phobia, anger, hostility, aggression, headaches, insomnia, substance abuse, smoking, hypertension, heart disease, fibromyalgia, irritable bowel syndrome, asthma, diabetes, cancer, HIV and Alzheimer's

disease (Sultanoff & Zalaquett, 2000). In research comparing pharmacotherapy and relaxation therapy for anxiety, relaxation interventions were found to have better long-term effects than medication treatments (see Sultanoff & Zalaquett, 2000, for a review). In addition to decreasing physical and mental health symptoms, experimental research has demonstrated that daily relaxation practice can increase positive emotions and a sense of life purpose (Fredrickson, Cohn, Coffey, Pek & Finkel, 2008).

According to the Benson-Henry Institute for Mind Body Medicine (2009), the best techniques are ones that are simple to teach and to learn. Although many types of relaxation techniques have been studied, progressive muscle relaxation (PMR) is one of the most frequently investigated and has been used for stress management since the early 1920's. PMR involves systematically tensing muscle groups for several seconds before releasing the tension and proceeding through the entire body, guiding all muscles into a more relaxed state.

*Progressive Muscle Relaxation.* The benefits of relaxation strategies, such as PMR, for improving well-being have been documented in various clinical and non-clinical populations, including college students. A sample of college students who practiced PMR once a week for five weeks scored significantly higher on measures of physical relaxation, mental quiet and joy compared to controls who participated in a deep breathing exercise (Matsumoto & Smith, 2001). In another study of healthy adults, PMR was effective at evoking physical relaxation, joy and mental quiet, with effect sizes (Cohen's *d*) ranging from 0.67-1.1 when compared to a yoga stretching comparison group (Ghoncheh & Smith, 2004). Regular PMR has also been found to increase quality of life in patients suffering from chronic health problems (Cheung, Molassiotis & Chang,

2003; Ghafari, Ahmadi, Nabavi, Anoshirvan et al., 2009; Hui, Wan, Chan, Yung, 2006; Sloman, 2002). Other studies of patients with health problems found that PMR led to increased internal locus of control (Pender, 1985; Baider, Uziely and Kaplan De-Nour, 1994). Having an internal locus of control, defined as the extent to which individuals believe that they can control over events in their lives, has been found to be related to numerous positive outcomes (DeNeve & Cooper, 1998). The effects of PMR on control have yet to be replicated in non-clinical samples.

Research has shown that PMR reduces symptoms such as depression, anxiety and negative affect in in students, as well as other clinical and nonclinical populations (Burish & Tope, 1992; Carlson & Hoyle, 1993; Jorm et al., 2008; Khasky & Smith, 1999). A meta-analysis suggested that relaxation was more effective at reducing depressive symptoms than no or minimal treatment and suggested that, in cases of moderate to severe depression, relaxation interventions should be considered as an adjunct to antidepressants or structured brief psychological treatments (Jorm et al., 2008). In another meta-analysis of 19 studies comparing various forms of relaxation to control groups, the overall between-group effect size (Cohen's  $d$ ) was .51 for the reduction of anxiety; the effect size for PMR was  $d = .55$  (Manzoni et al., 2008). Of 25 studies assessing pre-post treatment differences in anxiety following relaxation therapies, the overall within-group effect size was .57 ( $d$ ); PMR showed greater within-group efficacy in decreasing anxiety ( $d=.82$ ) than the other relaxation techniques (Manzoni et al., 2008). Taken together, these results highlight the potential for relaxation techniques to be used as a first-line treatment, and researchers have urged further investigation into this possibility (Jorm et al., 2008).

The literature has also documented the benefits of PMR on general health outcomes. A quantitative review evaluating pre-post treatment effect sizes of PMR in a variety of populations with a range of physical and stress related disorders demonstrated moderate effect sizes in terms of reducing symptoms (e.g., blood pressure, headache) associated with those disorders ( $r = .40$ ; see Carlson & Hoyle, 1993, for a review). PMR has been shown to be effective for health promotion, including improving insomnia, reducing blood pressure, gastrointestinal and pulmonary problems, and the unpleasant side effects of cancer treatment (Gift et al., 1992; Sheu, Irvin, Lin & Mar, 2003).

Other studies have examined the effects of PMR on stress reactivity. Stress refers to an individual's perception of environmental demands that tax or exceed his or her adaptive capacity (Cohen, Janicki-Deverts & Miller, 2007). Although the research is limited in this regard, in a longitudinal study comparing the effects of PMR to meditation and cognitive-behavioral therapy, college aged participants in the PMR and meditation conditions reported better overall mental health and less anxiety following a lab stressor, although the meditation condition out performed the PMR condition in terms of physical health outcomes (Gaylord, Orme-Johnson, & Travis, 1989). More recently, college students who participated in 20 minutes of relaxation (PMR or meditation), experienced a brief stressor, and had another 10 minute relaxation period, reported a greater recovery than the control group. Those who practiced PMR had a greater decline in somatic anxiety than the other two comparison groups, demonstrating that relaxation assists in recovering from stress (Rausch, Gramling & Auerbach, 2006).

Relaxation techniques other than PMR also have been found to be effective in *buffering* the effects of stress. For example, in a study of university students, participants

were randomly assigned to one of two different relaxation conditions or a control group (Laidlaw et al., 2003). Self-reported affect, perceived stress, and anxiety data were gathered pre and post relaxation training and again two months later. Midterm and final exam times were recorded to measure the effect of these interventions on exam-related stress. Those in the relaxation group experienced a greater decrease in negative affect than the control group after one month (post-test), whereas the control group reported increased anxiety, tension, and depression. All participants reported an increase in distress around exam times regardless of condition. During exam time, however, the control group reported more distress, more negative affect, depression, confusion, and less vigor than the relaxation groups. Those who practiced relaxation reported more positive affect and coped better with the effects of exam stress than did the control group. For a full literature review on the benefits of PMR please see Appendix B.

### *Gratitude*

Although historically discussed at length in theology, religion, and philosophy, gratitude has only recently begun to be discussed within the field of psychology (Emmons & McCullough, 2004) and a growing literature is documenting its benefits for mental and physical health. Gratitude has been shown to be related to mental and physical well-being, including positive affect, feelings of success, life satisfaction, less stress, reduction in depressive symptoms, as well as increases in physical exercise and sleep quality (see Wood, Froh & Geraghty for a review, 2010). In addition, gratitude may even protect individuals from developing mental health problems at all (McCullough et al., 2002).

*Gratitude interventions.* Simple interventions have been implemented to enhance gratitude. These interventions typically ask people to reflect on the more positive aspects of their lives, including what they are grateful for. To date, there have been a total of 12 experimental studies investigating the use of gratitude as a clinical intervention. Of these, 10 have been in adult populations, two have been in children/adolescents, and four have been with college samples. Although the number of experimental studies is limited, evidence has demonstrated positive effects of gratitude interventions on positive affect, happiness, global ratings of well-being, life satisfaction, connection with others, prosocial behavior, as well as satisfaction with school, family and friends (see Wood, Froh & Geraghty for a review, 2010).

There have been a total of seven experimental studies that have investigated the effects of gratitude on positive outcome variables. For example, Emmons and McCullough (2003) conducted a series of three experiments in one paper in which participants (either college students or adults with neuromuscular disease) were asked to write about 5 things for which they were grateful. Intervention time varied from weekly gratitude lists for 10 weeks to daily lists for 13 weeks. Comparison groups varied as well, including participants who wrote about daily hassles, events that had an impact, and no treatment. Results from these three studies indicated that participating in a gratitude intervention increased positive affect ( $d = .19-.56$ ) and life satisfaction ( $d = .30-.92$ ) relative to comparison groups.

Watkins and colleagues (2003) also found that their gratitude interventions increased positive affect ( $\eta^2 = .12$ ) relative to the control group after only a one-time brief intervention. Students were asked to participate in one of 4 different gratitude

interventions which were done once: list things over the summer they felt grateful for, write about someone they were grateful for, think about someone they were grateful for, or write a gratitude letter. The gratitude intervention groups were compared to students who either listed things they wanted to do over the summer but didn't or those who wrote about the layout of their living room. Comparisons were not made between the gratitude interventions, however. Only one other study investigated the effect of gratitude on positive affect (Sheldon & Lyobormirsky 2006) and although their results were not significant, college students still reported an increase in positive affect after 4 weeks compared to the control group ( $d = .16$ ). It is important to note, however, that researchers were unable to track the number of times participants engaged in the gratitude exercise when they were outside of the lab.

Gratitude interventions also lead to increases in happiness (Seligman et al., 2005) and well-being (Lyobomirsky et al., 2004). In Seligman et al.'s (2005) week-long online study in a large community sample, gratitude interventions included either keeping a list of three good things that happened daily or writing a gratitude letter. These interventions were compared to other positive psychology interventions as well as a more neutral control group that wrote about their early memories. At the one month and three month follow up, both gratitude conditions reported increases in happiness ( $\lambda = .21-.50$ ), but by six months, only the 'three good things' group maintained this gain. No effect sizes were reported for Lyobomirsky et al. (2004) study that asked students to think about things they were grateful for once a week for six weeks (compared to a no-treatment control), however, significant increases in well-being were reported for those in the gratitude group.

In addition to the effects of gratitude interventions on positive outcomes, they have also been found to reduce negative outcomes such as negative affect, depressive symptoms, worry, and body dissatisfaction (see Wood et al., 2010). Six of the 12 gratitude intervention experiments investigate these effects. For example, gratitude interventions have been shown to decrease depressive symptoms, and this effect ( $\lambda=.28-.32$ ) has been documented over a six month follow up period (Seligman et al., 2005). Both the Emmons and McCullough (2003) and Watkins et al. (2003) studies demonstrated that gratitude interventions significantly decreased negative affect ratings. Effect sizes ranged from  $d=.10$  to  $d=.51$  in the three part study by Emmons and McCullough, with an eta-squared of .06 in Watkins et al. (2003). Similar to their results for positive affect, Sheldon and Lyobomirsky (2006) found a non-significant decrease in negative affect. Finally, Gerahty and colleagues (2010a & 2010b) reported greater decreases in worry ( $d=1.5-1.1$ ) and body dissatisfaction ( $d=.11-.96$ ) among participants who kept a gratitude diary daily for two weeks in which they listed up to six things they were grateful for in comparison to a brief cognitive behavioral intervention and a wait list control group.

Although 4 of the 12 intervention studies have included some cursory health symptom measures, less is known about the effects of gratitude on physical health. For example, adults with neuromuscular disease who kept a gratitude list once a week for three weeks reported significantly less pain than a no intervention control group ( $d=.23$ ; Emmons & McCullough, 2003). After a ten week intervention in which college students wrote about five things they were grateful for weekly, participants reported more time exercising ( $d=.34$ ) and fewer physical symptoms ( $d=.31$ ) compared to groups who wrote

about either weekly hassles or neutral events (Emmons & McCullough, 2003). This same 3-part study found that gratitude was associated with improvements in hours of sleep ( $d=.59$ ) and refreshment upon waking ( $d=.43$ ) relative to the no-treatment control group.

Although not an intervention study, Wood et al.'s (2008) longitudinal study using structural equation modeling (SEM) found that gratitude led to well-being in first year undergraduate students undergoing the transition to college, suggesting that gratitude fostered resilience (e.g., less stress, less depression, higher social support) in this period of life transition.\*\*

*Cross sectional studies.* The extant gratitude intervention research is small, yet promising. Where it is lacking, however, we can look to the larger body of correlational research. Correlational research suggests that gratitude is associated with positive mental health outcomes. For example gratitude has been associated with positive self-esteem, subjective well-being, purpose in life, autonomy, self-acceptance, intrinsic motivation, prosocial behavior, social support and positive relationships (Wood et al., 2010).

Gratitude is associated with positive affect (average  $r = .52$ ) and is more strongly related

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\*\* *Footnote: The original proposal discussed the role of resilience in more detail than covered in this manuscript. Originally, it was proposed that trait resilience, as well as neuroticism, might function as moderator variables that affect the effectiveness of the gratitude and PMR interventions. A solid body of evidence suggests that neuroticism is associated with many mental and physical health outcomes, has been found to moderate the relationship between a negative event and subsequent negative emotion (Larsen & Ketelaar, 1991). Similarly, research has found that resilient individuals continue to experience positive emotions while under stress, and that this may explain their ability to recover successfully (Tugade et al., 2004). Despite resilience being theorized to be a "personal resource" that helps people cope with stress, it has yet to be investigated as moderating the relationship between gratitude or PMR interventions and mental health outcomes. Because neuroticism and resilience did not moderate the effects of PMR or gratitude interventions, discussion of these variables has been removed from this manuscript. For a full literature review on these variables please see Appendix D.*

to positive affect than to negative affect (Watkins et al., 2003). Despite the varying samples and methods, correlational findings consistently find that college students who reported higher mean levels of daily gratitude appeared to be more satisfied with their lives ( $r = .30$ -.62), happier ( $r = .27$ -.30), and more prone to positive emotionality (higher positive affect;  $r = .27$ -.38; McCullough et al., 2004; Watkins et al., 2003). Having an internal locus of control has also been found to be related to gratitude (Watkins et al., 2003). Previous research has demonstrated that having a sense of control is associated with less anxiety and depression, and increased well-being and life satisfaction (Skinner, 1996). Therefore, gratitude may have important clinical implications for positive mental health outcomes.

Correlational research has consistently found gratitude and thankfulness to be negatively associated with depression in non-clinical samples. In their correlational study of college students, depression was negatively correlated with both self ( $r = -.30$ ) and informant-report ( $r = -.26$ ) measures of gratitude (McCullough et al., 2002). Being “thankful” has been shown to be related to less risk for depression, as well as anxiety and substance abuse in a large epidemiological study of over 2500 twin pairs (Kendler, Liu, Gardiner, McCullough, Larson & Prescott, 2003). In this study, disorders such as major depression, generalized anxiety, phobia, panic, nicotine dependence, alcohol and drug dependence, antisocial behavior and bulimia nervosa were assessed during a personal interview. A thankfulness scale was created from a factor analysis of gratitude and religious coping items. Thankfulness, in fact, was associated with a decreased risk for all disorders, with the exception of panic and adult antisocial behavior (Kendler et al., 2003). Gratitude has been found to be associated with fewer depressive symptoms in more

clinical samples as well. For example, neuromuscular disease patients who reported lower mean levels of gratitude at baseline also reported more depressive symptoms at baseline ( $r = -.22$ ; Emmons & McCullough, 2003). These results illuminate the potential protection gratitude may offer against pathological conditions and psychiatric disorders (Bono & McCullough, 2006).

