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Catalytic Resilience Practices: Exploring the Effects of Resilience and Resilience Practices through Physical Exercise

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Exploring the Effects of Resilience and Resilience Practices through Physical Exercise

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Abstract

Resilience is of increasing interest to researchers and practitioners as the organizations where they work have become increasingly complex and dynamic. The recent COVID-19 pandemic has only magnified its importance. COVID-19 provides a unique opportunity to study how people navigate challenges and face adversity to be resilient both at home and at work. The main question organizations, teams, and employees are asking is how individuals gain and sustain resilience. To that end, theory and research has suggested a vast array of practices or strategies that individuals can engage in to build resilience to be better prepared to overcome adverse situations or challenges. However, the number of practices can be overwhelming and determining which practices should take precedence is unclear. The purpose of this study is to investigate a subset of the most promising resilience practices (i.e., physical exercise, sleep, active coping, growth reframing, use of social support, and applied mindfulness) to determine which are most likely to act as catalysts for other practices and ultimately be related to higher resilience. Growth reframing, exercise, and active coping were shown to be significant catalysts for other resilience practices strengthening the spillover model.

Keywords: resilience, exercise, physical activity, resilience strategies, resilience practices, catalytic behaviors, spillover behaviors

Chapter I: Introduction and Literature Review

An individual's need for resilience is becoming increasingly important as both the workplace and society become more dynamic and complex (Snowden & Boone, 2007; Uhl-Bien et al., 2007). Furthermore, organizations value resilient individuals because they can perform and flourish in today's environment. The good news is that resilience and resilience practices can be learned and developed to address immediate crises or long-term challenges (Bonanno, 2004; Hamel & Valikangas, 2003; Luthans et al., 2006; Masten, 1994, 2001; Masten & Reed, 2002; Youssef & Luthans, 2005). However, advice on how to increase one's resilience typically includes long lists of practices that individuals should engage in (Ackerman, 2017; Luthans et al., 2010; Tabibnia & Radecki, 2018; Yost, 2016). The lists can be overwhelming and there is limited research on where one should start. For example, limited literature has been devoted to identifying what practices or strategies might be best to start with as potential catalysts for other resilience practices. For instance, exercise could lead to better sleep which in turn increases a person's overall resilience. If strong, learnable, catalytic practices can be identified, the question of where one should start can be proactively cultivated into habits or ways of thinking that will have the maximum impact on subsequent practices and overall resilience (Duhigg, 2012; Kruglanski & Szumowska, 2020). When studying the idea that resilience practices catalyze one another in order to build resilience, the word *contagious* could also be used to describe the phenomenon. Contagion in essence is similar to being catalytic or spilling over. Studying contagion of resilience practices could be the beginning of seeing how resilience could be *catalytic*- within ourselves and those around us. This study will examine the potential spillover effect of one resilience practice to another within ourselves, to determine if there is a best resilience practice to start with because it engages other practices in one's everyday life.

Resilience takes place at individual (Luthans et al., 2006), group/community (Norris et al., 2008), organizational (Vogus & Sutcliffe, 2008), societal (Allenby & Fink, 2005; Raghavan & Sandanapitchai, 2019), and cultural (Dahlsgaard et al., 2005) levels. There is an increasing need for understanding resilience at multiple levels (Britt et al., 2016). While resilience at team and organizational levels is not what this study is focused on, studying resilience practices at the individual level does connect to other levels of resilience. In complex adaptive systems (CAS) habits and processes can influence individuals and the systems in which they operate (Schneider & Somers, 2006). CAS theory establishes that a leader may have more success introducing resilience practices as a company culture or habit by leveraging the processes and mechanisms already in place within the organization (Casti, 1994). Exercise contagion has been studied in terms of what health behaviors you share with colleagues through fitness tracking friends, pictures you share on a work email, chat or on your social media (Aral & Nicolaides, 2017; Church, 2017). With the nature of individuals working from home, encouragement of individual resilience practices may be catalytic both within oneself and to colleagues.

This is a unique time to collect data on resilience of all peoples during a pandemic and uncontrolled stress. The purpose of this study is to see if some practices are predictive of other resilience practices which in turn are related to a person's overall resilience.

More specifically, I propose that exercise will be related to a person's resilience both directly and by serving as a *catalyst* that triggers other resilience practices, which in turn, will lead to greater resilience. Furthermore, I propose that exercise will be the strongest catalyst leading to other practices or strategies that combine to increase one's overall resilience. To understand these relationships, I will first discuss the theoretical framing to guide this study. This includes a review of how a person theoretically chooses resilience practices based on what

practices are habitual or take more concentration (System I and II Thinking) and how one resilience practice theoretically can catalyze or spillover to another resilience practice (Behavioral spillover). Second, a review of the concept of resilience and how resilience is defined for this study will be discussed. Third, I will discuss the practices that are most likely to lead to resilience with a primary focus on exercise as a cause of resilience and catalyst for other resilience practices: sleep, active coping, growth reframing, use of social support, and applied meditation. This forms the basis of an integrated model and hypotheses for the proposed relationships. Throughout these discussions the terms *resilience practices* and *resilience strategies* will be used interchangeably to describe the varying approaches individuals use to build their resilience.

Theoretical Framing

Choosing Resilience: System I vs. System II Thinking

Given the vast array of behaviors, mindsets, and coping strategies that have been identified as being related to resilience (e.g., Ackerman, 2017; Carver et al., 1989; Luthans et al., 2010; Tabibnia & Radecki, 2018; Yost, 2016), the challenge becomes choosing from the overwhelming list, the sub-set of practices are best employed. Ideally, this is choosing the practices in advance that best increase the probability of resilience. Human decision-making capabilities have been described in what is known as system one or peripheral, and system two or central processing (Kahneman, 2011; Petty & Cacioppo, 1986). System one is one's automatic reaction, with little or no effort. System two is the effortful mental concentration that demands one to participate in more complex systematic thinking. Examples of cognitive tasks performed by system one are driving home from work, one's morning routine, and reading familiar words. Examples of cognitive tasks performed by system two are initially learning to drive, developing

a new morning routine, and reading unfamiliar words. Over time, system two practices can become habits and thus be routinized into system one thinking. For example, driving a car initially takes concentration but eventually a drive from home to work becomes routine habit. By analogy, to increase one's resilience, the goal is to convert system two resilience practices (e.g., exercise, mindfulness) into system one habits; that is, move away from constant attention to manage resilience practices, especially in highly complex, demanding environments and convert them to regular habits. A critical system two question then becomes: which habits are the best ones to establish? The challenge is to identify and establish a sub-set of habits that increase one's resilience capacity directly and that also "spillover" to trigger other resilience behaviors that also increase overall resilience.

Similar questions have been asked in other areas of psychology such as the study of self-control. Researchers have been calling for theory that moves beyond thinking of self-control as desired behavior *at the time of an event* to thinking about self-control *as a process* that includes behaviors and mindsets before, during, and after a self-control event so a person is not at the mercy of trying to manage self-control when it is being tested the most (Hofmann et al., 2009). In the same way, one doesn't want to try to manage resilience only at the time it is needed but establish system one resilience practices before resilience is needed. Recent research suggests that habitual behavior is goal-driven (Kruglanski & Szumowska 2020).

Researchers have explicitly called for proactively building resilience practices before they are needed at the organizational level, moving beyond resilience as simply surviving a crisis event to thinking about resilience as a process (Roux-Dufort, 2007; Williams, et al., 2017) that includes practices and mindsets adopted before an event (preventing crisis), during a challenging event, and after the event (recovery and growth from challenges; Fisher et al., 2018). To date,

limited research has been conducted on adopting individual resilience practices within a process model. That is, research is needed to identify the resilience practices that can be adopted ahead of time to build later resilience capacity.