In addition to psychological health benefits, correlational evidence suggests that gratitude is also related to better physical health (Wood, et al., 2010). For example, in their investigation of the relationship between gratitude and sleep, Wood, Joseph, Lloyd, and Atkins (2009) found that gratitude was related to sleep quality, duration, and sleep latency. Research, however, on gratitude and physical health is limited and more is needed to clarify this relationship (Wood et al., 2010). For a full literature review on the effects of gratitude, please see Appendix C.

### *Online Interventions*

Internet-based psychological interventions are both increasingly popular as well as an effective means of implementing interventions on a large scale (Barak, Hen, Boniel-Nissim & Shapira, 2008). Because participants can complete the intervention from a location of their choice they are convenient and provide greater access (see Copeland & Martin, 2004 for a review). With rapidly growing access to the internet, especially within student populations, web-based interventions may be especially useful for mental health purposes. In a study comparing data collected online versus traditional in-person methods, Gosling, Vazier, Srivastava and John (2004) found that participants in

web-based studies were no more likely to be suffering from psychopathology, and no less likely to take the study seriously or provide accurate information.

Web-based interventions have been shown to be effective for psychiatric disorders such as depression and anxiety, increasing quality of life, as well as improving health issues and behaviors, showing moderate to large effect sizes compared to wait list controls or placebos (Moore, Fazzino, Garnet, Cutter & Barry, 2011; van Straten, Cuijpers & Smits, 2008). In fact, van Straten et al. (2008) found that, after only four weeks, adult participants experienced benefits virtually identical to those found in meta-analyses of similar face to face treatments, implying that web-based interventions are a worthwhile alternative to other more conventional psychotherapeutic approaches.

Although there are many studies assessing the effectiveness of online cognitive behavioral interventions (see Barak et al., 2008), to date, very few studies have assessed the effectiveness of online relaxation interventions. In one study, college students experiencing academic worry were randomly assigned to one of four conditions, one of which involved relaxation (Wolitzky-Taylor & Telch, 2010). At the end of the intervention period, those in the relaxation condition showed greater reduction in academic worry than those in the wait-list condition. The effectiveness of relaxation was similar to that of a worry exposure intervention. Another study compared the effects of relaxation administered via computer (versus by a therapist) in a student population and found that there was no difference in benefits as a function of method of administration (Carlbring, Bjornstjerna, Bergstrom, Waara & Andersson (2007). Both groups reported being more relaxed (as measured by galvanic skin response and a self-report measure of

relaxation) than the control group who surfed the internet. To my knowledge, no studies have assessed an online PMR intervention.

Similarly, few ( $n=3$ ) studies have assessed online gratitude interventions. Seligman et al. (2005) used online methods to recruit participants, deliver the intervention, and collect all data. Geraghty, Wood and Hyland (2010a; 2010b) have conducted gratitude intervention studies online using community samples to investigate effects on worry and body dissatisfaction. Because all three studies reported favorable outcomes, they concluded that online gratitude interventions produce significant positive outcomes, often superior to other online comparison groups. I am aware of no studies that have assessed online gratitude interventions in college student samples.

#### *Limitations of Current Research*

Despite experimental and correlational research demonstrating the positive mental and physical health outcomes associated with gratitude, PMR, and relaxation in general, the extant literature is still limited in several ways. First, the existing psychological literature has been criticized for its overreliance on the reduction of symptoms and the failure to assess more positive outcomes in conjunction with symptoms (Gable & Haidt, 2005; Wood & Tarrier, 2010). Although research on gratitude has grown out of the field of positive psychology, and has typically assessed positive outcomes, the research on PMR is limited in this respect. Most of the studies on PMR, and on relaxation in general, are focused on the reduction of negative outcomes (e.g., physical and psychological symptoms). Few studies have investigated how PMR may be used to enhance positive mental health outcomes (e.g., life satisfaction, perceived control). In fact, most studies on PMR have been primarily focused on clinical populations who are dealing with

significant physical health issues (e.g., cancer, surgery). Only a handful of studies have investigated the positive outcomes associated with PMR such as quality of life, locus of control, joy, relaxation, and mental quiet. However, research on PMR and quality of life is limited to participants with chronic health problems and studies documenting the benefits on relaxation, joy and mental quiet are limited by small sample sizes.

A second limitation is the lack of research on how gratitude and PMR affect stress outcomes. Although Emmons and McCullough (2003) investigated how gratitude benefited those with chronic illness, gratitude has not been investigated in the context of coping with a discrete stressful event. To date there have been no experimental studies investigating the possible stress-buffering effects of gratitude interventions and only two studies (Gaylord et al., 1989; Rausch et al., 2006) that have investigated the effects of PMR on stress induced in the laboratory. Although the stress buffering effects of other relaxation techniques have been investigated (e.g., self-hypnosis and meditation; Laidlaw et al., 2003) further research is necessary to replicate these results with PMR. Furthermore, little is understood about the impact of these interventions on building an individual's personal resources to draw on in challenging times. Teaching individuals to cultivate gratitude or relaxation on a daily basis may provide important benefits for those undergoing stressful experiences.

In addition, research investigating the effectiveness of these interventions has not assessed perceived control as an outcome. It is hypothesized that strategies such as PMR or gratitude, approaches that may help individuals regulate emotional and physiological responses to stress, would also enhance participants' perceived control. Although two older PMR studies measured control (Baider, 1994; Pender 1985), their definitions of the

construct were not consistent (i.e., control over health versus internal locus of control), and both studies recruited participants suffering from serious disease. The relationship between gratitude and perceived control has not been researched.

Additionally, although PMR studies tend to focus primarily on physical health symptoms, gratitude studies focus mostly on psychological outcomes (see Emmons & McCullough, 2003, for an exception). Assessing the effectiveness of gratitude interventions on a wider array of physical health symptoms would contribute to a better understanding of the potential benefits of this intervention.

Another major limitation of this research, and gratitude research in particular, is its dependence on correlational data. A total of 12 gratitude interventions have been conducted; however, they have varied in methodology, population and outcomes. More research is necessary to test if gratitude interventions can buffer the effects of stress and improve mental and physical health (Wood et al., 2010).

Finally, although PMR and gratitude have been theorized to behave similarly - to increase well-being and undo the negative physiological arousal associated with the stress response – the two different approaches have never been investigated in the same study. Do both produce similar outcomes? The literature offers us no data that would answer this question, although one study suggested that relaxation and gratitude may share a reciprocal relationship (i.e., relaxation techniques may produce feelings of thankfulness as a byproduct; Bono & McCullough et al., 2006). Comparing the PMR and gratitude literatures leaves one with an unclear picture of how these interventions might compare. One meta-analysis found a medium effect size of PMR on anxiety (relative to control groups;  $d = .55$ ) overall, with the largest effect for volunteer and student samples ( $d = .73$ ;

Manzoni et al., 2008). Although no studies have tested the effect of gratitude on anxiety within student populations, a gratitude intervention has been shown to have a significant effect on worry ( $d = .11$ ) within a community sample (Geraghty et al., 2010).

Studies of gratitude interventions in college samples have found effect sizes (Cohen's  $d$ ) to range from .19 (positive & negative affect) to .36 (life satisfaction) when compared to control groups (Emmons & McCullough, 2003) and other experimental research has yielded medium effect sizes of gratitude interventions on variables such as depression, affect and life satisfaction (see Wood et al., 2010). Yet a recent review of gratitude research cautions against interpreting the experimental evidence because of the lack of clearly defined and comparable control groups (Wood et al., 2010). The effect sizes from existing intervention studies suggest that PMR may be somewhat more effective than gratitude; however because of the many methodological and study differences, it is difficult to make this claim. More research is necessary comparing these two interventions.

### *Study Purpose*

The purpose of this study was to investigate the effects of relaxation and gratitude interventions on positive and negative mental health variables, physical health, and reactions to stress. Individuals were randomly assigned to one of these two interventions or to a control group. This study contributed to the existing literature in several ways. First, I measured a wider range of positive variables (e.g., life satisfaction), and went beyond evaluating intervention effectiveness as merely a reduction in symptoms. Assessing both physical and mental health outcomes in the same study addressed several

weaknesses in both literatures, and provided a broader understanding of the applicability and effectiveness of these approaches. Studying a non-clinical, healthier, college student population also augmented the extant literature on PMR.

Second, the study answered the call of previous researchers for more studies that examine the repeated experience of positive emotions (Fredrickson et al., 2008) and contributed to the stress reactivity literature given the limited understanding of how positive emotions, or interventions that induce positive states, influence reactions to stress.

Additionally, the study's experimental, prospective and web-based design allowed for an empirical test of the causal role of gratitude and PMR on stress outcomes and permitted testing of between-group differences (e.g., PMR vs. gratitude vs. control) and within-group differences (pre/post test). The data generated from prospective studies are considered stronger than data from retrospective studies because baseline assessments take place before the event (e.g., stress) has occurred. Because the stressor participants were exposed to was experimentally controlled, the study provided a unique perspective on any preventative effects of the interventions on stress reactivity. This study also was unique in that participants were recruited, assessed and participated in the interventions solely via the internet without any face-to-face contact.

Finally, perhaps one of the most important contributions of this study is that it investigated these two conceptually different interventions, which are both related to positive emotions, within the same study. This has the potential to illuminate important similarities and differences between these approaches.

It was predicted that individuals in both treatment conditions would have better mental health (increases in positive affect, life satisfaction, serenity, perceived control; decreases in negative affect, distress, daily hassles) and better health (self-reported physical symptoms) outcomes compared to those in the control condition both post-intervention (Day 7), following the stress task (please see description in method) and at the one-month follow up (Day 37). In addition, those in the PMR condition were predicted to report fewer physical symptoms than those in the gratitude condition.

## **Method**

### *Study Design*

This study used a 3 group experimental design to assess the impact of gratitude and relaxation interventions on physical and mental health and stress reactivity. Participants practiced the strategies independently, on their own time, online via an internet link. Assessments took place (1) pre-intervention (baseline), (2) pre stress induction (Day 7), (4) post stress induction, and (5) at one month follow up (Day 37). See Figure 1 for an outline of the measurement timeline and strategy. All assessments were conducted online using a confidential and secure computer program.

### *Participants and Procedure*

The sample consisted of 271 undergraduate students attending a large Midwestern university who were enrolled in undergraduate psychology courses. Participants were eligible to receive extra credit in their course for participation in this study and were recruited through their courses and an online bulletin board. The study was approved by the University's institutional review board.

Students who volunteered to participate were emailed secure login information and a link to the study's website where they completed baseline assessments. Next participants were randomly assigned to one of the three conditions (i.e., relaxation, gratitude or control) using an automated computer algorithm. Students completed online surveys during the Spring 2010 semester. An *a priori* power analysis determined the minimum sample size to be at least 159 participants ( $\alpha = 0.05$ ,  $f^2 = 0.25$ , and minimum power level = 0.80), with approximately 53 participants in each condition. Inclusion criterion was participation in a psychology course; there were no exclusion criteria.

The computer program randomly assigned the 271 participants to one of the three experimental groups. The randomization procedure resulted in 84 individuals in the relaxation condition, 99 in the gratitude condition, and 88 in the control group. It is unclear why, although randomized, the computer program created unequal sample sizes. Of the 271 participants who completed the Day 1 survey, 86% completed at least 5 days of the 7 day interventions (N=247). Individuals (n = 24) who did not complete at least 5 days of the intervention were excluded from the final sample in order to be able to measure the true effects of the interventions. \*\* Five days was chosen as a cut off because the majority of the research on both interventions has taken place over the course of a week (or more) and those that only partially completed the intervention protocols may have skewed the results. Using the 86% compliance criteria, there were 11 (13%) non-completers in the relaxation group, five (5%) in the gratitude group, and eight (10%) in the control group. Thus, the sample sizes for the final compliant sample were as follows:

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\*\* *Footnote: Intent to treat analyses was completed using the full sample. Results did not differ.*

73 compliant individuals in the relaxation condition, 94 in the gratitude condition, and 80 in the control group. 206 of the 247 (83%) who completed 5 of 7 days of the intervention also completed a 30-day follow up (Day 37). Of those, 58 were in the PMR group, 81 were in the gratitude group and 67 were in the control condition. Thus, 30 day follow-up response rates for each condition were as follows: 79% in the PMR group, 86% in the gratitude group and 84% in the control group.

Most of the participants on Day 1 were female (70%), between the ages of 18-21 (85%) and identified as European American (75%). The demographic characteristics of the completer sample were virtually identical: 70% female, 85% between 18-21, and 77% European American. The analyses reported here are based on the compliant sample of 247 individuals who participated in at least 5 days of the interventions. This sample size exceeded the intended sample size of at least 159. Table 1 provides demographic information about the compliant sample as well as tests of differences between groups. There were no significant differences between the PMR, Gratitude and Control groups on any of these demographic variables.

*Pre-Intervention/Baseline Assessment (1).* Participants were recruited through introductory psychology courses and an online bulletin board. They were told that the study was about emotions and people's emotional reactions to stress. Students who volunteered were emailed secure login information and a link to the study's website where they completed baseline assessments. They were then randomly assigned to condition (relaxation, gratitude or control) and the computer program provided intervention instructions at Time 1.

*Daily assessments.* Participants were sent daily reminder emails and logged in daily for one week to either listen to a PMR relaxation audio recording, write 5 things they are grateful for, or complete the control instructions.

*Post Intervention Assessment (2).* Following the completion of the one-week (7 days) intervention, participants filled out post outcome measures online including affect, distress, life satisfaction, perceived control, physical symptoms, serenity, gratitude, and relaxation.

*Stress Induction.* The stress induction consisted of an acute, time-limited stressor in which participants attempted to complete a challenging mental task (i.e., Stroop color-naming task) under time pressure. This methodology was used because meta-analytical results suggest that acute cognitive stressors elicit a similar stress response as other types of social, emotional, and experiential stressors, including speech preparation tasks (Dickerson & Kemeny, 2004; Segerstrom & Miller, 2004). A recent meta-analysis on the effects of various stress induction procedures also found that the same fight-or-flight response activated in response to life-threatening situations can be activated in response to far more mundane events (Denson et al., 2009).

*Follow up.* One month after the conclusion of the treatment portion of the study, participants were emailed a series of self-report instruments to measure longer term effects of the interventions. Participants completed measures of distress, affect, physical symptoms, perceived control, life satisfaction, serenity, gratitude and relaxation. In addition participants were asked about the extent to which they continued either the gratitude or PMR relaxation exercises on their own.

*Intervention Procedure*

*Relaxation Condition.* To induce relaxation, an audio recording of a standard PMR script was used (Reilly & Shopshire, 2002). The relaxation audio included instruction in controlled breathing and progressive muscle relaxation. After logging into the study site, participants clicked on a link that provided instructions leading them through a relaxation exercise. This audio was approximately eight minutes in length. The instructions provided were as follows:

Beginning today, you will be asked to participate in a brief relaxation exercise once a day for 7 days that involves tensing specific muscle groups and then relaxing them. First, find a quiet location to listen to this where you won't be distracted. Don't permit the phone to ring while you're practicing. Use a fan or something similar to blot out background noise, if necessary.

*Try to practice at a regular time each day.* On awakening, before retiring, or before a meal is generally the best time. A consistent daily routine will increase the positive effects. Try not to practice immediately after eating as food digestion tends to disrupt the process. *Assume a comfortable position.* Your entire body should be supported. Lying down on a sofa or bed and sitting in a reclining chair are two ways. Try not to fall asleep. Loosen any tight garments. Give yourself permission to put aside any concerns of the day. Do not TRY to relax. Do not TRY to control your body. Do not judge your performance. The point is to let go.

Sit quietly and in a comfortable position, with your legs uncrossed and your arms resting at your sides. Once you are comfortably supported in a quiet place, follow the link below.

**Day 1 Only:** For the next 7 days (including today) we will be asking you to log into this website to complete this exercise daily. Try your best to log in at the same time every day and be consistent when possible (e.g., at the end of the day, before dinner).

**DAY 2-7:** Make sure you are in a setting that is quiet and comfortable. Remember to loosen any tight garments, try not to worry about anything and assume a passive, detached attitude.

*Gratitude Condition.* After logging into the study site, participants in the gratitude condition were given the following written instructions:

*There are many things in our lives, both large and small, that we might be grateful about. Take some time to reflect over the past day and write down on the lines below up to five things in your life that you are grateful or thankful for.*

**Day 1 Only:** *For the next 7 days (including today) we will be asking you to log into this website to complete this exercise daily. Try your best to log in at the same time every day and be consistent when possible (e.g., at the end of the day, before dinner).*

The gratitude instructions were adapted from the Emmons and McCullough (2003) experimental study in a sample of college students. In that study, participants were asked to think about five things they were grateful for over the last week; this study asked the same question daily. Participants had a total of eight minutes, regulated by the computer program, to complete this task.

*Control Condition.* The control group was asked to describe their daily schedule. Instructions were as follows:

*For the next few minutes, please describe your schedule today from the moment you woke up until now. If you are doing this in the morning or midday, perhaps describe your schedule yesterday - from beginning to end; or you might also describe your schedule from this morning, including what else you plan to do the rest of the day.*

This writing exercise was timed, allowing 8 minutes, using the same amount of time as the relaxation and gratitude interventions. This active control condition was chosen to assess potential benefits of engaging in any computer activity to determine which interventions are most effective.

*Stress-Induction for Stroop Task.* In the classical Stroop task, participants are instructed to name the color of a word while ignoring the meaning of the word written

(e.g., the word “red” is written in green). This task results in an interference effect, resulting in increased response time and has been replicated in numerous studies (Linnman, Carlbring, Ahman, Andersson & Andersson, 2006; see MacLeod, 1991, for a review). In this study, a web-based Stroop protocol was used (Linnman et al., 2006) using the Macromedia Flashplayer computer program. Four gray boxes upon which each of the color names were printed were displayed on the computer screen. Participants were instructed to indicate their color-naming choice by clicking on the box representing the color in which the word was displayed as quickly as possible. Words were presented above the four color options and the location of each color option was randomized for each participant. The initiation of every new trial required the participant to click on a circle placed in the center of the four color options. If this was not done within 4 seconds of the last stimulus presentation, a reminder was displayed at the bottom left of the computer screen. The computer recorded response time and errors. To become familiar with the task, and to learn the location of each color option, participants were required to respond correctly 16 times during a practice session before the main trial began. Words remained on the computer screen until a response was made. The test is estimated to take approximately ten minutes to complete (Linnman, et al., 2006).

Before participants clicked on the link to begin the Stroop task they were given the following instructions:

*Your performance on the following task (e.g., completion time, number of items answered correctly) will give us a composite score. This score has previously been found to be related to intelligence (e.g., IQ), as well as academic success. We will be comparing your score to those of other students to see how your test results may predict overall intelligence level and future successes (e.g., GPA, job satisfaction).*

## *Measures*

*Gratitude.* The Gratitude Questionnaire: 6-item form (GQ-6) consisted of 6 self-report items (e.g., “I feel thankful for what I have received in life) that participants endorsed on a 7-point Likert-type scale (1 = strongly disagree; 7 = strongly agree) to indicate how well they described “your feelings about your life as a whole.” The GQ-6 is the preferred outcome measure used in gratitude research; it is sensitive to change and has had an internal consistency reliability of .82 in college student samples (McCullough et al., 2002) and in this study ranged from .80-.85 across time periods. This measure was administered at baseline, post-intervention and at follow up.

*Relaxation.* The Smith Relaxation States Inventory (SRSI; Smith, 2001) was used to assess relaxation. The SRSI consists of 30 self-report items that tap 15 relaxation states (i.e., mental quiet, physical relaxation, joy) and three stress states (i.e., somatic stress). The SRSI asks participants to rate each item according to how one feels “right now at the present moment” using a Likert scale of 1 (*not at all*) to 4 (*very much*). Cronbach’s alpha reliabilities typically range from .60 to .88 (Smith, 2001) and in this study ranged from .91-.95 across time periods. The SRSI was administered at baseline, post-intervention and at follow up.

*Positive Affect.* The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), developed as a short measure of positive and negative affect, has two separate scales. Each scale consists of 10 items, and is comprised of single mood terms (e.g., “excited” or “distressed”). Participants were instructed to rate the degree to which they were experiencing each affective term on a scale from 1 (“very slightly or not at all”) to 5 (“extremely”) at the present moment (i.e., right now). The scale has

demonstrated convergent and discriminant validity, sufficient stability over time, internal consistency, and orthogonal factor structure (Watson et al., 1988). The internal-consistency reliability coefficients for the positive and negative affect scales were .90 and .87, respectively, in a previous study of college students (Kaler, 2009) and in this study ranged from .90-.94. The PANAS was administered at baseline, post-intervention, post-stress task and at follow up.

*Life Satisfaction.* The five-item Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) was used to assess subjective well-being. Items are rated on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Participants are asked to rate their level of agreement with the statements regarding their life as a whole. The SWLS has a 2-month test–retest correlation coefficient of .82 and coefficient alpha of .87 (Diener et. al., 1985). The SWLS is widely used and well-validated (Pavot & Diener, 1993; McCullough et al., 2002) and used frequently as an outcome measure in positive psychology interventions. Cronbach’s alpha reliabilities ranged from .90 to .94 in this sample. This measure was administered at baseline, post-intervention and at follow up.

*Perceived Control.* The 8-item Present Control subscale of the Perceived Control Over Stressful Events scale (Frazier et al., 2011) was adapted to assess how participants currently (e.g., “right now”) perceive their sense of control over stress in general (e.g., How I deal with stressful events is under my control). Items are rated on a 1 (strongly disagree) to 4 (strongly agree) scale. This subscale has previously demonstrated good internal consistency and test-retest reliability, as well as convergent, discriminant, predictive, and incremental validity (Frazier et al., 2011). The alpha coefficients in this

study ranged from .86 to .89. Control was measured at baseline, post-intervention and at follow up.

*Serenity.* The Serenity Scale (Kreitzer, Gross, Waleekhachonloet, Reilly-Spong & Byrd, 2009) is a 23-item measure consisting of items that describe thoughts feelings or actions associated with peace and serenity. Scores on the Serenity Scale have been found to be reliable and valid (Kreitzer et al, 2009). Participants were asked to describe how often in the last week they had a particular experience (i.e., I am aware of an inner source of comfort, strength and security; I accept situations I cannot change) on a scale from 1 (never) to 5 (always). The internal-consistency reliability coefficient for this scale in a previous study was .95 (Kreitzer et al., 2009) and they ranged from .91 to .95 in this study. Serenity was assessed at baseline, post-intervention and at follow up.

*Depression/Anxiety/Stress.* The Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995) is a reliable and valid 21-item measure consisting of three subscales measuring anxiety, depression, and stress. Participants respond to the items on a 0 (does not apply) to 3 (very much) scale regarding the degree to which each item applied to them over the last week. The DASS-21 and its subscales have good internal consistency reliability and convergent validity in the form of substantial correlations with measures of similar constructs (Crawford & Henry, 2003). Other studies have determined the alpha coefficient for the total score to be .92 in college-aged samples (e.g., Frazier et al., 2009). Cronbach's alpha reliabilities ranged from .91 to .93 in this sample. The DASS was administered at baseline, post-intervention and at follow up.

*Negative affect.* Negative affect was assessed using the PANAS, which was described above. Cronbach's alpha reliabilities ranged from .84-.86 in this sample.

*Daily Stress.* The Daily Stress Inventory (Brantley, Waggoner, Jones, & Rappaport, 1987) was used to assess if stressful experiences common in college students (e.g., hurried to meet a deadline, argued with a boy/girlfriend) occurred, and then how much stress was caused as a result of each event within the past 24 hours. Thirty-eight items were rated on a scale of 1 (occurred but was not stressful) to 7 (caused me to panic). The Daily Stress Inventory has been used in previous research on college students with alphas ranging from .83 to .87 (Brantley & Jones, 1989). In this sample the alphas ranged from .93-.94. Daily stressors were assessed at baseline and post-intervention.

*Physical symptoms.* The Cohen-Hoberman Inventory of Physical Symptoms (CHIPS; Cohen & Hoberman, 1983) is a list of 33 common physical symptoms that participants rated in terms of how much each problem bothered or distressed them during the past week. Items were rated on a 5-point scale from "not at all" to "extremely." The items exclude symptoms of an obviously psychological nature (e.g., felt nervous or depressed), but do include many physical symptoms that have been traditionally viewed as psychosomatic (e.g., headache, weight loss). The CHIPS has been used successfully in studies of young adults (Brenner, Norvell & Limacher, 1989) with reported reliability coefficients ranging from .88-.95. In this sample the alphas ranged from .93-.94. Physical symptom data were gathered at baseline, post-intervention and at follow up.

*Subjective Event Severity.* Subjective severity of the stressor was assessed to ensure that the Stroop task was in fact a stressful experience. Participants rated how much distress (anxiety, worry, frustration) the Stroop test caused them on a 5-point scale (1 = no distress to 5 = extreme distress) immediately following completion of the task. Other studies have used similar 1-item measures (e.g., Ehlers, Mayou, & Bryant, 1998).

Additionally, participants were retrospectively asked to indicate which of eight physical indicators (i.e., increased heart rate, sweaty, cold hands) of anxiety they experienced during the Stroop test.

## Results

### *Preliminary Analyses*

Inspection of the data revealed 4 outliers (two each on anxiety and perceived control). These values were winsorized by replacing them with the closest non-outlier value. Correlation analyses were done with and without the winsorized values. Because the results were essentially the same, the original values were used in the final analyses. All skewness and kurtosis statistics were within acceptable levels. The correlation matrix for all measures on Day 1 is presented in Table 2.

Baseline (Day 1) means, standard deviations, multivariate analysis of variance (MANOVA) and analysis of variance (ANOVA) results, and between-group effect sizes at baseline are presented in Table 3. One MANOVA was run grouping positive variables together, another was run grouping negative variables, and the ANOVA was used to analyze the physical symptom data. There were no significant differences between the three groups on any of the measures at baseline.

To assess compliance, gratitude lists were reviewed for those in the gratitude condition. The majority of responses were deemed to be genuine (e.g., family, getting a good grade, friends, the weather). For those in the PMR condition, an item immediately following the audio link asked participants: “I was able/unable to listen to the recording.” This was followed by a small box where they were given space to write in an

explanation. This variable and text was reviewed. Upon examination, on the first day of the study 13 people were unable to listen to the audio, but this seemed due to technological and procedural difficulties. After the first day, only 1-2 people had difficulty listening to the recording.

*Manipulation check.* In order to see whether the gratitude and PMR interventions were effective in producing significant increases in the gratitude and relaxation measures two MANOVAs were conducted with gratitude and relaxation at Day 7 and at Day 37 as the dependent variables.

The omnibus F test for the MANOVA assessing between group differences on Day 7 was significant (Wilks'  $\lambda = .93$ ,  $F(4,476) = 4.34$ ,  $p < .05$ , partial eta squared = .04). The univariate tests indicated significant between-group differences for the relaxation measure, but not for gratitude. Bonferroni post-hoc comparisons revealed that those in the PMR group reported significantly more relaxation than the control ( $d = .64$ ) and gratitude ( $d = .51$ ) groups.

On Day 37, the omnibus F test for the MANOVA assessing between group differences in relaxation and gratitude was significant (Wilks'  $\lambda = .94$ ,  $F(4,404) = 3.37$ ,  $p < .05$ , partial eta squared = .03). Again, the univariate tests indicated significant between-group differences for the relaxation measure, but not for gratitude. Bonferroni post-hoc comparisons revealed that those in the PMR group reported significantly more relaxation than the control group ( $d = .60$ ), but not the gratitude group ( $d = .16$ ).