Behavioral Spillover

Spillover theory has been used throughout many disciplines, often between economics and psychology to explore when engagement in a behavior influences engagement in other behaviors, or when a behavior in one area is heightened or decreased in another area. Practically speaking, many resilience strategies are discussed in the literature, but few say, "start with this strategy" or "if you engage in this strategy these ones then come more naturally." The Spillover Crossover Model (SCM; Bakker et al., 2012, 2009, 2008) describes three aspects of spillover: (a) how similar behaviors spillover between one another by engaging in just one initially, (b) engagement in one behavior or feelings in one area of your life spillover over to engaging in the same behavior or feelings in additional contexts of one's life (i.e., work, home, church, etc.), (c) and engaging in a behavior can crossover to others like a spouse or child (i.e., I am engaging in lots of exercise, those close to me are now engaging in more exercise). For the purposes of this study, the focus will be on the spillover between similar behaviors aspect of this model. Furthermore, there are three types of behavioral spillover: promotion, permitting, and purging (Dolan & Galizzi, 2015). The hypothesis in this study is that resilience practices are promotional; that is, it is proposed that engaging in one resilience practice will promote positively engaging in other resilience practices; however, the study will also be able to detect if behaviors purge (inhibit) one another (e.g., exercise will increase mindfulness rather than inhibit it). Promotion spillover helps guide the questioning in organizations around "if I were a manager or leader and could give my employees one really good place to start in order to be more resilient, what would

I tell them to do?" Identifying those catalytic resilience practices allows leaders to get those 2 for 1 behaviors from employees- the "gateway" behavior.

Multiple health behavior change (MHBC) research indicates that change in one health behavior can increase (or decrease) engagement in other health behaviors (Prochaska, 2008; Prochaska et al., 2008, 1992). Multiple health behavior change research has looked at cost effective interventions that promote significant change in the one targeted behavior that then promotes changes in other health behaviors. For example, in a multiple health behaviors study, six-month follow-up assessments indicated that those who were assigned exercise as the targeted catalyst behavior had significantly reduced risky health behaviors such as stress, poor diet, and smoking (Prochaska et al., 2012, 2008). Consequently, this single intervention appeared to catalyze other behaviors related to the targeted behavior, thus increasing the chances of effective change in multiple health behaviors (Prochaska, 2008).

A similar promotion spillover pattern can be seen in the pro-environmental behavior literature. Pro-environmental behavior in one area causes one to engage in (or not engage in) related behaviors (Dolan & Galizzi, 2015). For example, engaging in the choice to recycle has been shown to catalyze decreased use of excess packaging (Thøgersen, 1999), energy conservation, water conservation, composting, and increased use of reusable bags (Berger, 1997). This is positive promotion spillover and provides insights into how one positive behavior might trigger other positive behaviors. Promotion spillover typically occurs in two ways: (a) engaging in one behavior can catalyze engaging in another similar behavior, and (b) engaging in a behavior causes lack of or decreased engagement in other behaviors (Truelove et al., 2014).

Theoretical Causes of Promotion Spillover

From a physiological perspective, it is proposed that physical exercise spills over into other practices such as healthy eating, sleep, increased mental acuity, and mood. Physical exercise can catalyze cognitive and behavioral resilience practices, which in turn, increase one's overall resilience (Blakely et al., 2004; Tucker & Reicks, 2002). Cognition depends on one's physical health as does sleep, social interaction, mindfulness, and other resilience factors (Childs & de Wit, 2014; Prochaska, 2008; Zhang & Chen, 2019). But there are also likely cognitive causes of spillover. One of the theories that has been proposed to explain the spillover effect is cognitive dissonance theory (Bem, 1972; Festinger, 1957), where in order to avoid the discomfort of cognitive dissonance, engagement in one behavior increases the likelihood of engagement in another similar behavior. For example, engaging in exercise can cause a person to also consider engaging in other health behaviors such as increased fruit and vegetable consumption (Panos, 2018). Thus, the framework of behavioral promotion spillover can be used to explain why increased behavior in one resilience practice such as exercise can act as a catalyst to the increase of engagement in other resilience practices that one may not have engaged in without exercise. For example, someone who engages in exercise to increase their resilience may be more likely to experience cognitive dissonance when eating unhealthy food or failing to get a good night's sleep.

To understand how the spillover construct is related to resilience, it is important to define resilience including how it has historically been operationally measured and identify the practices or strategies that research suggests can build one's resilience capacity.

Relationship Between Resilience and Resilience Catalysts

Resilience

Resilience is a complex construct that is receiving increasing attention in the literature at the individual (e.g., Tabibnia & Radecki, 2018) and organizational (e.g., Fisher et al., 2018) levels. The definition and operationalization of resilience has varied. For example, several early measures of resilience confused the construct by defining and evaluating precursors of resilience, including social support, emotional regulation, optimism, and commitment (Fisher et al., 2018; Luthans et al., 2007). Moreover, what constitutes resilience has also been debated. Models have differentially defined resilience as many things such as, surviving adversity, returning to previous levels or states, and/or bouncing back, adapting to stressful circumstances, to not become ill despite significant adversity, to overall functioning and more. For this study, resilience is operationalized as more than just getting by and adopts the definition from Luthans, et al. (2007), that resilience is the ability to move through challenges in a way that leads to increased positive adaptation to meet present and future challenges. Thus, resilience is not only survival but the ability to take on adverse or positively challenging experiences and to "bounce forward" and grow from them (Block & Block, 1980; Block & Kremen, 1996; Folke, 2006; Lazarus, 1993; Luthans et al., 2007).

This understanding of resilience is consistent with current thinking that resilience can go beyond merely surviving a challenge but using what is learned to take on future challenges (Bonanno & Diminich, 2013; De Meuse, 2017; Dweck, 1986; Lombardo & Eichinger, 2000). It is associated with a large number of behavioral, psychological, and emotional outcomes such as a greater capacity for growth in challenging times (Dweck, 1986), less burnout, lower absenteeism (Avey et al., 2006), greater resistance to stress (Childs & de Wit, 2014; Ong et al.,

2006), and overall greater physical health and sense of wellbeing (Ho et al., 2015; Tugade, & Fredrickson, 2004). Given how strongly resilience is related to well-being, understanding the causes of resilience is important.

Resilience Catalysts

Several behavioral, cognitive, and emotional practices have been identified that increase resilience including nutrition/diet, gratitude, stress perception, cognitive therapy, decision making skills, error management, seeking feedback, reflection, deliberate practice, locus of control, adaptability, future self, reward system, humor, optimism, exercise, sleep, social support, active coping, growth reframing, applied mindfulness, and many more (Kuntz et al., 2017; Luthans et al., 2010; Tabibnia & Radecki, 2018). The sheer number of potential cognitive and behavioral practices can be overwhelming. But some practices offer more potential to help individuals increase their resilience. Specifically, four criteria help identify particularly promising practices: (a) Which practices have research support that they are related to resilience? (b) Which practices are behaviors that can be learned and instilled as habits? (c) Which practices are most likely to "spill over"? and (d) Which practices help people be resilient in the moment and over time?

Based on this narrowing criteria, six resilience practices emerge: exercise, sleep, active coping, growth reframing, social support, and applied mindfulness. Furthermore, exercise in particular has been shown to have an abundance of benefits both psychologically and physiologically and thus, may not only lead to resilience but act as a catalyst for other behaviors. Similar to the hierarchy of needs, there is reason to believe that physiological practices that promote one's health is the first strongest step in order to then best engage in cognitive, social, or

emotional coping mechanisms. For example, exercise has been said to allow one to have a clearer head or elevated endorphins activating one's need to want to socialize with others.