*Group Differences Post-Intervention.* Three separate (M)ANOVAS were conducted to measure group differences in the four positive outcome variables, the five negative outcome variables, and the one physical health symptom measure. Post-

intervention (Day 7) means, standard deviations, MANOVA results, and effect sizes for the three groups post-intervention (but pre-stress test) are shown in Table 4. The omnibus F test for the MANOVA assessing between group differences in the four positive well-being measures was significant, Wilks'  $\lambda = .90$ ,  $F(8,464) = 3.21$ ,  $p < .001$ , partial  $\eta^2 = .05$ . The univariate tests indicated significant between-group differences for the perceived control and serenity scales. Bonferroni post-hoc comparisons revealed that those in the PMR group reported significantly more serenity than the control ( $d = .44$ ) and gratitude ( $d = .41$ ) groups. They also reported more perceived control than the control ( $d = .40$ ) and gratitude ( $d = .34$ ) groups.

The omnibus F test for the MANOVA assessing between group differences in the five mental health symptom measures also was significant, Wilks'  $\lambda = .92$ ,  $F(10,454) = 1.92$ ,  $p < .05$ , partial  $\eta^2 = .04$ . The univariate tests indicated significant between-group differences only for the negative affect scale. Follow-up tests revealed that those in the PMR group reported significantly less negative affect than the control ( $d = -.56$ ) group. Group differences in stress (as measured by the DASS) were marginally significant and suggested that those in the PMR condition reported less stress than the control ( $d = -.28$ ) group.

The omnibus F test for the ANOVA assessing between group differences in the physical health symptom measure also was significant,  $F[2,241] = 3.16$ ,  $p < .05$ , partial  $\eta^2 = .04$ . Although the follow-up tests were not significant, PMR participants reported fewer physical health symptoms post-intervention than the gratitude ( $d = -.32$ ) and control ( $d = -.28$ ) groups. There were no group differences on positive affect, life satisfaction, depression, anxiety, or daily stressors on Day 7.

*Group Differences in Stress Reactivity.* Post-stress induction (Post-Stroop) means, standard deviations, MANOVA results, and effect sizes are shown in Table 5. These analyses assessed whether the groups differed in terms of their reactions to the Stroop task on the four measures listed in Table 5. Although the Stroop test did induce distress in the total sample (as evidenced by ratings on the emotional distress scale indicating mild to moderate distress), the omnibus F test for the MANOVA assessing between group differences in stress reactivity was not significant (Wilks'  $\lambda = .97$ ,  $F(6,362) = 1.08$ ,  $p < .05$ , partial eta squared = .02). Group differences on physical symptoms of anxiety were marginally significant ( $p = .09$ ), and suggested that those in the PMR condition reported fewer anxiety symptoms than both the gratitude ( $d = -.41$ ) and control ( $d = -.32$ ) groups.

An unanticipated problem occurred as a result of the software used for the Stroop task. The majority of participants experienced technical difficulties when asked to click on the link to begin the task. Below the task link the investigator's email address was provided in case there were technical problems. Many participants emailed the investigator reporting they were unable to access the task due to a problem with software compatibility. Although they were eventually provided with a working link - usually within a matter of hours - 10% of the compliant sample was missing data for this aspect of the study.

*Days 8-36.* On Day 7 participants were instructed that should they wish to continue with either the gratitude or relaxation exercise they would be able to continue to log into the study website and were encouraged to do so for tracking purposes. Upon examination of these data, however, only 39 of the 210 participants logged in between

Days 8-36. Each intervention group was represented equally, however, with 14 people (7%) in each of the PMR and gratitude groups logging in during that time period, and 11 (5%) people in the control group logging in. After further examination of the data, it was evident that most of these 39 people did not actually participate in the intervention. In fact, there is only evidence that 3 individuals completed the PMR and that 1 person completed their gratitude list.

*Group Differences at Follow-Up.* To assess treatment effects at follow-up, two MANOVAs (one for positive and one for negative outcomes) and one ANOVA (for physical symptoms) were conducted comparing the three groups on measures completed at Day 37. Of the total compliant sample (N=247), 83% (N=206) completed the follow up measures: 80% (n=58) of the PMR, 86% (n=81) of the gratitude and 86% (n=67) of the control group. The omnibus F test for the MANOVA for positive outcomes was not significant, Wilks'  $\lambda = .96$ ,  $F(8, 390) = .99$ ,  $p = .44$ , partial  $\eta^2 = .02$ . Thus, the positive outcomes for the PMR group in terms of increased serenity and perceived control initially found to be significant on Day 7 were no longer significant by Day 37. The overall MANOVA for negative outcomes also was not significant, Wilks'  $\lambda = .95$ ,  $F(8, 386) = .99$ ,  $p = .26$ , partial  $\eta^2 = .03$ . However, the univariate test for negative affect was significant with those in the PMR group again reporting significantly less negative affect than those in the control group ( $d = -.51$ ). The groups did not differ in terms of physical symptoms. Follow up (Day 37) means, standard deviations, F tests, and effect sizes for the two groups are shown in Table 6.

*Reliable Change.* The percentage of participants who reported reliable change on the outcome variables was calculated separately for those in both intervention groups.

The reliable change statistic is used to see whether a change in an individual's score (e.g. before and after some intervention) is statistically significant based on how reliable the measure is, in other words whether or not this change cannot be explained by measurement error (Evans, 1998). It is defined as the change in a client's score divided by the standard error of the difference for the test(s) being used. Using a reliable change criterion calculator ([www.psych.org/stats/rcsc1.htm](http://www.psych.org/stats/rcsc1.htm)) the standard error of change was calculated using the following formula:  $SD1 * \sqrt{2} * \sqrt{1 - rel}$  where "SD1" is the initial standard deviation, "sqrt" indicates the square root and "rel" indicates the reliability (Christensen & Mendoza, 1986). Reliable positive changes (improvements) and reliable negative change (decrements in functioning) were both calculated. Between 9% (Day 37 control and D37 positive affect) and 44% (Day 7 negative affect) of the relaxation group reported reliable improvement on the various negative and positive outcome variables. These data are summarized in Table 7. It is interesting to note that 31% to 44% of the participants across groups reported reliable *negative* change in positive affect (e.g., less positive affect) over the course of the study. This was unexpected, and after carefully reanalyzing the data for accuracy, could not be explained.

I originally proposed to investigate neuroticism and trait resilience as moderators of treatment effectiveness (e.g., whether treatment effectiveness differed as a function of trait resilience or neuroticism). All (N= 54; 9 outcome variables x 2 moderator variables for 3 sets of comparisons) analyses examining resilience as a moderator were non-significant (e.g., the relaxation group was compared to the control group, then to the gratitude group; the gratitude group was then compared to the control condition). Three of the 27 analyses examining neuroticism as a moderator were significant. Specifically,

neuroticism moderated the relationship between experimental group and serenity (Day 7) and negative affect (Day 7 & 37). Specifically, in both analyses the relationship between neuroticism and outcomes was stronger for those in the control group. Because only 3 of the moderator analyses were significant, these analyses are not included in this paper.

## Discussion

As college counseling centers around the United States report increasing rates of depression, suicidal ideation and severity in those they serve, additional approaches to addressing these needs are imperative to reduce the burden counseling center staff are facing. Given that approximately half of college students who screen positive for depression do not seek care, and most students with mental health problems do not receive treatment (Eisenberg et al., 2007), approaches that are accessible to these students are needed to reduce stress and incidence of depression, as well as contribute to students' overall well-being. Furthermore, research suggests that interventions that cultivate positive emotions may be an effective preventative strategy, reducing costs associated with mental health care and preventing mental health problems such as anxiety, depression and stress-related symptoms (Fredrickson, 2000).

Positive psychology offers simple strategies that students can use on their own, with the goal of reducing mental health symptoms and enhancing their well-being. The purpose of this study was to investigate two such interventions – gratitude and relaxation – and to research their effect on physical and mental health variables, including positive and negative outcomes, and reactions to stress. Assessing both physical and mental health outcomes in the same study addressed several weaknesses in research on both

gratitude and PMR, and provides a broader understanding of the applicability of these approaches. For example, only a small number of studies have investigated the effects of gratitude on physical health. Conversely, PMR studies have primarily assessed health-related symptoms (e.g., nausea), limiting our understanding of how PMR contributes to psychological outcomes. This study specifically addressed these limitations by 1) assessing a broader range of physical health outcomes of gratitude interventions and 2) assessing mental health outcomes of PMR.

This study also improved upon prior research by using a web-based, experimental and prospective design. This was especially critical given the overreliance on correlational methods in the gratitude literature. By randomly assigning participants to treatment conditions, the effects of extraneous variables were reduced, and error variance was minimized. Using an experimental prospective study design allowed us to have a much clearer understanding of the causal role of gratitude and PMR on physical and mental health outcomes, as well as stress reactivity.

The study also builds upon the existing understanding of PMR, which has typically been studied in more clinical populations, by collecting data within a nonclinical, healthier student population. Furthermore, this study's design allowed for two conceptually different interventions to be investigated together and compared. The addition of perceived control as an outcome variable was also novel. Specific results are discussed below.

*PMR.* With regard to positive well-being, students in the PMR group reported more serenity post-intervention than either the gratitude or neutral writing control groups. This is consistent with previous research with college students showing that those who

practiced PMR regularly scored significantly higher on measures of physical relaxation, mental quiet and joy compared to control group participants (Matsumoto & Smith, 2001). It is interesting to note, however, that the participants in Matsumoto and Smith study practiced relaxation for four or five weeks, whereas this study produced similar results after only seven days.

This was also the first study, to my knowledge, that assessed perceived control as an outcome variable. After only one week, PMR participants reported feeling as if they had more control over stress in their lives. This is important because having a sense of control has long been linked to better physical and mental well-being (Skinner, 1996). This is consistent with previous research that has demonstrated PMR as an effective intervention for enhancing feelings of control and coping (Chen et al., 2009) and is similar to other studies that investigated PMR in populations with health problems. For example, practicing PMR led to increased health-related locus of control in a sample of hypertensive patients (Pender, 1985) and enhanced feelings of control in cancer patients (Baider, Uziely, & Kaplan De-Nour, 1994). The findings of this study replicate these findings in a nonclinical, healthy sample.

Another positive outcome variable measured in this study was positive affect. It was hypothesized that both treatment conditions would report an increase in positive affect following the intervention period, after the stress task and at follow up 30 days later. Yet neither intervention had a significant effect on positive affect at any time point. This was surprising because previous experimental research demonstrated that daily relaxation practice increases positive emotions (Frederickson et al., 2008). In fact, reliable change analyses indicated participants in all three groups actually reported

reliable decreases in positive affect. Although the data were carefully examined for potential errors and reasons why this might have been, no obvious explanation could be found. Perhaps over time, as the study and semester went on, students in general were feeling less positive than they had in the beginning of the semester. These findings are contrary to Fredrickson's undoing hypothesis that repeated experiences of positive emotion inducing interventions can undo the negative effects of stress (Frederickson, 2000). The interventions also did not have an effect on life satisfaction, which may be less amenable to change in a short time period.

Interestingly, the longest-lasting effect of PMR was in terms of reduction of negative affect. The PMR group reported less negative affect than the control group at both posttest and follow-up. This is consistent with results of another study in which students who participated in a relaxation intervention reported a greater decrease in negative affect compared to the control group (Laidlaw et al., 2003). This is the only benefit that persisted until follow up. The benefits gained on the more positive variables measured (control, serenity) were no longer apparent 30 days later. Of particular note, 44% of the PMR group reported reliable decreases in negative affect after only seven days and 25% still reported reliable decreases 30 days later. Although those in the PMR group consistently demonstrated a pattern of lower rates of depression, anxiety, stress and daily stressors than both the gratitude and control groups, these differences were not statistically significant.

Although it is impossible to know if students continued practicing relaxation on their own, they were provided a link to the intervention site and encouraged to log in if they were interested in continuing on their own. This was included for tracking purposes,

and was added given that Seligman et al. (2005) found that participants continued to practice positive psychology techniques beyond the conclusion of their study. Results from these data, however, suggested that few people accessed the relaxation exercise between Day 7 and 37.

As predicted, overall those in the PMR condition reported fewer physical symptoms post-intervention than those in comparison conditions, however the pairwise comparisons were insignificant. Consistent with previous research, PMR has been effective in improving insomnia, and reducing blood pressure, gastrointestinal and pulmonary problems and the negative physical side effects of cancer treatment (Gift et al., 1992; Sheu, Irvin, Lin & Mar, 2003).

Even when group differences were not significant, the data always displayed a trend demonstrating that PMR participants fared better than the other two groups. Meta-analytic research on PMR has found average effect sizes ( $r$ ) to be .40, although the samples used in the meta-analysis were clinical populations with a mix of physical and/or psychological diagnoses (Carlson & Hoyle, 1993).

*Gratitude.* This study also contributed to current knowledge regarding gratitude interventions because of the limited number of experimental studies. Those participants in the gratitude condition did not appear to significantly benefit from the intervention. This finding was unexpected and inconsistent with previous research showing that brief gratitude exercises lead to greater well-being, life satisfaction and positive affect (Wood et al., 2007). Although those in the PMR condition were significantly more relaxed at the end of the intervention week (as well as one month later), those in the gratitude group were *not* more grateful as measured at the same time points. In fact, those in the PMR

condition not only reported being more relaxed, but also more grateful than the gratitude group (measured on Day 37). Although it is surprising that a gratitude intervention did not produce more gratitude, one previous study did find that PMR produced increased feelings of thankfulness (Khasky & Smith, 1999). It may be that the gratitude measure was not sensitive enough to detect any change since the instructions did not give a specific time frame, but asked respondents to reflect on their feelings about their life as a whole.

One other possible explanation for why the gratitude condition did not produce significant change is that seven days was not a long enough intervention period. Although previous research suggests that that time period should have been enough time to produce an effect, in general, experimental gratitude research is lacking and varies in methodology. Seligman et al. (2005) asked college students to write down three good things every day, and found significant differences in happiness and depressive symptoms compared to the other positive psychology interventions after only one week. Other studies have asked students to write down things they are grateful for only once a week, but then assess outcomes at anywhere from 1 week to 13 days post-intervention. The reason for these results requires additional research.

*Stress Reactivity.* One of the primary aims of this study was to investigate the effects of PMR and gratitude on stress reactivity. Psychological interventions practiced in *advance* of a stressor have been hypothesized to have potential value for enhancing affect and physical health when stressors do occur (Gruzelier, 2002). Research suggests that strategies such as PMR and gratitude may be an effective first line of defense in

preventing mental health problems (Jorm et al., 2008). Unfortunately, this hypothesis was not supported and neither intervention had an effect on stress reactivity.