To begin, research will be reviewed on how exercise is related to resilience and is likely to trigger other resilience practices. Then, the other resilience practices will be reviewed in turn.

Literature Review of Resilience Catalysts

Exercise

Physical activity or exercise is defined and conceptualized at three different levels: Vigorous exercise, moderate exercise, and light exercise. Physical activity and exercise will be used interchangeably to describe any bodily movement increasing the heart rate, whether that be a planned and structured exercise session or movement from normal activities. Furthermore, all have been shown to have great benefit on the body and mind when done 20-30 minutes a day, 3-5 days a week (Haskell et al., 2007; Holmes, 2014; Pate et al., 1995). Vigorous exercise includes activities that increase heart rate and breathing such as heavy lifting, aerobics, or bicycling. Moderate exercise increases heart rate from resting and makes breathing slightly harder than normal and includes activities such as carrying light loads, or doubles tennis. Light exercise is low exertion movement such as a brisk walk from place to place for pleasure, sport, or daily routine.

Research suggests that exercise leads to many positive outcomes including wellbeing and resilience (Childs & de Wit, 2014; Zhang & Chen, 2019). Exercise has been theorized to promote both physical and mental health through enhancing one's resilience to stress, stress exposure, chronic stress (McEwen, 2007), anxiety, depression, and anger (Conn 2010a; Conn 2010b; McDonald et al., 1991; Hassmén et al., 2000). Physical activity can also promote energy, relaxation, and higher quality sleep (DiLorenzo et al., 1999; Youngstedt, 2005), boost one's

immune system (LaPerriere et al. 1990), and increase positive affect, cognitive functioning, and executive functioning (Reed & Buck, 2009). Organizations also have a stake in the physical activity of their employees because those who engage in more physical activity are able to reduce work-related stress and have higher attendance rates due to mental and physical wellbeing (Conn et al. 2009; Proper et al., 2006). Childs and de Wit (2014) studied these theories by looking at regular exercisers and more sedentary individuals and found that those who exercise exhibit smaller declines in positive affect during a challenging or adverse situation. Many people do not get enough exercise to experience these beneficial effects. Studies conducted during COVID-19 describe how physical activity impacts our mental, psychological, and physical wellbeing (Amatriain-Fernández, 2020; Chen et al., 2020; Matias et al., 2020).

Exercise measures have been most used and validated over the years by assessing the type of exercise, how long exercise was performed, and how many days that exercise occurs in a week. Technology and fitness trackers have increased in usage. Unfortunately, they have been shown to have a large error range. One of the most common assessments of exercise, that has been shown to be reliable and related to actual exercise levels is the International Physical Activity Questionnaire Short Form (IPAQ-SF) which tracks type of exercise, duration of exercise, and the number of days the exercise occurs in a week to assess a person MET level as described above (Craig et al., 2003).

Research suggests that exercise is not only related to resilience and other outcomes but is also related to other resilience behaviors. Through both neurological and biological effects, exercise acts as a catalyst for several other behavioral and cognitive practices including sleep (Singh et al., 1997), active coping, growth reframing, social support (Childs & de Wit, 2014), and applied mindfulness (De Bruin et al., 2017). In terms of spillover, there is reason to believe

that the effects of exercise catalyze both cognitive and behavioral resilience practices, which in turn, further increase one's overall resilience (Blakely et al., 2004; Tucker & Reicks, 2002). Thus, exercise is hypothesized to be a "gateway behavior" so that when a person exercises, they feel the benefits of the exercise, thus engaging in other behaviors that are related to the health or exercise benefits (Tucker & Reicks, 2002).

Sleep

Research on sleep suggests it includes two important dimensions: the quality of how well one has slept (i.e., staying asleep, number of times waking up, etc.), and quantity of sleep time or if one feels one is getting enough sleep (Barnes, 2012; Barnes et al., 2011; Litwiller et al., 2017). Sleep has been associated with physiological, psychological, and physical well-being (Litwiller et al., 2017; McCuistion, 2016). When it comes to the workplace, there is evidence that poor sleep quantity and quality are closely tied to important physiological processes such as inadequate information processing, reduced task performance, and increased accidents (Hsieh et al., 2009; Kling et al., 2010; Mullins et al., 2014). Sleep quality and quantity is shown to be related to employee performance, safety, health, and attitudes (Litwiller et al., 2017). Poor sleep quality is common in the U.S. (Bixler et al, 1979; Karacan et al., 1976; Mellinger et al., 1985), with more than 30% of Americans getting less than 6 hours of sleep in one sleeping session particularly during work nights (Luckhaupt et al., 2010). Low quality sleep is shown to have significant negative effects on mental condition (Ford & Kamerow, 1989; Sivertsen et al., 2009), physical condition (Sivertsen et al., 2009), and capacity for other behaviors such as quality of social relationships (Totterdell et al., 1994).

Investigations on sleep and the measurement of sleep have supported the construct's diverging sub-scales of sleep quality and sleep quantity as two important dimensions of sleep

(Barnes, 2012; Barnes et al., 2011) and their measurement has been shown to be reliable and valid (Dewald et al., 2010). Quality of sleep is most often measured through self-report measures (Litwiller et al., 2017; Min et al., 2014). While sleep in relation to resilience has not been thoroughly examined, it is believed to be both directly and indirectly correlated (McCuistion, 2016). Additionally, individuals with higher quality and quantity of sleep should be able to function more effectively in challenging times, thus having a larger capacity to be more resilient.

Active Coping

Active coping is defined as "taking active steps to try to remove or circumvent the stressor or to ameliorate its effects" (Carver et al., 1989, p. 268). It is the extent to which one can regulate one's feelings about an adverse or challenging event and can engage in actions to reduce anxiety in those moments. Active coping is a method that tells the brain one is in control of doing something about the situation.

Active coping is considered a resilience practice that allows one to approach tough times with positive emotions and coping strategies to bounce back (Folkman & Moskowitz, 2000, 2004). Examples of active coping strategies include concentrating efforts on doing something about one's situation, actions taken to rid of or fix the problem at hand, or taking the situation one step at a time and identifying those steps. These practices and other active coping strategies have shown to be positively related to psychological well-being and health (Affleck & Tennen, 1996). Those who are able to recognize and control their own personal boundaries/limits tend to be more resilient through adversity (Kobasa, 1979; Ong, et al., 2006). These boundaries and limits, as well as a plan for the challenge are more easily identified through active coping strategies.

Active coping strategies have been found to be stronger when one has engaged in physical exercise or activity (Kim & McKenzie, 2014). Exercise may lead to one having a clear head, thus fostering active coping strategies such as seeking information to solve problems and taking the problem one step at a time (Kim & McKenzie, 2014).

Growth Reframing

Growth reframing is defined as a cognitive practice used to identify negative aspects of a situation and to psychologically modify them as a positive growth edge (Carver et al. 1989; Dweck, 1986; Hertel & Matthews, 2011). Dimensions include: looking for the positive in the situation (Carver et al., 1989), viewing the obstacle as an opportunity to bounce back (Luthans et al., 2010), and focusing on the growth and development that occurs through that experience (Dweck, 1986). Growth reframing is a combination of positive reframing tactics, growth mindset, and cognitive modification strategies, which all focus on how one can reframe an event on emerging stronger and wiser because of that experience.