After examining the stress ratings, it was evident that the Stroop task was, in fact, at least moderately stressful for participants. However, no group reported significantly more (or less) distress than any other group following the task. Similar to other non-significant results, those in the PMR group tended to have lower ratings of anxiety and distress post-Stroop than the other groups. Perhaps the Stroop task was not stressful *enough*, as students completed this task in the comfort of an environment of their own choosing. Another explanation may also be that participants knew the research was voluntary and therefore would not be used in an evaluative manner. The results may also have been different if the intervention persisted longer than 7 days. Although neither the PMR nor gratitude research literature has used the Stroop test as a stress-induction task before, other relaxation intervention studies have found that relaxation strategies buffer the effects of exam stress (Laidlaw et al., 2003). Thus, more research on the stress-buffering effects of these interventions is needed.

*Limitations.* Although this study contributes to the existing literature in many ways, it is not without limitations. First, the interventions were short. Longer term studies would help us to evaluate what benefits might exist if participants were to engage in these interventions beyond a one week period. A second limitation is that, despite reviewing students' qualitative answers to the intervention instructions ("list up to five things you are grateful for") these results were not analyzed or coded. Upon review, many reported being grateful for things such as family, friends, God, safety, nature, and receiving a good grade, but some responses seemed more superficial in nature (e.g.,

“facebook”, “booze”). These types of responses might have influenced the effectiveness of the gratitude intervention.

Another limitation is that the majority of participants were European American females aged 18-21. Therefore, our results are only generalizable to a primarily young, Caucasian female student population. Although this demographic is representative of the University of Minnesota student population, it may not generalize to other college campuses. Future research using a more diverse population, both demographically and geographically, would help gain a more comprehensive understanding of the effects of these interventions on a broader range of participants.

These data are also limited in that participants were not asked for their opinions or feedback about the interventions. It has been recommended that non-arbitrary and more comprehensive outcomes should be measured when evaluating intervention effectiveness (Kazdin, 2006) including both quantitative and qualitative data (Dattilio, Edwards & Fishman, 2010). Data on participant satisfaction would have contributed to a fuller understanding of the benefits (or drawbacks) of the PMR or gratitude exercises (Nelson & Steele, 2006). It would also have been helpful if service utilization (mental or physical health) or other “real life” outcomes had been assessed throughout the course of the study.

Finally, the software used for the Stroop task frequently created technical difficulties for participants and this might have impacted the results. Often, students emailed the investigator to report they were unable to access the task due to software compatibility problems. Although they were eventually provided with a working link, usually within a matter of hours, this issue created some participant attrition, and could

have affected the results of those that did complete the task. Conversely, this added annoyance might have also unintentionally increased the stress level associated with the task. The effect of this software glitch is unknown. The online Stroop task was chosen for its ease of access and implementation, with the aim of providing participants a task they could do on their own, without coming into the lab, thereby reducing attrition. Future research, however, might improve upon the choice of task and methodology. For example, researchers might employ a “real life” stressor (e.g., exams) to better understand if the benefits of PMR are generalizable beyond an artificially created stressor like the Stroop.

*Implications.* From this study, we may conclude that as a direct result of participating in a brief PMR practice, students report reduced negative affect and increased feelings of serenity and perceived control. This study contributed to the existing literature demonstrating the positive effects of a regular relaxation practice on the mental and physical health of college students. Although not preventative in nature, these strategies still produced positive results and have important clinical implications for those with mental health problems, as well as the clinicians that serve them. Recent reports on the mental health of college students have found that the mental health needs of college students are growing, and that students enter college today with more severe and pathological conditions (Kitzrow, 2009; National Survey of Counseling Center Directors, 2009). Given that students in this study gleaned benefits after only 7 days, some of which persisted one month later, it would be reasonable to conclude that PMR would be a useful strategy to implement with this population.

Counseling center websites might consider providing a link to similar relaxation exercises that students could access in the privacy of their own homes. Teaching PMR could be implemented and/or integrated into existing curricula (i.e., freshman orientation) to prevent or reduce the occurrence and severity of mental health problems frequently cited by college counseling center directors (National Survey of Counseling Center Directors, 2009). These results highlight PMR as a useful strategy that requires minimal intervention time, is easy to teach, internet-accessible, cost-effective, and could take some of the burden off of mental health professionals and college counseling centers.

Table 1. Demographics (Compliant Sample)

	<b>PMR</b>	<b>Gratitude</b>	<b>Control</b>	
	(N=73)	(N=94)	(N=80)	Chi-square(df)*
<b>Sex</b>				
Men	25 (34%)	26 (28%)	22 (28%)	$\chi^2 (2) = 1.10$
Women	48 (66%)	68 (72%)	58 (72%)	$p = .58$
<b>Age</b>				
Under 18	0	2 (2%)	2 (3%)	$\chi^2 (6) = 4.84$
18-21	63 (86%)	77 (82%)	70 (88%)	$p = .56$
22-30	9 (12%)	11 (12%)	8 (10%)	
31-40	1 (1%)	3 (3%)	0	
<b>Year</b>				
Freshman	40 (55%)	48 (51%)	44 (55%)	$\chi^2 (12) = 6.90$
Sophomore	15 (21%)	18 (19%)	18 (23%)	$p = .86$
Junior	9 (12%)	12 (13%)	11 (14%)	
Senior	7 (10%)	11 (12%)	4 (5%)	
Other	2 (3%)	4 (4%)	3 (4%)	
<b>Ethnicity</b>				
European American	55 (75%)	72 (77%)	62 (78%)	$\chi^2 (12) = 11.53$
African American	1 (1%)	3 (3%)	1 (1%)	$p = .48$
Asian American	8 (11%)	13 (14%)	12 (15%)	
Hispanic/Latina(o)	3 (4%)	0	0	
Middle Eastern/ Arab American	1 (1%)	1 (1%)	0	
Multiracial	1 (1%)	3 (3%)	2 (3%)	
Other	4 (6%)	2 (2%)	3 (4%)	

\*Pearson's chi-square significance level

Table 2. Correlation Matrix of Baseline Measures

	<i>Variable</i>											
	1	2	3	4	5	6	7	8	9	10	11	12
(N=247)												
<u>Positive Outcomes</u>												
Positive Affect <sub>1</sub>	1	-	-	-	-	-	-	-	-	-	-	-
Life Satisfaction <sub>2</sub>	.31**	1	-	-	-	-	-	-	-	-	-	-
Perceived Control <sub>3</sub>	.32**	.42**	1	-	-	-	-	-	-	-	-	-
Serenity <sub>4</sub>	.16*	.49**	.47**	1	-	-	-	-	-	-	-	-
Relaxation <sub>5</sub>	.51**	.44**	.26**	.49**	1	-	-	-	-	-	-	-
Gratitude <sub>6</sub>	.17**	.59**	.39**	.45**	.20**	1	-	-	-	-	-	-
<u>Negative Outcomes</u>												
Negative Affect <sub>7</sub>	.00	-.29**	-.28**	-.17**	-.17**	-.27**	1	-	-	-	-	-
Stress <sub>8</sub>	-.05	-.28**	-.55**	-.36**	-.16**	-.33**	.34**	1	-	-	-	-
Depression <sub>9</sub>	-.11	-.55**	-.52**	-.43**	-.20**	-.57**	.29**	.60**	1	-	-	-
Anxiety <sub>10</sub>	.04	-.27**	-.55**	-.18**	-.02	-.38**	.34**	.63**	.60**	1	-	-
Daily Stressors <sub>11</sub>	.00	-.26**	-.41**	-.13**	.02	-.36**	.33**	.43**	.44**	.50**	1	-
<u>Health Outcome</u>												
Physical Symptoms <sub>12</sub>	.00	-.26**	-.46**	-.18**	-.06	-.37**	.32**	.52**	.43**	.60**	.52**	1

\*  $p < .05$ ; \*\*  $p < .00$

Table 3. Baseline (Day 1) Measures

	<b>PMR</b> (n=73) M (SD)	<b>Gratitude</b> (n=94) M (SD)	<b>Control</b> (n=80) M (SD)	F	df	p	partial $\eta^2$
<i>Positive Outcomes</i>							
Positive Affect	3.04 (.84)	2.89 (.89)	2.93 (.73)	.81	247	.48	.007
Life Satisfaction	5.06 (1.30)	5.17 (1.32)	5.10 (.95)	.18	247	.84	.001
Perceived Control	3.10 (.59)	3.00 (.57)	3.00 (.50)	.82	247	.44	.007
Serenity	3.24 (.65)	3.18 (.62)	3.11 (.56)	.76	247	.47	.006
Gratitude	5.91 (1.0)	5.84 (1.1)	5.84 (.86)	.16	245	.86	.001
Relaxation	2.50 (.54)	2.39 (.60)	2.38 (.55)	.96	245	.39	.008
<i>Negative Outcomes</i>							
Negative Affect	1.79 (.66)	1.63 (.58)	1.71 (.58)	1.35	244	.26	.001
Stress	1.83 (.55)	1.89 (.57)	1.98 (.60)	1.39	244	.25	.01
Depression	1.54 (.52)	1.60 (.57)	1.64 (.58)	.67	244	.53	.005
Anxiety	1.52 (.44)	1.56 (.61)	1.58 (.49)	.20	244	.82	.002
Daily Stressors	20 (7.94)	21 (7.74)	19 (8.34)	.67	244	.51	.005
<i>Health Outcome</i>							
Physical Symptoms	1.75 (.66)	1.81 (.68)	1.79 (.58)	.16	244	.85	.001

Table 4. Post-Intervention (Day 7) Measures

	<b>PMR</b> (n=73) M (SD)	<b>Gratitude</b> (n=94) M (SD)	<b>Control</b> (n=78) M (SD)	F	df	p	partial $\eta^2$	<u>Partial <math>\eta^2</math> for Covariate***</u>
<u>Positive Outcomes</u>								
Positive Affect	2.58 (1.02)	2.58 (.92)	2.39 (.85)	1.40	242	.25	.012	.23
Life Satisfaction	5.22 (1.36)	5.42 (1.19)	5.10 (1.07)	2.46	242	.09	.02	.54
Perceived Control	3.20 (.49) <sup>b</sup>	3.03 (.51)	3.01 (.45)	3.91	242	.02*	.02	.25
Serenity	3.35 (.69) <sup>b</sup>	3.07 (.67)	3.06 (.62)	7.62	242	.001**	.06	.43
Gratitude	5.97 (.95)	5.87 (1.0)	5.85 (.81)	0.20	240	.822	.002	.52
Relaxation	2.69 (.62) <sup>b</sup>	2.37 (.64)	2.32 (.53)	8.25	240	.000**	.07	.35
<u>Negative Outcomes</u>								
Negative Affect	1.32 (.41) <sup>a</sup>	1.46 (.57)	1.62 (.63)	6.53	239	.002**	.05	.05
Stress	1.76 (.84)	1.81 (.80)	2.02 (.92)	2.75	239	.07	.02	.30
Depression	1.46 (.55)	1.52 (.49)	1.65 (.60)	1.50	239	.23	.01	.41
Anxiety	1.40 (.38)	1.46 (.48)	1.49 (.52)	.74	239	.48	.006	.30
Daily Stressors	20 (8.11)	21 (7.78)	21 (8.52)	.67	246	.52	.005	.37
<u>Health Outcome</u>								
Physical Symptoms	1.49 (.57)	1.67 (.56)	1.64 (.50)	3.16	245	.04*	.03	.49

\*  $p < .05$ ; \*\*  $p < .001$ ; \*\*\* Pillai's trace; *a* = significantly differs from control group; *b* = significantly differs from both gratitude & control group

Table 5. Post-Stroop Group Differences

	<b>PMR</b> (n=62) M (SD)	<b>Gratitude</b> (n=73) M (SD)	<b>Control</b> (n=51) M (SD)	F	df	p	partial $\eta^2$
Positive Affect	2.70 (1.0)	2.70 (.93)	2.48 (.73)	1.25	189	.29	.013
Negative Affect	1.38 (.37)	1.51 (.52)	1.50 (.58)	1.36	186	.26	.02
Emotional Distress	2.37 (.96)	2.53 (.96)	2.42 (.94)	.53	186	.59	.006
Anxiety (Physical Symptoms)	.14 (.15)	.21 (.19)	.20 (.22)	2.47	186	.09	.03

Table 6. Follow Up (Day 37) Group Differences

	<b>PMR</b> (n=58) M (SD)	<b>Gratitude</b> (n=81) M (SD)	<b>Control</b> (n=67) M (SD)	F	df	p	partial $\eta^2$	<u>Partial <math>\eta^2</math> of</u> Covariate**
<i><u>Positive Outcomes</u></i>								
Positive Affect	2.54 (.93)	2.56 (.98)	2.49 (.84)	.02	204	.96	.000	.17
Life Satisfaction	5.31 (1.38)	5.48 (1.29)	5.10 (1.16)	1.64	204	.20	.016	.23
Perceived Control	3.13 (.50)	2.98 (.57)	3.00 (.48)	1.93	204	.15	.02	.17
Serenity	3.03 (.67)	3.03 (.74)	2.87 (.55)	.51	204	.60	.005	.38
Gratitude	5.93 (.91)	6.06 (.92) <sup>a</sup>	5.75 (.93)	3.35	204	.04*	.03	.50
Relaxation	2.50 (.68) <sup>as</sup>	2.39 (.74)	2.13 (.54)	3.91	204	.02*	.04	.30
<i><u>Negative Outcomes</u></i>								
Negative Affect	1.60 (.59) <sup>a</sup>	1.78 (.67)	1.90 (.59)	3.55	204	.03*	.04	.06
Stress	1.70 (.55)	1.88 (.67)	1.94 (.63)	1.43	204	.23	.01	.26
Depression	1.43 (.41)	1.58 (.62)	1.58 (.58)	1.32	204	.27	.01	.27
Anxiety	1.43 (.40)	1.48 (.54)	1.47 (.44)	.25	204	.78	.003	.12
<i><u>Health Outcome</u></i>								
Physical Symptoms	1.60 (.60)	1.63 (.57)	1.65 (.54)	.88	209	.42	.009	.38

\*  $p < .05$ ; \*\* Pillai's Trace; a = significantly differs from control group