The importance of reframing comes from appraisal theory and cognitive emotion regulation literature. Appraisal theories suggest that "the way we evaluate an event determines how we react emotionally" (Lazarus, 1999, p. 87). Therefore, growth reframing as a practice is crucial to react in a way one may not naturally. When facing a negative challenge, being able to change the way one sees that challenge and how that challenge impacts the person, will enable that person to be more resilient through the situation. Cognitive modification, cognitive reappraisal, and emotional regulation all play a role in growth reframing as a practice (Tabibnia & Radecki, 2018; Troy & Mauss, 2011).

Research suggests growth reframing leads to several positive outcomes including well-being and resilience (Ong et al., 2010). Additionally, it has been shown to be related to factors

such as success, commitment, and work performance (Duckworth et al., 2007). Furthermore, in a study looking at coping strategies that students employed when dealing with challenges or avoiding failure, reframing as a practice predicted higher life satisfaction for those students (Stoeber & Janssen, 2011). Resilience emerges when individuals can cultivate cognitive practices that turn negative or difficult situations into a positive but challenging learning opportunity.

Social Support

Leveraging social support occurs at two levels: instrumental support and emotional support (Carver et al., 1989). Emotional social support is defined as "getting moral support, sympathy, or understanding" as one navigates an adverse situation (Carver et al., 1989, p. 269). Instrumental social support is defined as “seeking advice, assistance, or information” as one navigates an adverse situation (Carver et al., 1989, p. 269). These tactics often happen simultaneously when one is reaching out to one’s network as a practice to better overcome a situation they are in or are going to encounter (Srivastava et al., 2006).

In McGonigal’s book *The Joy of Movement: How Exercise Helps Us Find Happiness, Hope, Connection, and Courage* (2019), they describe the chemical processes that allow people to feel differently after exercising. McGonigal is a health psychologist and known for her work that takes neurological findings and concepts and translates them into practices that enhance health and wellbeing. McGonigal notes that exercise “high” primes people to connect with others and on days one exercises they experience more positive interactions with others than those who do not exercise.

Reaching out for support is anxiety/stress reducing and confidence building, thus leading to higher resilience when facing a challenging situation (Cohen, 2004). Literature indicates that

neurological and physiological changes (i.e., growth of the amygdala and frontal cortex) that occur after one has exercised can explain why individuals tend to engage in more social behavior (Childs & de Wit, 2014). The volume of one's amygdala is correlated with perceived social support (Sherman et al., 2016) and engagement of social behaviors (Cohen, 2004).

Applied Mindfulness

Applied mindfulness is the application of mind-body promotion or awareness in daily life in order to let go of thoughts of worry about the future and/or regret from the past (Kabat-Zinn, 2003; Li et al., 2016). Mindfulness in general has been shown to be effective in many areas of the body and the brain including treating stressful or high anxiety situations (Chiesa & Serretti, 2009) and overall mental well-being (Carmody & Baer, 2008). De Bruin et al. (2017) found that meditation and physical activity are two strong ways for an individual to reduce stress. Thus a 6-week training that used meditation and physical activity practices in concurrence was administered. The study found that there were positive impacts in the participants' lives even after 6 months of training. The impacts included better sleep, higher optimism, greater resilience, better understanding of themselves, better coping in adverse situations, and increased self-efficacy.

Research suggests mindfulness practices lead to several positive outcomes including well-being and resilience (Brown & Ryan, 2003; Carmody & Baer, 2008; Leary, 2004). In particular, applied mindfulness practices allow one to add clarity to the situation they are in or clear their mind to see more clearly what is going on in turn reducing worry of the unknown.

The majority of the mindfulness research is focused on the therapeutic healing context, thus measuring how mindful someone is or is not. These self-report measures assess the extent of how one's level of mindfulness is related to aspects of one's mental health (Brown et al., 2007).

In comparison, applied mindfulness seeks to examine how one becomes mindful and what behaviors or activities they are engaging in to achieve mindfulness.

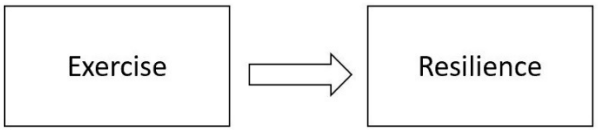
Integrated Research Model

Based on the previous discussion, it is hypothesized first that, replicating previous research, all resilience practices will be related to resilience. More specifically, the more a person engages in each practice the higher their capacity for resilience.

Hypothesis 1a. Exercise is positively related to resilience.

Figure 1

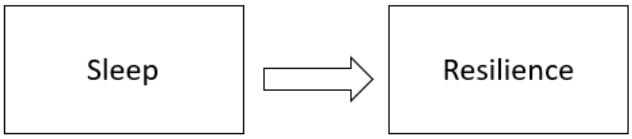
The Proposed Relationship Between Exercise and Resilience



Hypothesis 1b. Sleep is positively related to resilience.

Figure 2

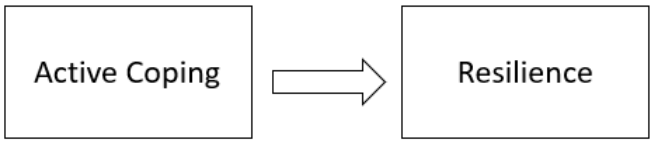
The Proposed Relationship Between Sleep and Resilience



Hypothesis 1c. Active coping is positively related to resilience.

Figure 3

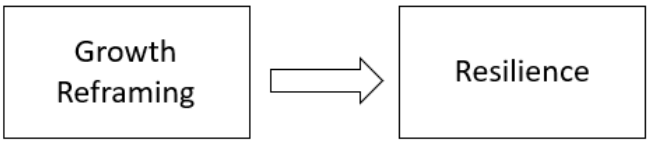
The Proposed Relationship Between Active Coping and Resilience



Hypothesis 1d. Growth reframing is positively related to resilience.

Figure 4

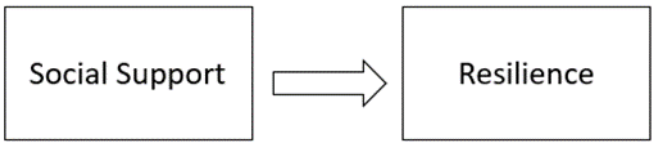
The Proposed Relationship Between Growth Reframing and Resilience



Hypothesis 1e. Use of social support is positively related to resilience.

Figure 5

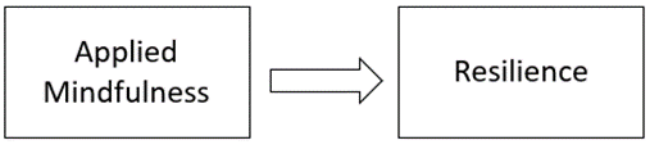
The Proposed Relationship Between Use of Social Support and Resilience



Hypothesis 1f. Applied mindfulness is positively related to resilience.