Table 7. Percentage of Participants Reporting Reliable Change\*

	PMR		Gratitude		Control	
	+ Δ	- Δ	+ Δ	- Δ	+ Δ	- Δ
Positive Affect						
Day 7	10%	43%	12%	31%	5%	44%
Day 37	9%	32%	12%	37%	15%	42%
Perceived Control						
Day 7	14%	6%	9%	5%	12%	7%
Day 37	9%	32%	13%	12%	10%	10%
Serenity						
Day 7	15%	5%	5%	8%	10%	17%
Day 37	12%	26%	10%	28%	12%	33%
Life Satisfaction						
D7	7%	3%	12%	1%	9%	7%
D37	15%	9%	14%	4%	12%	14%
Negative Affect						
Day 7	44%	6%	18%	6%	18%	16%
Day 37	25%	14%	6%	19%	14%	25%
Stress						
D7	13%	1%	12%	1%	7%	32%
D37	16%	8%	5%	7%	12%	8%
Anxiety						
D7	15%	3%	8%	3%	7%	3%
D37	14%	4%	9%	5%	13%	5%
Depression						
D7	12%	3%	12%	5%	8%	11%
D37	23%	5%	8%	5%	14%	11%
Daily Stressors						
D7	13%	1%	30%	7%	29%	11%

Physical Symptoms

D7	24%	1%	17%	6%	19%	6%
D37	14%	7%	20%	4%	16%	11%

*\*Percentage of positive change for positive outcomes was calculated as an increase in mean, and as decrease in means for negative outcome variables.*

Figure 1. Measurement Timeline and Strategy

<b>Baseline Day 1</b>	<b>Daily Measures (Day 1 - 7)</b>	<b>Post Intervention (Pre-Stressor) Day 7</b>	<b>Post Stressor Day 7</b>	<b>Follow Up (1 month; Day 37)</b>
Affect Distress  Daily Stress Physical Symptoms Life Satisfaction Perceived Control Gratitude Relaxation Serenity Resilience Neuroticism	Affect	Affect Distress  Daily Stress Physical symptoms Life Satisfaction Perceived Control Gratitude Relaxation Serenity	Affect Distress (of stressor)	Affect Distress  Physical symptoms Life Satisfaction Perceived Control Gratitude Relaxation Serenity

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## Appendix A

### Theoretical Background on Positive Emotions

Positive emotions may be one important way of achieving a fulfilling and engaging life free from disorder. Although there is no formally agreed upon definition of positive emotion, many agree on several qualities: they feel good, they contribute to life satisfaction, and they may alter people's thinking and actions (Fredrickson, Mancuso, Branigan & Tugade, 2000). There is some debate regarding whether positive emotions are just one end of the emotional spectrum, merely the opposite of negative feelings. However, reducing negative emotions does not necessarily create or result in positive emotions. Research suggests, however, that positive emotions do play a unique and important role in regulating the effect of negative emotions (Fredrickson, 2000; Fredrickson & Levenson, 1998).

Although there are many theories of emotion, most theories have been built and tested about the more negative experiences humans endure, with only few focusing on positive experiences (Fredrickson, 1998). Fredrickson's research, however, has focused more intentionally on the role positive emotions play in health, healing and optimal functioning. The Broaden and Build Theory (Fredrickson, 1998) postulates that positive emotions *broaden* thought-action repertoires and *build* personal resources, initiating what is known as an "upward spiral" toward increasing emotional well-being.

Thought-action repertoires refer to the idea that the emotions we experience prepare our bodies physically and psychologically to act in a particular way, promoting survival. From this perspective, negative emotions *narrow* a person's thought-action repertoire, whereas positive emotions serve to increase the behavioral options we have

available to us. For example, a negative emotional experience such as fear of being attacked motivates us to take one of two actions: defend ourselves or make sure we leave the situation. Conversely, positive emotions such as calm, might help us creatively problem solve even when faced with a new challenge.

This theory postulates that positive emotions lead to a larger “repertoire” of actions available to the individual (Fredrickson, 1998). This expanded flexibility in thought and behavior can also result in resource building, benefiting the individual over time. Resources may be social (e.g., support), physical (e.g., immune functioning, cardiovascular reactivity), psychological (e.g., resilience, optimism) and/or intellectual (e.g., creativity) (Fredrickson, 1998).

Positive emotions can also play an important role in undoing the detrimental effects of negative emotions and have been characterized by a *lack* of autonomic reactivity, which is part of the body’s response to stress (Levenson, Ekman, & Friesen, 1990). Referred to as the “undoing” hypothesis, research suggests that positive emotions can decrease autonomic nervous system reactivity (e.g., elevated heart rate) that results from negative emotions such as fear and anger (Fredrickson & Levenson, 1998; Fredrickson et al., 2000).

According to Fredrickson and colleagues, positive emotions have a unique ability to decrease negative emotions and the psychological and physiological states they generate (Fredrickson, 2009). Taken together, the undoing hypothesis and broaden-and-build theory suggest that positive emotions speed recovery from the effects of negative emotions and return the body to a more suitable level of activation. This allows an individual to pursue a wider range of behaviors that are less constricted and fear-

motivated, while also implying that cultivating positive emotions may be important in achieving emotional health.

Positive emotions are theoretically effective for counteracting the effects of excessive, prolonged negative emotions and may be especially relevant when channeled into effective prevention, treatment and coping strategies (Fredrickson, 2000).

Techniques such as relaxation therapies, meditation, yoga, cognitive reframing, finding positive meaning, and finding activities that increase joy, contentment or happiness are all ways positive emotions may be elicited.

Relaxation and gratitude interventions are two frequently studied approaches that increase positive emotions and enhance well-being. Relaxation is theorized to be one of the most important skills to learn and implement in daily life (Sultanoff & Zalaquett, 2000) and is used widely for people to cope with stress-related problems, including decreasing the occurrence of tension and anxiety disorders. Additionally, because many people have negative attitudes towards medications and psychotherapy, relaxation may be a more acceptable and less stigmatizing psychological intervention (Jorm, Morgan & Hetrick, 2008). The benefits of relaxation have been documented over the last 30 years, demonstrating consistent and significant efficacy (Manzoni, Pagnini, Castelnuovo & Molinari, 2008).

In research comparing drug versus relaxation therapy for anxiety, relaxation interventions were found to have better long-term effects than drug treatments (see Sultanoff & Zalaquett, 2000, for a review). Relaxation has been found to be effective in a variety of populations including those with anxiety, panic disorder, generalized anxiety symptoms, test anxiety, social phobia, anger, hostility, aggression, headaches, insomnia,

substance abuse, smoking, hypertension, heart disease, fibromyalgia, irritable bowel syndrome, asthma, diabetes, cancer, HIV and Alzheimer's disease (Sultanoff & Zalaquett, 2000). There are many methods used to achieve a relaxing state, but, according to Sultanoff and Zalaquett (2000), the procedures that are most commonly practiced in the clinical setting are Jacobson's (1938) Progressive Muscular Relaxation, Schultz and Luthe's (1969) Autogenic Training, and Benson's (1976) Relaxation Response. According to the Benson-Henry Institute for Mind Body Medicine, the best techniques are the ones that are simple to teach and to learn. Using relaxation to reduce stress, Benson proposes, will reduce disease vulnerability and enhance health.

Gratitude is another construct that has been investigated in the context of enhancing psychological and physical health outcomes. However, despite that psychologists understand a great deal about emotions, much less is understood about the nature of gratitude. Although historically discussed at length in theology, religion and philosophy, gratitude has only recently begun to be discussed within the field of psychology (Emmons & McCullough, 2004). Synonymous with terms such as thankfulness and appreciation, gratitude has been conceptualized as an emotion, attitude, virtue, habit, personality trait, and coping response (Emmons & McCullough, 2003). Gratitude has been shown to be related to measures of both psychological and physical well-being including positive affect, feelings of success, life satisfaction, less stress, reduction in depressive symptoms, as well as increases in physical exercise, and sleep quality (Wood, Gillett, Linley, & Joseph, 2008, Seligman, Steen, Park, & Peterson, 2005; Emmons & McCullough, 2003, Peterson, Ruch, Beermann, Park, & Seligman, 2007). Being capable of expressing gratitude is thought to be an important component of "the

good life,” a way to improve and put one’s life into perspective, and is an integral component of health, wholeness and well-being (Emmons & McCullough, 2004; Emmons, 2009).

## Appendix B

### Empirical Findings on Progressive Muscle Relaxation

Relaxation practices have been shown to alleviate symptoms associated with a vast array of both physical and psychological conditions, including lowering heart rate and blood pressure, symptoms that are linked to chronic stress (Benson, 2008). Meta-analytic findings suggest the mental health benefits of relaxation training in general (Manzoni et al., 2008) and in particular, relaxation has been found to enhance the well-being of college students (Gruzelier, 2002). Experimental research has demonstrated that daily relaxation practice increases positive emotions, and life purpose, as well as also decreasing physical symptoms (Fredrickson, Cohn, Coffey, Pek & Finkel, 2008).

Though many types of relaxation techniques have been studied, progressive muscle relaxation (PMR) is one of the most frequently investigated and has been used for stress management since the early 1920's. PMR involves systematically tensing muscle groups for a few seconds before releasing the tension and proceeds through the entire body, giving all muscles the opportunity to relax. PMR has been shown to be effective in not only reducing mental and physical health symptoms, but also bolstering more positive states such as positive affect, quality of life, and perceived control.

***Positive Outcomes of PMR.*** The literature has characterized the benefits of relaxation on affect as “unquestionable” and the benefits of relaxation strategies on affect have also been demonstrated in college students under stress both in and outside of the lab (Gruzelier, 2002). Research on PMR has demonstrated that it is an effective intervention for enhancing feelings of control and coping (Chen, Chu, Lu, & Chou et al., 2009). College students who practiced PMR once a week for five weeks scored

significantly higher on measures of physical relaxation, mental quiet and joy compared to those in the control condition who participated in a deep breathing exercise (Matsumoto & Smith, 2001). These results were replicated in a study that compared PMR to yoga exercises, and found that adult participants who practiced PMR once a week enjoyed significantly more benefits than those who did yoga. PMR was more effective at evoking a relaxation state, including physical relaxation, joy, mental quiet and disengagement, with effect sizes ranging from .32-.53 (Ghoncheh & Smith, 2004).

Three cited studies have found increased reports of quality of life following regular PMR practice. Cancer patients who participated in PMR for 30 minutes twice a week, and who maintained a home practice following surgery, reported a significant increase in quality of life compared to the control group (Cheung, Molassiotis & Chang, 2003). For example, in a community-based study comparing the effects of PMR with other relaxation strategies (i.e., guided imagery or blended) on quality of life in cancer patients, there was a significant group effect. Patients in the relaxation conditions reported significant positive changes in their quality of life; there were no differences between the relaxation groups (Sloman, 2002).

In another study of cancer patients, the effects of PMR were assessed over 10 weeks post surgery. Participants were taught PMR twice by staff and then encouraged to practice at home for 10 weeks. Quality of life was assessed before and after the surgical procedure. The use of PMR was associated with improved quality of life in the experimental group. The researchers concluded that PMR should be used in long-term care of cancer patients because it can improve their psychological health and quality of life, as well as because it may be a cost-effective intervention that needs minimal training

and can easily be offered to interested patients (Cheung et al., 2003). Similarly, cardiac and heart bypass patients who practiced PMR also reported a significant increase in quality of life from pre to post intervention (Hui, Wan, Chan, Yung, 2006).

Having a sense of control has long been linked to better psychological outcomes (e.g., less distress, anxiety and depression) and control has been documented as a predictor of physical and mental well being (Skinner, 1996). Both experimental and correlational studies have shown that individual differences in perceived control are related to a variety of positive outcomes as well, including health, optimism, coping, adjustment, and functioning in a variety of life domains (Skinner, 1996). Previous research has shown that perceived control is also associated with recovery from a variety of negative life events (see Taylor & Armor, 1996, for a review). Yet only two studies, both of which were conducted over 15 years ago, have investigated how relaxation interventions may influence one's perception of control. Pender (1985) found that a PMR intervention led to increased health-related locus of control in a sample of patients with hypertension and Baider, Uziely and Kaplan De-Nour (1994) found PMR to enhance feelings of control in cancer patients. These findings have yet to be replicated in non-clinical, healthy samples.

***PMR and Negative Outcomes.*** Negative affect plays an important role in emotion regulation difficulties and is associated with various forms of psychopathology including depression, anxiety, anger and autonomic arousal (Tull, Jakupcak, McFadden & Roemer, 2007; Bleil, Gianoros, Jennings, Flory & Manuck, 2008). PMR has been associated with improvements in negative affect and has moderate average effect sizes

( $r=.40$ ) for physical and stress related disorders (see Carlson & Hoyle, 1993, for a review).

In a recent meta-analysis comparing PMR to other relaxation techniques (e.g., autogenic training, meditation, and a combined approach), progressive relaxation produced an effect size of  $d=.55$ , with a within group reduction of anxiety superior to the other techniques (Manzoni et al., 2008). PMR has been shown to reduce anxiety in a variety of clinical and non-clinical populations including students (Khasky & Smith, 1999), surgical patients (Cheung, Molassiotis & Chang, 2003) and individuals with hypertension (Pender, 1985), cardiac problems (Hui et al, 2007), obsessive compulsive disorder (Falls Stewart et al. 1993), schizophrenia (Chen et al., 2009), chronic pulmonary obstruction (Brenes, 2003), night eating syndrome (Pawlow, O'Neil & Malcom, 2003), alcoholism, irritable bowel syndrome, diabetes and cancer (Manzoni et al., 2008).

Meta-analytical findings on the effectiveness of relaxation in the treatment of depression found that relaxation techniques were more effective at reducing self-rated depressive symptoms than no or minimal treatment (Jorm, et al., 2008). Several studies have documented the effectiveness of PMR in particular in reducing depression (see Burish & Tope, 1992, for a review). Cancer patients in emotional distress who practiced PMR three times a day for 10 days reported fewer symptoms of depression compared to the comparison group who received drug therapy; these results were corroborated by observer reports of depressed mood as well (Holland et al., 1991). Similarly, patients who practiced PMR two times a day for three weeks had significantly fewer symptoms of depression than the control group at the end of the treatment protocol (Sloman, 2002). Meta-analytical findings suggest there are few differences between relaxation and other

psychological treatments (Jorm et al., 2008). This would suggest the potential for relaxation techniques to be used as a first-line treatment, and researchers have urged further investigation into this possibility.

***PMR and Stress Reactivity.*** I could locate only one study that examined the effects of PMR on stress reactivity. In a longitudinal study comparing the effects of PMR to meditation and cognitive-behavioral therapy, participants in the PMR condition reported increased overall mental health and decreased anxiety following a lab stressor in which researchers used loud tones to induce the stress response (Gaylord, Orme-Johnson, & Travis, 1989). Although technically not a stress-reactivity study, in another study, participants who were randomly assigned to either a PMR, yoga, or imagery group and practiced these only for 25 minutes reported less somatic stress compared to other relaxation techniques (Khasky & Smith, 1999). Because of the paucity of research on PMR and stress reactivity, I also reviewed the effects of other forms of relaxation on stress outcomes. Relaxation techniques, in general, have been found to be effective in buffering the effects of stress. For example, in one study university students were randomly assigned to two different 4-week relaxation conditions or to a control condition (Laidlaw, Naito, Dwivedi, Enzor, Brincat & Gruzelier, 2003). Semester midterm and final exam times were also recorded to measure the effect of these interventions on exam-related stress. Self-reported affect, perceived stress, and anxiety data were gathered pre and post relaxation training and again two months later. At the conclusion of the study, those in the relaxation group experienced a greater decrease in negative affect; the control group reported more anxiety, tension, and depression. There were no differences between the two relaxation conditions (Laidlaw et al, 2003). Consistent with

Fredrickson's research on resiliency, students in this study, regardless of condition, reported an increase in distress and tension around exam times. However, those in the relaxation conditions were more successful in coping with the effects of this exam stress. In fact, during exam time, the control group reported more negative affect, less vigor, more depression, more confusion, and had a higher overall level of distress than the relaxation groups. Participants in the relaxation conditions reported more positive affect than the control group. Researchers concluded that participants who practiced relaxation regularly generally coped more successfully with the stress of midterm and final exams (Laidlaw et al., 2003).

***PMR and Health Outcomes.*** Emotional stress has long been linked to physical health outcomes. Chronic stress has been associated with decreased immune functioning (Denson et al., 2009). Therefore, strategies that decrease stress and increase positive emotion have important implications for physical health outcomes.

In a meta-analysis investigating the effects of relaxation strategies (including PMR) for cancer patients, participants reported clinically significant reductions in nausea, pain, and physiological arousal (blood pressure and pulse rate), despite wide variations in type of cancer, stage of disease or chemotherapy protocol (Luebbert, Dahme & Hasenbring, 2001). The benefits of PMR on health outcomes have been documented in the research literature and PMR has been used for health promotion, including the reduction of blood pressure, improving insomnia and alleviating gastrointestinal problems. PMR-specific research has found that cancer patients that participated in PMR (with varied regularity) reported less nausea, vomiting, pain and headaches than those in control groups (Campos de Carvahla, 2007; Molassiotis, 2000; Burish & Tope, 1992).

These results are consistent if PMR is practiced only once to if it practiced daily for one week. Participants with pulmonary disease also reported physical changes as a result of PMR (Gift et al., 1992); after listening to a PMR audiotape for 20 minutes a week over a four week period, participants reported less shortness of breath and fewer airway obstructions. The positive health benefits of PMR have also been documented in hypertensive patients who reported reduced blood pressure, pulse rate, perceived stress, and an increase in perceived health (Sheu, Irvin, Lin & Mar, 2003).

## Appendix C

### Empirical Findings on Gratitude

Gratitude can be facilitated experimentally thru relatively simple interventions and experimental evidence implies that gratitude is incompatible with negative emotions as well as pathological conditions. As discussed earlier, gratitude has been shown to be related to both positive and negative mental health outcomes including increases in positive affect, feelings of success, life satisfaction, sleep quality and frequency of physical exercise, as well as less stress, depressive symptoms (Wood et al, 2008; Seligman, Steen, Park, & Peterson, 2005; Emmons & McCullough, 2003, Peterson, Ruch, Beermann, Park,& Seligman, 2007). In addition, gratitude may even go so far as protect individuals from developing mental health problems at all (McCullough et al., 2002). Although there have been few experimental studies, correlational research would suggest the important influence gratitude has on both positive and negative health and mental health outcomes.

***Gratitude and Positive Outcomes.*** Like relaxation, gratitude has been theorized to be related to positive mental health and health outcomes, including having the potential to build psychological resources, enhance social bonds and mitigate against negative feelings (Fredrickson, 2004). Gratitude has also been said to have the ability to broaden thought-action repertoires, initiating the “upward spiral” toward increasing emotional well-being (Fredrickson, 2004).

***Experimental Evidence.*** In a randomized controlled study, participants who were assigned to a gratitude-inducing condition reported an increase in positive emotions and well-being (Emmons & McCullough, 2003). In Study 1, participants were randomly

assigned to a gratitude, hassles, or neutral life events condition and asked to keep weekly records of their affect, coping, health behaviors, physical symptoms and overall life appraisals. Study 2 built on this design, adding another social comparison (e.g., think about ways in which you are better off than others) experimental group to the previous three groups used in Study 1. Participants were then asked to keep daily records of these same measures. Study 3 recruited patients with neuromuscular disease, who were then assigned to either a gratitude or control condition and completed daily reports of affect, well-being, health behaviors and activities of daily living.

All three studies demonstrated positive effects of the gratitude intervention, though results varied somewhat between them. In Study 1, there was a significant main effect of the gratitude intervention on well-being ratings of one's life as a whole and expectations concerning the upcoming week; students who were instructed to write about 5 things they were grateful for over the last week rated their life more favorably on these two items than participants in the comparison (e.g., hassles) group. There was no effect on affect.

Study 2, which asked students to complete a daily gratitude exercise, determined that gratitude did, in fact, increase reports of positive affect significantly more than the two comparison conditions (hassles and social comparison). In the third study, measuring the effectiveness of a daily gratitude intervention in neuromuscular disease patients, those who were asked to record things they were grateful for on a daily basis for three weeks reported significantly higher positive affect than the comparison group which only completed the pre, post and daily measures ( $d=.56$ ). Considered together, the results of these three studies suggest there are benefits to regularly focusing on one's blessings.

Other researchers have found that priming people to think about things they are grateful for has a positive effect on affect (Sheldon & Lyubomirsky, 2006; Watkins, Woodward, Stone & Kolts, 2003). For example, participants in one study were randomly assigned to a gratitude condition in which they were asked to think about the many things in their life, both large and small, that they had to be grateful about (e.g., relationships, sacrifices, opportunities). After four weeks of practicing on their own, participants in the gratitude condition reported an increase in positive affect compared to the control group who was asked to “pay more attention to their life” (Sheldon & Lyubomirsky, 2006).

In another study, students who were instructed to recall things they did over the summer that they were grateful for showed an improvement in affect (Watkins et al., 2003). These researchers then went on to test different methods of inducing gratitude. Specifically, participants were assigned to one of three grateful conditions. In the ‘grateful thinking’ condition, participants were instructed to think about someone (living) for whom they were grateful. In the second ‘grateful essay’ condition, participants wrote a brief essay about the person for whom they were grateful. In the third ‘grateful letter’ condition, participants wrote a letter directly to the person for whom they were grateful. Gratitude, affect, depression, and emotional distress were measured pre and post intervention. Results determined that the ‘grateful thinking’ condition had the strongest effect on affect. In addition, those who reported the highest levels of gratitude reported the highest levels of positive affect.

Teaching people to reflect on the more positive aspects of their lives, including what they are grateful for, has also been found to increase self-reports of happiness (Seligman, Steen, Park & Peterson, 2005). Participants in this large study (N=577) were randomly

assigned to one of six conditions: 1) writing down three things that went well and their causes daily for one week (“Three Good Things”), 2) writing and delivering a letter of gratitude to someone who had been kind to them (“Gratitude Visit”), 3) identifying their signature strengths, 4) applying signature strengths to their lives, 5) writing about themselves at their best, and 6) a placebo control condition in which they described an early memory. Participants completed basic demographic questions, as well as measures of subjective happiness and depression pre and post intervention. All assessments and intervention instructions took place over the internet. Participants were encouraged to print out or write down the instructions for their exercise and to keep them accessible during the week to come and were instructed to return to the website to complete follow-up questionnaires at the conclusion of the one week intervention period.

Participants in the *Gratitude Visit* condition showed the largest positive changes; they experienced a large and significant boost in happiness scores that were maintained one month later. Participants in the *Three Good Things* exercise, despite not experiencing the initial boost in happiness, experienced more long term benefits, staying significantly happier than the comparison groups at the three and six month follow ups (Seligman, et al., 2005).

*Correlational Evidence.* Experimental evidence on the effects of gratitude is scarce; however, correlational studies have demonstrated relations between gratitude and affect, happiness and life satisfaction (Park et al., 2004; McCullough et al, 2002). Correlational studies have found that gratitude is associated with positive affect (average  $r=.52$ ) and is more strongly related to positive affect than to negative affect (Watkins et al., 2003).

In a two-part study examining the relationship between gratitude and daily affect, two groups of participants - those with physical illness (N=96) and college students (N=112) - completed self-report measures of gratitude, affect, life satisfaction, well-being, among others (McCullough, Tsang & Emmons, 2004). Baseline measures in both studies included gratitude, affect and life satisfaction. Participants also kept daily diaries of affect (including gratefulness, intensity of that affect, and situations they felt grateful for (part two only)). In the sample of neuromuscular disease patients, daily diaries were recorded for 21 days, whereas in the college sample, diaries were only recorded for 14 days. Despite the varying samples and methods, findings were consistent: adults with physical illness, as well as college students, who reported higher mean levels of daily gratitude appeared to be more satisfied with their lives ( $r=.31-.30$ ), happier ( $r=.27-.30$ ) and more prone to positive emotionality (higher positive affect;  $r=.27-.38$ ). The baseline ratings predicted the experience of gratitude over the daily diary reporting period. Interestingly, negative affect was not related to mean levels of gratitude in daily mood in either parts of this study (McCullough et al., 2004).

In another multipart study examining the correlates of gratitude in college students, latent factors of gratitude and happiness were correlated .50 (McCullough et al., 2002). Even after controlling for personality and affect, correlations between gratitude and happiness ranged from .33-.37 in an adult community sample (McCullough et al., 2002). This study also found that both the self-report and informant-report measures of gratitude were positively correlated with all of the measures of well-being including life satisfaction, vitality, subjective happiness, optimism, hope, and positive affectivity. Watkins et al (2003) found that the correlation between gratitude and satisfaction with

life ranged from .49-.62 in a three part study of college students. In a large sample of adults, gratitude was among one of the most robust predictors of life satisfaction (Peterson, Ruch, Beermann, Park, & Seligman, 2007).

Having a sense of control has long been linked to positive psychological outcomes. Correlational evidence exists documenting the relationship between gratitude and having an internal locus of control (Watkins et al., 2003). However, this is the only correlational study that I found that documents this relationship, and no experimental studies to date have investigated how inducing gratitude may enhance one's perception of control. Having a sense of control has been associated with less anxiety and depression, and increased well-being and life satisfaction (Skinner, 1996). Therefore, if gratitude can increase a person's perception of control, this may have important clinical implications for positive mental health outcomes.

The mounting evidence makes gratitude interventions particularly appropriate for individuals who want to increase their happiness and well-being (Wood et al., 2007). Interestingly, and similar to research on resilient people, grateful people do not deny or ignore the negative aspects of life. They experience negativity, but also are able to find positive meaning and experience positive states simultaneously (Emmons, 2009).

### ***Gratitude and Negative Outcomes.***

*Experimental Evidence.* Gratitude interventions have also been shown to decrease depressive symptoms and these effects have been documented over a six month follow up period (Seligman et al., 2005). In this internet-based study discussed earlier, participants were randomly assigned to one of five positive psychology interventions or a placebo control. Participants in the gratitude condition ("Three Good Things") not only reported

less depression, but also continued to engage in the gratitude activity on their own beyond the study's conclusion which researchers believed contributed to continued beneficial outcomes.

As discussed earlier, negative affect is also negatively associated with gratitude and experimental evidence has demonstrated that those in gratitude-inducing conditions report significantly less negative affect than control groups (Sheldon & Lyubomirsky, 2006; Emmons & McCullough, 2003). It is important to note, however, that negative and positive affect are distinct constructs that function differently from one another, particularly under conditions of stress (Folkman & Moskowitz, 2000; Fredrickson, 2003; McCullough, Tsang, & Emmons, 2004).

*Correlational Evidence.* Correlational research has consistently found gratitude and thankfulness to be negatively associated with depression in non-clinical samples. In their correlational study of college students, depression was negatively correlated with both self ( $r=-.30$ ) and informant-report ( $r=-.26$ ) measures of gratitude (McCullough et al., 2002).

Being “thankful” has been shown to be related to less risk for depression, as well as anxiety and substance abuse in a large epidemiological study of over 2500 twin pairs (Kendler, Liu, Gardiner, McCullough, Larson & Prescott, 2003). In this study, disorders such as major depression, generalized anxiety, phobia, panic, nicotine dependence, alcohol and drug dependence, antisocial behavior and bulimia nervosa were assessed during a personal interview. A Thankfulness scale was created from a factor analysis of gratitude and religious coping items that reflected feelings of thankfulness.

Thankfulness, in fact, was associated with a decreased risk for all disorders, with the

exception of panic and adult antisocial behavior (Kendler et al., 2003). Gratitude has been found to be associated with fewer depressive symptoms in more clinical samples as well. For example, neuromuscular disease patients who reported lower mean levels of gratitude at baseline also reported more depressive symptoms at baseline ( $r = -.22$ ; Emmons & McCullough, 2003).

Researchers highlight, however, that the relationship between depression and gratitude is lower than the relationship between gratitude and positive affect. Thus, gratitude is more closely linked to positive affective traits than to negative ones (McCullough et al., 2004). Taken together, these results imply that gratitude is “incompatible” with negative emotions and pathological conditions, illuminating the potential protection it may offer against psychiatric disorders (Bono & McCullough, 2006).