Figure 6

The Proposed Relationship Between Applied Mindfulness and Resilience

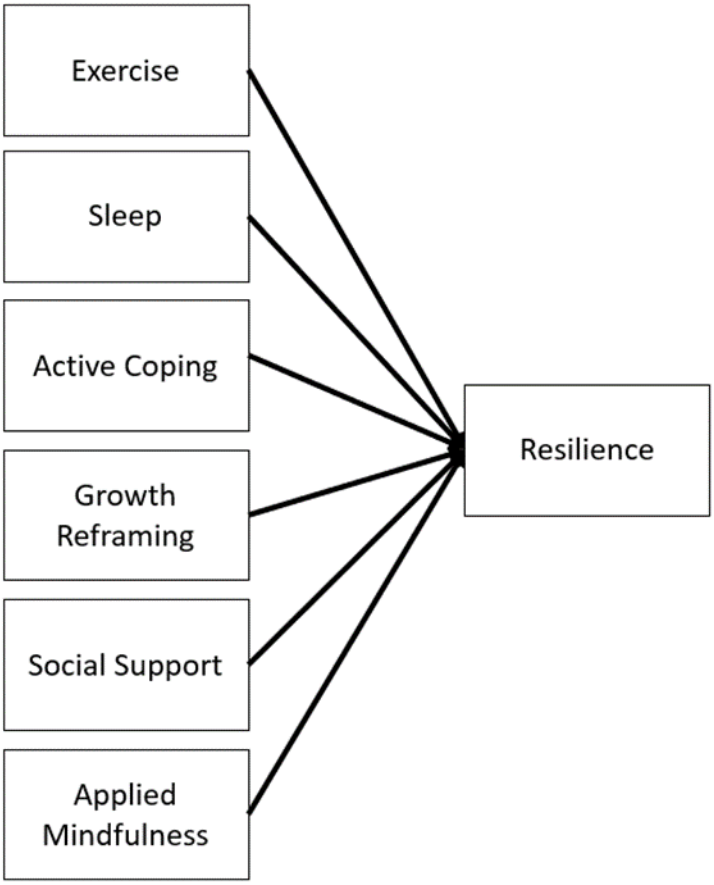


Additionally, it is proposed that these resilience practices will have an additive effect, together predicting an even higher portion of individuals' resilience. More specifically, the more practices a person is engaging in the higher their resilience.

Hypothesis 2. Additively, resilience practices will be positively related to resilience.

Figure 7

The Proposed Additive Relationship Between Resilience Practices and Resilience



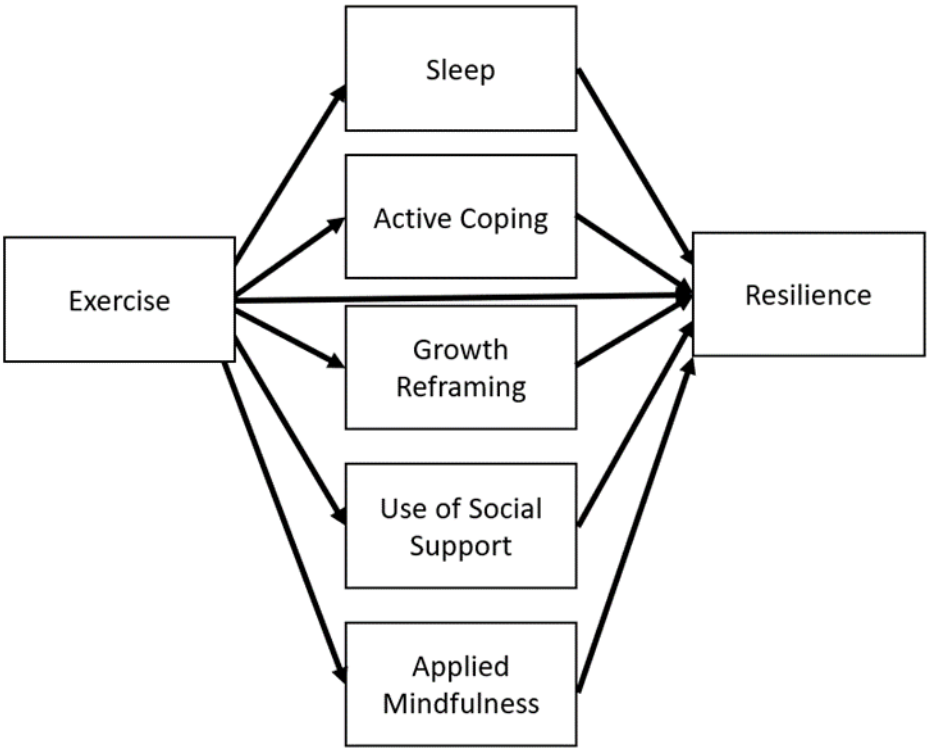
Furthermore, it is hypothesized that exercise will serve as a catalyst for other resilience practices that, in turn, will be related to increased resilience. Even if exercise is not the most strongly related to resilience in hypothesis 1, it is still proposed that it will be the strongest catalyst in the overall model of catalyzing other resilience practices.

Hypothesis 3. Exercise is a catalyst for the resilience practices of sleep, active coping, growth reframing, social support, and applied mindfulness which, in turn, will be related to higher resilience.

This hypothesis will be tested in two stages. To begin, the model in Figure 2 will be tested on half of the sample to determine if data supports the proposed model. If not, the model will be trimmed to create a better fit and then in the second step, tested against the second half of the sample for goodness of fit.

Figure 8

Theoretical SEM Model to Assess Extent to Which Exercise Acts as Catalyst for Other Resilience Practices

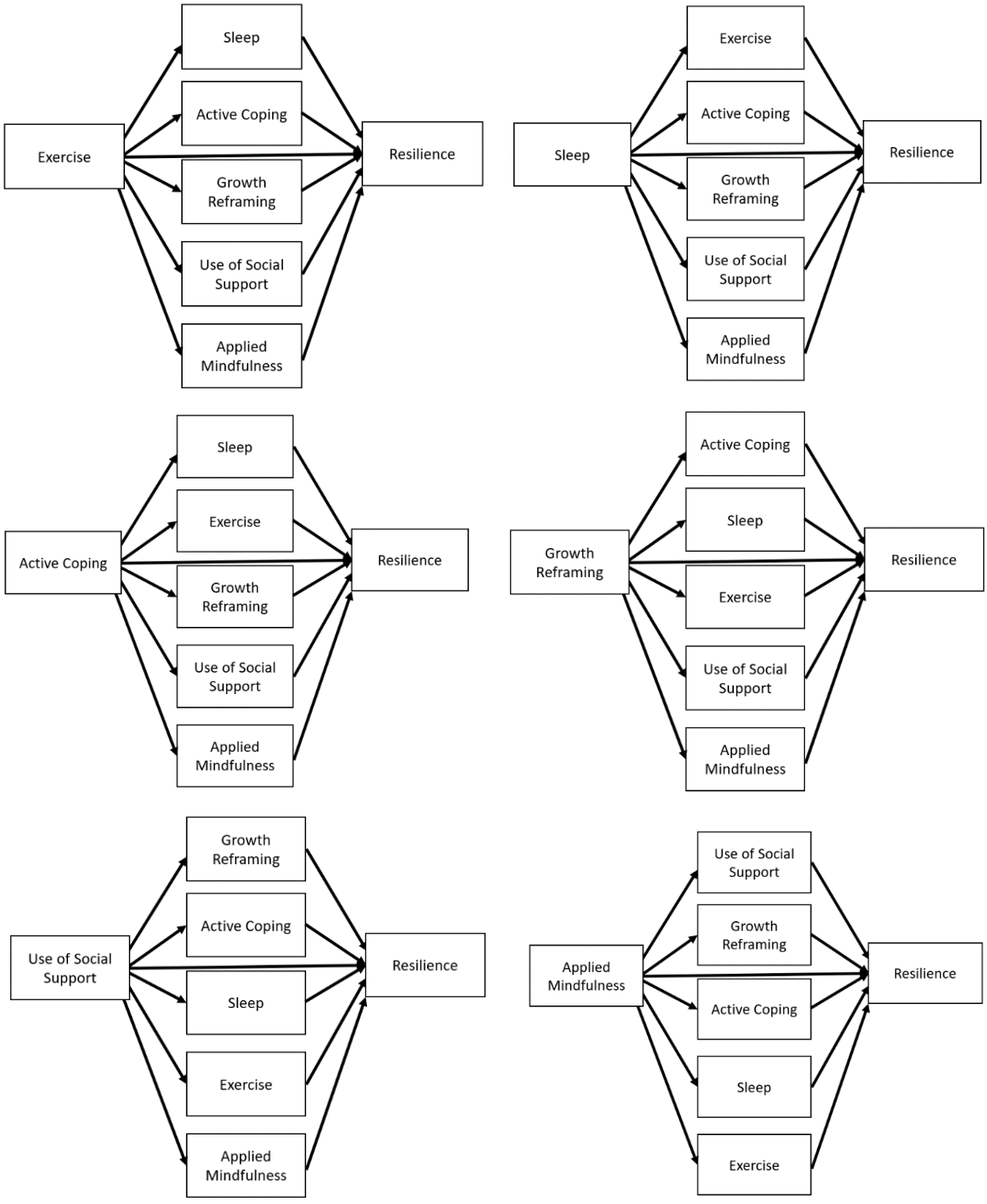


Finally, it is hypothesized that exercise will be a significantly stronger catalyst than the other practices (e.g., the model with exercise as a catalyst will be a significantly better fit of the data than the other models where other practices are the potential catalysts).

Hypothesis 4. Exercise will be the best model fit when compared to models with the other practices as catalysts. That is, exercise as the catalyst for other resilience practices and, in turn, leading to resilience, will be the best fitting theoretical model when compared to the other resilience practices acting as catalysts for the resilience practices which in turn leads to resilience.

Figure 9

Theoretical Catalytic SEM Models to be Tested for Hypothesis 4



Note. Exercise Model hypothesized to outperform.

Chapter II: Method

Method

A concurrent correlational design with a cross-sectional self-report survey was utilized. This design is appropriate because this research seeks to understand the prevalence of behaviors (i.e., mediators of the relationship between exercise and resilience) within a sample, without manipulation or iteration by the researcher (Sedwick, 2014), assessing the relationship between exercise (IV), resilience (DV), and resilience practices (mediators).

Participants and Procedures

Participants were recruited through the crowdsourcing web service Prolific Academic. Prolific is a platform that has been specifically developed for researchers incorporating strong recruitment practices and protecting participants' legal rights (e.g., minimum hourly wage) in comparison with other online platforms (Palan & Schitter, 2018). Using the criteria of internal reliability, naivety, and dishonesty, Prolific performs comparably to Amazon's MTurk platform (Peer et al., 2017). Prolific has advantages over other online sourcing web services including participants' unfamiliarity with common research tasks/designs and participant pools with a more racially diverse background (Palan & Schitter, 2018). For adequate sample size of an SEM model it is suggested that 300 is the minimum in order to detect an effect (Comrey & Lee, 2013; Tabachnick & Fidell, 2013). The number recruited for the study was 500.

Preliminary Screening Criteria

Participants were screened to ensure participants are greater than 22 years of age and located in the United States. While participants only received the survey link after agreeing they meet study criteria (i.e., US residence and 22 years of age or older), participants were again asked to self-report this information as part of the demographic section of the survey for

verification. After assessing census data on the United States for 2019, approximately 50% of the population that was ages 18-24 were in employed roles. Thus, some of this group is likely still in high school or starting college and are not traditionally "working age" in the United States. Due to this, the age 22 was decided as the starting age criteria, as the census data showed that those age 22-55 had an approximate employment rate of 79.9%, there is confidence that most participants in this age group had changing working conditions during this time because of COVID-19.

Additionally, the use of two instructed response items (IRIs) were included within the body of the survey as an attention check of careless participant responding, which is recommended by Meade and Craig (2012). The IRIs indicate participants should give one specific response to the question (e.g., *Please select Agree for this item*). Participants who do not answer in alignment with the identified criteria or answer incorrectly to any of the IRIs will be deleted from the sample prior to data analysis.

Participant Sample

The survey was administered on April 25th, 2020, at the start of the COVID-19 pandemic in the United States. At this time, the U.S. was reporting between 25,000-35,000 new cases daily, had approximately 62,594 deaths associated with the virus, and the highest civilian unemployment rate of the pandemic thus far at 14.7% of the U.S. workforce (Rossen et al., 2020; U.S. Bureau Labor of Statistics, 2020). At this time, 30 states were under statewide stay at home orders, and 13 states had certain parts/cities of the state under stay-at-home orders (Mervosh et al., 2020).

A total of 507 participant surveys were collected from Prolific Academic. See Missing Data section below to see the criteria followed for deletion of some participants. The final

sample included 487 participants (see Table 1 for participants demographics). The sample was composed of females (45.2%) and males (53.8%), aged 22-76 (M=36.22, SD 12.57), who identified primarily as White (67%).

Table 1

Participant Demographics

	Mean	SD	Range	%	N
Gender					
Female				45.2	221
Male				53.8	263
Other				0.0	2
Age	36.22	12.57	22-76		
Race					
White/Caucasian				67.0	326
Hispanic/Latinx				6.0	31
Asian/Asian American				14.0	67
Black/African American				7.0	34
Hispanic & White				3.0	14
Asian & White				1.0	4
Asian & Hispanic				1.0	3
Black & White				1.0	3
American Indian/Native American				1.0	3
Asian & Black				0.0	2
Black & Hispanic				0.0	2
Native American & White				0.0	2
Hawaiian				0.0	1
Middle Eastern				0.0	1
Asian, Black, & White				0.0	1
Multiracial				0.0	1

Note. (*N*=487).

Measures

To test the hypotheses and proposed model, seven measures from a survey were analyzed. A description of each measure is described in the following section. The main study included one outcome measure—resilience; and six predictor practices including exercise, sleep, active coping, growth reframing, social support, and applied mindfulness. The measures selected for each construct were based on the following overall criteria: (a) the nature of how one engages

in each of these resilience practices, (b) quantity or amount is not a sufficient measure for many of these variables as stated in the literature review, thus quality aspects of each variable had to also be included in measurement, (c) safety of participants in data collection due to current stay at home orders during COVID-19.

Resilience

Resilience was assessed using the Brief Resilience Scale (Smith et al., 2008), a 6-item scale that assesses the degree to which participants are able to bounce back from stress or an adverse challenge. Participants rated the extent to which they agree with each statement on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). There were three positively worded items and three negatively worded items. The negatively worded items were reverse scored, and all 6 items then aggregated into a single score. Example items include "I find it easy to adapt to changing situations" and "I tend to take a long time to get over set-backs in my life."

Exercise

Exercise was assessed using a shortened version of the International Physical Activity Questionnaire (IPAQ) developed by an International Consensus Group in 1998. The shortened version is the 9-item International Physical Activity Questionnaire Short Form (IPAQ-SF; Craig et al., 2003) used to assess participants' physical activity. Participants were asked to report on three types of exercise (walking, moderate, and vigorous). Since sitting does not represent any physical exertion, those items were excluded leaving 6 items for this study.