***Gratitude and Health Outcomes.*** Correlational and experimental evidence both suggest that gratitude is related to physical health, including improved sleep quality (Wood et al., 2009), increased amounts of exercise and fewer health complaints (Emmons & McCullough, 2003). After a ten week gratitude intervention in which college students wrote about five things they were grateful for weekly, participants in the gratitude condition reported more time exercising and fewer physical symptoms compared to groups who wrote about either weekly hassles or neutral events. However, the effects of gratitude on immunity are still largely unknown. More research is needed to clarify this relationship as well as explore the potential role variables such as positive affect may have in the relationship between gratitude and health (Wood, Joseph & Linley, 2007).

## Appendix D

### Empirical Findings on Moderator Variables

**Resilience.** If positive emotions can mitigate the effects of stress after the stressor has occurred, perhaps they may also have important implications for enhancing psychological resilience. Resilience has been defined from multiple perspectives. The first describes it as a personality trait that allows people to bounce back and adapt to negative emotional experiences (Lazarus, 1993). Fredrickson's research has operationalized resilience in this way, and expanded the idea to suggest that, though a stable personality trait, resilience can be enhanced by recurrent experiences of positive emotions (Tugade & Fredrickson, 2004).

Operationalizing resilience as a personality trait, however, is not the only way the literature has conceptualized this construct. Others conceptualize it as a dynamic and complex process in which individuals adapt positively after encountering adversity (Luthar, Cicchetti & Becker, 2000), and views resilience more as an outcome, specifically defined by the ability of people to maintain healthy levels of functioning even after experiencing a disruptive event (Bonnano, 2004). Resilience from this perspective is often measured by the lack of self-reported symptoms (i.e., less depression, or anxiety; Bonnano, 2004).

When defined as a personality trait, a range of self-report, observational and longitudinal studies has supported the relationship between resilience and positive emotions. Resilient individuals report experiencing more positive emotions in response to stressors, both in the laboratory and in daily life (Tugade & Fredrickson, 2004;

Fredrickson, Tugade, Waugh & Larkin, 2003). This research suggests that positive emotions function as both an outcome and mechanism of effective coping (Fredrickson, Tugade, Waugh & Larkin, 2003; Tugade & Fredrickson, 2004).

The relationships between trait resilience, positive emotions, and stress were investigated in a three-part lab based study intended to expand upon the broaden and build theory (Tugade & Fredrickson, 2004). The first part of this study used physiological measures to examine how positive emotions were related to cardiovascular recovery from negative emotional arousal (i.e., the speech preparation task). In this study, university students completed measures of mood and resilience before being asked to produce a speech. Baseline physiological data were gathered, the stress task was induced, cardiovascular reactivity was monitored, and participants were asked to report their mood, subjective emotional experience, and cognitive appraisal of the stress task. Results showed that trait resilience was associated with more positive affect ( $r=.38$ ), and shorter cardiovascular arousal ( $r=-.26$ ). Positive emotions also mediated the relationship between resilience and arousal ( $b=.16$ ). Study 2 replicated these findings and also demonstrated that positive emotions and trait resilience were related to how stress was evaluated (i.e., threat or challenge). Participants who appraised the stress-inducing speech task as a positive challenge were able to more successfully regulate their negative emotions, showing shorter cardiovascular recovery time and more positive affect. Mediation analyses revealed that, for those who experienced the task as threatening, positive emotions partially accounted for the relationship between resilience and cardiovascular recovery time ( $r=-.18$ ). These results again supported the important role positive emotions have in enhancing resiliency.

In part three of this study, resilient individuals not only reported experiencing more positive emotions ( $r=.32$ ), but also found more positive meaning ( $r=.27$ ) when asked to write about their current problems. Again, these data demonstrated the powerful role positive emotions had in decreasing stress. Positive emotions, in fact, mediated the relationship between resilience and meaning-finding ( $r= .16$ , Tugade & Fredrickson, 2004).

From these studies, Fredrickson and colleagues have concluded that positive emotions mediate the relationship between resilience and stress reactivity and that resilient people use positive emotions to find meaning in negative situations. What is interesting, however, is that their studies show that resilient individuals experience positive emotions in the midst of stressful experiences, and alongside of negative emotions. Although one might argue that individuals use positive emotions as a way to avoid or ignore their negative feelings, research suggests that resilient people still experience negative emotions and recognize stress when it is happening. Resilient people, however, go on to experience positive outcomes in spite of stress and negativity (Tugade & Fredrickson, 2004). For example, in one study in which stress was induced using the speech preparation task, those who reported higher trait resilience experienced equally high levels of anxiety and frustration as their less resilient counterparts. However, they reported experiencing more positive emotions at the same time. Researchers hypothesized that these resilient individuals may have been using strategies such as relaxation and optimistic thinking to cultivate positive emotion, which subsequently had advantages for how they coped with stress.

I could find only one prospective study investigating the effect of positive emotions and trait resilience on future stressors. Fredrickson et al. (2003) collected baseline information on a group of university students in the months before September 11, 2001. Pre-9/11 measures included reports of resilience, affect, satisfaction with life, optimism, tranquility and neuroticism. Following the unfortunate terrorist attacks, they realized they had inadvertently gathered prospective data on the effects of stress and participants were recruited to complete follow up assessments. Post-crisis measures included positive/negative emotions, current problems, positive meaning finding, depressive symptoms, life satisfaction, optimism, and tranquility. They hypothesized that those who reported more resilience would also have fewer depressive symptoms and that the relationship between resilience and depression would be mediated by positive emotions post crisis (approximately 8 months later).

The results illuminated several interesting points. Students who were *higher* in trait resilience also tended to be *lower* in neuroticism ( $r=-.50$ ). Pre-crisis resilience was associated with life satisfaction ( $r=.32$ ) and optimism ( $r=.35$ ) measured post 9/11. Resilient participants were also in better moods ( $r=.32$ ), reported experiencing positive emotions more frequently ( $r=.59$ ), and reported fewer symptoms of depression ( $r=.40$ ) after 9/11. Positive emotions mediated the relationship between resilience (measured pre-9/11) and positive change in optimism, life satisfaction and tranquility. Again, the resilient group identified feeling equal amounts of negative emotions such as anger, fear, disgust, stress and problems following the attacks, but these individuals were able to offset their negative experiences by using positive emotions and avoided being emotionally overwhelmed. Additionally, participants who were more resilient were more

likely to find positive meaning ( $r=.44$ ) within the problems they faced following the September 11<sup>th</sup> attacks. The authors claimed that this resiliency “predisposed” participants toward positive affectivity (Fredrickson et al., 2003).

This study suggests that cultivating positive emotions, especially in the aftermath of a traumatic life event, may improve subjective emotional experiences, undo physiological arousal, enhance coping, minimize mental health problems and encourage psychological thriving (Fredrickson et al., 2003). Optimism and positive affect were identified as potential “resources” that can be accessed repeatedly in response to stressful life events.

Longitudinal research suggests that positive emotions predict change in trait resilience and life satisfaction (Cohn, Fredrickson, Brown, Mikels & Conway, 2009). Students were followed for one month and emotions were assessed daily. Data were analyzed to examine the relationship between emotions, resilience and life satisfaction. Results suggested that participants who experienced frequent positive emotions were more satisfied with their lives because they built personal resources to help them deal with a wide range of life’s challenges, thereby increasing their resilience. Two mediator models were tested in this study. The first significant mediator model found that positive emotions were the mechanism by which pre and post resilience scores were related. The second significant model found that change in resilience scores, in fact, mediated the relationship between positive emotions and increased life satisfaction. The authors concluded by suggesting that happy people become more satisfied with their lives because of the resources they develop for living well (Cohn et al., 2009).

Resilience in the face of stress has been said to be characterized by five main factors including positive emotions, cognitive flexibility, meaning, and coping style (see

Southwick, Vythilingam and Charney, 2005 for a review). Southwick and colleagues discussed the important role of positive emotionality and optimism in the capacity to tolerate stressful events, and that these variables have been associated with other important outcomes such as reduced rates of stress-related illness, service usage, and mood disturbances. Failing to recover quickly from stressful events, in fact, has been theorized to increase one's vulnerability to developing anxiety and other mood disorders (Southwick et al., 2005). Defining resilience as less depression, substance abuse, and life stress, Bonanno, Galea, Bucciarelli and Vlahov (2007) identified several predictors of resilience including age (over 65), race-ethnicity (Asian & Other), gender (female), education level (college educated), social support and more income.

Though resilience has been operationally defined in different ways, a clear picture begins to emerge from the research literature: studies consistently report an association between resilience and positive emotion (Ong, Bergeman, Bisconti, & Wallace, 2006; Tugade et al., 2004) and resilient people report more life satisfaction and optimism than their less-resilient counterparts. They also have lower levels of neuroticism. Positive emotions mediate the relationship between resilience and well-being following stressful experiences. Resilient people also have the unique ability to bounce back from stress faster than others, are more apt to find benefits, and rise to the challenge of a stressful situation. Self-regulation, mental flexibility, and coping are all enhanced by the experience of positive emotions; the physiological response to stress is reduced and positive emotions can help people to find meaning in times of stress. For the purposes of this study, resilience is conceptualized as the ability to maintain positive psychological and physical functioning (e.g., less distress) following a stressor.

*Neuroticism.* Previous research has found that neuroticism can increase one's vulnerability to psychological problems including depression, posttraumatic stress symptoms, panic attacks, and other mood disorders (see Lahey, 2009, for a review). In a recent meta-analysis that examined the relationship between neuroticism and disorder symptoms, those with clinical disorders (e.g., Generalized Anxiety) typically displayed high levels of neuroticism (Malouff, Thorsteinsson, & Schutte, 2005) and neuroticism has been shown to be related to all disorders in the Diagnostic and Statistical Manual (APA, 2004) (Malouff et al., 2005). Both self and peer ratings have demonstrated that positive emotions (e.g., joy, love, contentment) are also negatively associated with neuroticism (Shiota, Keltner & John, 2006). Neuroticism has also been associated with physical health conditions such as HIV progression, somatic complaints, increased service usage, and mortality (Lahey, 2009). Studies also consistently suggest that individuals who have higher levels of neuroticism tend to appraise events more negatively than do individuals with lower levels (Lahey, 2009).

Three explanations have been proposed to describe the link between neuroticism and mental health problems (Lahey, 2009). First, genetics are said to influence neuroticism as well as the mental disorders that are correlated with neuroticism. Second, people higher in neuroticism report more stressful events and daily hassles, including more difficulty with relationships and social support. Finally, they have larger physiological responses to stress (Lahey, 2009).

Given its important role in psychological and physical outcomes, it is important to assess how neuroticism might affect the effectiveness of the gratitude and PMR interventions. Positive emotion research has highlighted the importance of assessing this

personality trait because it may predispose people toward negative affectivity (McCullough et al., 2002). In fact, neuroticism is negatively related to resilience. Fredrickson and colleagues (2003) found a negative association ( $r=-.50$ ) between resilience and neuroticism in a baseline assessment of a sample of college students pre and post crisis. The authors concluded that more resilient people share a common low-neuroticism trait.

Although no research could be located on the relationship between neuroticism and relaxation, neuroticism has been linked to gratitude in several studies. In a correlational study investigating correlates of signature strengths and well-being, Park, Peterson and Seligman (2004) found that neuroticism was negatively associated with gratitude ( $r=-.36$ ) and life-satisfaction ( $r=-.50$ ). Similarly, trait gratitude was found to be negatively related with neuroticism in a sample of college students (Wood et al., 2008). Other research has found that grateful people are consistently less neurotic ( $r=-.30$ ) than those who are less grateful (McCullough et al., 2002). McCullough's research also suggests that gratitude may be a "characteristic adaptation" used by less neurotic people and that it is important to account for neuroticism in gratitude research (McCullough et al., 2002).

These data suggest that neuroticism is associated with less well-regulated emotional responses to stressful events. Given that those high in neuroticism are prone to more negative affect, and thus may respond more intensely to stressful events, neuroticism may potentially moderate the effect of psychological interventions on mental health outcomes.

*Moderation Effects.* Defined as a qualitative (e.g., gender) or quantitative (e.g., level of distress) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable (Baron & Kenny, 1986), moderating variables alter the strength of the relationship between these two variables (Frazier, Tix, & Barron, 2004). Moderators often involve characteristics of the individual (e.g., gender, anxiety level) or experimental condition (e.g., gratitude or relaxation). Moderators attempt to answer the question *for whom* a treatment is most effective.

Although a solid body of evidence suggests that neuroticism is associated with many mental and physical health outcomes and neuroticism has been found to moderate the relationship between a negative event and subsequent negative emotion (Larsen & Ketelaar, 1991), research on moderators of the effectiveness of PMR and gratitude interventions is lacking. In fact, no study was located that investigated moderators of the effectiveness of a PMR intervention.

Although never tested specifically, gratitude researchers have suggested that people who are prone to negative emotions (e.g., high in neuroticism) also experience more negative emotional reactions to unpleasant events (McCullough et al., 2004). Given this, neuroticism will be investigated as a potential moderating variable that may affect the effectiveness of the gratitude and PMR interventions. Specifically, it is hypothesized that neuroticism will moderate the effectiveness of both interventions on mental health outcomes. That is, participating in gratitude or relaxation exercises may be less effective for people who are more neurotic given their susceptibility to experiencing higher negative emotions in general.

In a similar way to, resilience may also moderate the effectiveness of the interventions in that people who are more resilient at baseline may benefit from the PMR and gratitude exercises. Previous research has determined a robust relationship between positive emotions and resilience (see Tugade, Fredrickson & Feldman, 2004 for a review). Resilience has been found to predict reports of positive emotionality post stress induction and was positively associated with positive affect ( $r=.38$ ; Tugade et al., 2004). This study also found that resilience was negatively correlated ( $r=-.26$ ) with stress reactivity (e.g., cardiovascular arousal) indicating that those with higher trait resilience measured at baseline evidenced faster cardiovascular recovery from negative emotional arousal. Tugade et al. (2004) reported that resilient individuals continue to experience positive emotions in the midst of stressful events, which may explain their ability to recover successfully. They hypothesize that resilient people may be better able to understand the benefits associated with positive emotions and use this knowledge to cope with negative events. Despite resilience being theorized to be a “personal resource” that helps people cope with stress, it has yet investigated as moderating the relationship between gratitude or PMR and mental health outcomes. It is expected that those who report higher trait resilience as measured at baseline will also report more positive affect and mental health benefits from the interventions.