Vigorous exercise was assessed as hard physical work that includes very heavy breathing and high aerobic activity. Moderate exercise was assessed as a mild physical activity including some shortness of breath. Walking includes any amount of walking one does in a normal day,

including to and from work, walking a family dog, and walking for sport or leisure. Each type of exercise was described separately and then participants reported how many days in the past week they engaged in that type of exercise and on average for how many hours and minutes each type of exercise was performed in those 7 days. To consider all the activity and exercise holistically, the Metabolic Equivalent of a Task (MET) is used to calculate an overall score (Craig et al., 2003). Vigorous exercise is equivalent to 8.0 METs (that is 8 times the energy expended beyond a person when at rest), moderate exercise is equivalent to 4.0 METs, and light exercise is equivalent to 3.3 METs. To combine the three levels of exercise into a common metric: the Metabolic Equivalent of a Task (MET) -minutes/week which represents the amount of energy expended beyond resting levels. These exercise scores were computed with the MET scores and added to create a total weekly MET score for each participant. Visual inspection of the data in the beginning of data cleaning indicated that for all text response exercise variables (vigorous, moderate, and walking - hours and minutes), any items that were missing were considered zero. For example, if the respondent answered 1 day, 4 hours, and NA minutes, the minutes were considered 0 additional minutes to the four hours already listed. This measure taps into additional NEAT (non-exercise activity theromogenesis) fitness that has shown to have important effects on physiological, cognitive, and behavioral health. This is activity and energy expended one does throughout their entire day, that is not their structured exercise time, that contributes to one's health but could not be assessed in a session in a formal lab (Levine, 2002).

Sleep

Sleep quality and habits were assessed using two items from the Assessment of Sleep and Sleepiness in Parkinson's disease scale (Marinus et al., 2003). Participants first rated the quality of their sleep: "Overall, how well have you slept at night during the past week?" on a 6-point

Likert scale from 1 (*very badly*) to 6 (*very well*). Participants then rated the amount of sleep "In the past week, to what extent do you feel you have had too little sleep at night?" on a 5-point Likert scale from 1 (*not at all*) to 5 (*a lot*) which was reverse-scored.

Active Coping

Active Coping was assessed using an adapted version of the COPE active coping sub-scale (Carver et al., 1989). The COPE scales have been the most commonly used measure to assessing coping behaviors across a wide variety of situations including the workplace (Kato, 2015). Various studies have established reliability and validity over the three decades (Kato, 2015; Litman, 2006; Lyne & Roger, 2000; Monzani et al., 2015). The active coping sub-scale consisted of 4 items rated on a 5-point Likert scale ranging from 1(*never*) to 5 (*always*). Example items included "I have been concentrating my efforts on doing something about the situation I am in" and "I have been taking direct action to get around the problems." Active coping measures often gauge how well one tends to cope, in contrast to the interest here in how one engages and how often one engages in active coping strategies.

Growth Reframing

Growth reframing was assessed using two items from an adapted reframing sub-scale of the COPE assessment (Carver et al., 1989), a third item based on Luthans et al.'s (2007) definitions of resilience, and fourth item based on Carol Dweck's (1986) growth mindset. These items were combined to best capture the resilience practice of growth reframing in challenging situations. The measure consisted of 4 items rated on a 5-point Likert scale ranging from 1(*never*) to 5 (*always*). Example items included "I have been looking for something good in what is happening" and "I have been looking for ways to 'bounce back' and grow from this experience."

Social Support

Social support was assessed using two items from the instrumental social support and two items from the emotional social support sub-scales of the COPE assessment (Carver et al., 1989; See Appendix F). Items are rated on a 5-point Likert scale ranging from 1(*never*) to 5 (*almost always*). An example item for instrumental support was "I have been getting help and advice from other people" and for emotional support was "I have been getting comfort and understanding from someone." Many measures of social support assess whether or not it is something one has, or something one feels they have; in contrast, the interest here is if one actively engages in gaining social support and whether that is emotional support or instrumental support.

Applied Mindfulness

Applied mindfulness was assessed using an adapted version of the Applied Mindfulness Process Scale (AMPS; Li, 2016). The AMPS was developed to assess the extent to which people participate in a variety of mindfulness practices in their lives. Similar to social support measures, many mindfulness measures assess how mindful one is in that moment or in their daily life. In contrast, the interest here was in *what* actions one engages in to become mindful. Four items were selected from the AMPS to assess how often a participant has used mindfulness practices in the past 7 days (See Appendix G). Each item was rated on a 6-point Likert scale ranging from 1 (*never*) to 5 (*almost always*). Example items included, "I relaxed my body when I was tense" and "I was aware of and appreciated the pleasant events in my life."

Chapter III: Results

Statistical Analyses

To test the proposed regressions, multiple mediated hypotheses and models, R Studio (v. 1.2.5033) with R (v. 3.6.2) and SPSS 27 was used to complete data cleaning and all regression analyses. For the structural equation modeling (SEM) and path analyses in hypothesis III and IV R Studio (v. 1.2.5033) with R (v. 3.6.2) and AMOS 27 were used. The use of SEM path analysis enables the testing of greater model complexity and more precise error management, compared to other analysis platforms (e.g., SPSS, PROCESS Macro; Nachtigall, et al., 2003). The capacity to account for measurement error and method bias in the measurement mode and test the proposed model in entirety with fit statistics in the structural model, adds rigor to the analyses.

Missing Data

Data was analyzed, assessed, and managed for missingness in SPSS 27 and R (v. 3.6.2). Mean scores were computed for people with at least 4/5ths of their items completed. Missing data analyses were completed in R Studio (v. 1.2.5033) with R (v. 3.6.2). Available item analysis (AIA; [@parent_handling_2013]) is a strategy for managing missing data that uses available data for analysis and excludes cases with missing data points only for analyses in which the data points would be directly involved. Parent (2013) suggested that AIA is equivalent to more complex methods (e.g., multiple imputation) across a number of variations of sample sizes, magnitude of associations among items, and degree of missingness. Thus, utilizing Parent's (2013) recommendations to guide the approach to managing missing data. Missing data analyses were conducted with the R packages mice (v. 3.7.0), Amelia (v. 1.7.6), and BaylorEdPsych (v. 0.5).

Starting with sample *N*= 507, one case was removed for not giving consent to the survey, and an additional 16 were removed for not passing the quality checks throughout the survey bringing the sample size to *N*=490. Additionally, two cases did not meet the threshold of 22 years and were removed (*N*=488). Cases were then deleted cases when missingness was 90% or more, none of which had that amount of missingness.

To cross reference the missingness analysis above, item level data was assessed in SPSS 27 by checking by case (i.e., blank cells, unengaged responding, and outliers) where one case was deleted for unengaged responding (i.e., same answer across all cells, no variance; *N*=487). Scales were calculated using Parent's (2013) recommendation that some reasonable amount of missingness be allowed. For scales containing only two items, 50% missingness was allowed; for scales containing four items, 25% missingness was allowed; and for all others, 20% missingness was permitted (*N*=487). Little's MCAR test diagnoses whether or not the missing observations are missing completely at random. When Little MCARs was applied at this level of analysis, results suggested that the larger p-value ($p > 0.05$) indicated weak evidence against the null hypothesis. Thus, failing to reject the null hypothesis, with the data being MCAR, no patterns exist in the missing data $\chi^2_{(22)} = 11.98$, $p = .958$.

Assumption Testing and Reliability

Due to the large sample size, Field's (2013) guidance and general central limit theorem was followed, specifically, that the assumption of normality is less important because as a sample size increases, normality assumptions are less of a threat to statistical relationships. Additionally, Field (2013) notes that large sample sizes (e.g., 100-200) increase the tendency for significant normality tests, resulting in the application of unnecessary corrections.

A review of box plots indicated only two outliers on the exercise measure. Data showed skewness and kurtosis were within acceptable parameters (i.e., +/- 3; Kline, 2005), except for the exercise measure, which was just shy of meeting the kurtosis threshold (3.74) and within parameters for skewness. There was sufficient linearity (i.e., linearity explained the most variance and was significant). Residuals were normally distributed and showed no heteroscedasticity (no funneling/fanning around the fit line). Additionally, multicollinearity was assessed for all six predictor variables using the variance inflation factor (VIF). All predictor VIF's were significantly below threshold indicating that the assumption that all variables are not highly correlated had been met. Reliability was assessed using composite reliability (*CR*; see Table 2). Adequate reliability was found across measures ranging from $\alpha = .76$ -.92.

Method Bias

Because the study data was obtained through a single method and cross-sectional design, there is potential for common method bias (CMB) which influences study outcomes by inflating the strength of observed relationships. Two analyses were conducted to assess method bias: (1) Harman's single factor test and (2) the common latent factor method. Results from Harman's single-factor analysis indicated approximately 27.8% of the variance across all study items were attributable to a single factor solution which is below the recommended cutoff of 50% (Podsakoff et al., 2003). Similarly, results from the more conservative common latent factor method approach indicated approximately 4% of the variance was explained by a common factor, which was again below the 50% threshold. Both tests indicated that method bias was not posing a significant threat to study outcomes. As such, the marker variable method was excluded from the study analyses.

Once the data was prepared, the following analyses were conducted: (a) descriptive statistics and reliability coefficients, (b) linear regressions and a multiple linear regression to assess the relationship between the resilience practices and resilience (Hypotheses 1 & 2), (c) confirmatory factor analysis using structural equation modeling (SEM) to assess the measurement validity of exercise as a catalyst for other resilience practices model (Hypothesis 3), (d) path analysis of the measurement model to assess the respecified model on two samples (Hypothesis 3), (e) path analysis using SEM of six measurement models to compare fit indices (Hypotheses 4).

Descriptives and Correlations

Table 2 presents means, standard deviations, interrcorrelations, and reliability coefficients for the variables measured in this study. The means and standard deviations of the measures show a typical 1-5 point scale average variation, although this is not surprising with most measures being on a 5-point scale. The ranges would still suggest good distribution. Overall, because of the variance and ranges distribution there is not concern for ceiling or floor effects. Adequate reliability was found across measures ranging from $\alpha = .76$ -.92. The lowest reliability being for active coping at $\alpha = .76$. Overall, resilience practices scales were significantly related to each other as well as with resilience. Social support and sleep were not significantly related with one another ($r = .007$, $p > .05$). Additionally, social support and resilience were not significantly related ($r = .040$, $p > .05$). Overall, trends show that exercise, growth reframing, and applied mindfulness have the strongest relationships with all the other practices. The highest significant correlations occurred between the growth reframing and active coping ($r = .66$, $p < .01$), growth reframing and applied mindfulness ($r = .56$, $p < .01$), and active coping and applied

mindfulness (r = .45, p < .01). Overall, the trends show significantly positive relationships between resilience practices and resilience.

Table 2

Zero-order Correlations, Descriptives, and Reliabilities (Cronbach's alphas)

	Mean (*SD*)	Range	1	2	3	4	5	6	7
Predictors									
1. Exercise	6.85(*2.20*)	0-11	--						
2. Sleep	3.27(*1.0*)	1-5	.199**	**.846**					
3. Active Coping	3.33(0.72)	1-5	.232**	.092*	**.763**				
4. Growth Reframing	3.16(*0.86*)	1-5	.145**	.135**	.657**	**.784**			
5. Social Support	2.78(*0.96*)	1-5	.150**	.007	.374**	.367**	**.852**		
6. Applied Mindfulness	2.90(*0.83*)	1-5	.199**	.245**	.445**	.560**	.248**	**.793**	
Outcome									
7. Resilience	3.24(*0.92*)	1-5	.184**	.338**	.339**	.314**	.040	.313**	**.920**

Note. (N =487). Composite reliabilities appear in bold on the diagonal. Exercise was transformed into one item. * p < .05, ** p < .01, ***p < .001.

Hypothesis 1: Resilience Practices and Resilience

After the data had been cleaned and all assumptions established, regressions were used to analyze whether each resilience practice predicted resilience, and the extent to which the combined impact of the five resilience practices predict resilience. The beta-weights suggest that there is unique variance being predicted by exercise, sleep, active coping, growth reframing, and applied mindfulness. In the first set of hypotheses, it was predicted that each resilience practice would individually be related to resilience. This was tested using simple linear regression entering in the resilience practice as the predictor and resilience as the outcome. This process was repeated for all six resilience practices. The effect sizes (R^2) for six practices as they relate to resilience were statistically significant with the highest practices being active coping ($R^{2=}$ *.12;* β = .339, p < .001), sleep ($R^{2=}$ *.11;* β = .338, p < .001), growth reframing ($R^{2=}$ *.10;* β = .314, p <

.001), applied mindfulness ($R^{2=}$ *.10;* β = .313, p < .001) and exercise ($R^{2=}$ *.03;* β = .184, p < .001). In contrast, social support was nonsignificant and the lowest relationship ($R^{2=}$ *.002;* β = .040). Thus, hypothesis 1a, 1b, 1c, 1d, and 1f were supported while 1e was not. This suggests that all the predicted resilience practices, sans social support, were uniquely predicting resilience. This suggests social support was the only resilience practice not to significantly predict resilience.

Table 3

Regression Analysis of Predictors on Resilience

Predictor	*B*	SE_B	β	R^2	*F*	95% CI's Lower	Upper
Hypothesis 1a							
Exercise	.077	.019	.184	.03***	17.07***	.040	.113
Hypothesis 1b							
Sleep	.310	.039	.338	.11***	62.70***	.233	.387
Hypothesis 1c							
Active Coping	.429	.054	.339	.12***	62.77***	.323	.536
Hypothesis 1d							
Growth Reframing	.333	.046	.314	.10***	52.20***	.243	.423
Hypothesis 1e							
Social Support	.038	.043	.040	.00	.77	-.047	.123
Hypothesis 1f							
Applied Mindfulness	.344	.047	.313	.10***	52.75***	.251	.438

Note. (N = 487). * p < .05, ** p < .01, ***p < .001.

Hypothesis 2: Additive effect of resilience practices

In the next hypothesis, an additive effect of all the resilience practices operating together to make up a significant portion of the resilience variance was proposed. Using multiple regression, this hypothesis was supported (R^2 = .243, F= 25.67, p < .001) indicating that the resilience practices predict approximately one-quarter of resilience variance. Additionally, five

practices (exercise, sleep, active coping, growth reframing, and applied mindfulness) showed unique predictive variance indicating that they predicted resilience above and beyond the other practices with sleep and active coping predicting the most unique variance beyond the other strategies. Interestingly, social support showed a negative relationship indicating it is potentially a suppression variable. It would mean that while social support has no significant relationship with resilience directly, it still contributes to the overall predictability of resilience (Horst, 1941). One of the statistical indicators of classical suppression is when the beta weight's sign is opposite of the bivariate, as we have in this case. Thus, hypothesis 2 was partially supported.

Table 4

Multiple Regression Analysis of Predictors for Unique Variance of Resilience

Hypothesis and Predictor	*b*	SE_B	β	t	R^2	*F*	95% CIs Lower	95% CIs Upper
Hypothesis 2					.243***	25.674		
Step 1								
Exercise	.034	.017	.083	1.99*			.001	.068
Sleep	.247	.038	.269	6.54***			.172	.321
Active Coping	.286	.069	.226	4.13***			.150	.422
Growth Reframing	.112	.062	.106	1.83			-.009	.233
Social Support	-.118	.042	-.123	-2.81**			-.200	-.035
Applied Mindfulness	.112	.055	.101	2.04*			.004	.219

Note. $N = 487$. * $p < .05$, ** $p < .01$, ***$p < .001$.

Hypothesis 3: Exercise as a Catalyst

Structural equation modeling was used to analyze hypothesis three that proposed that physical exercise is a catalyst for the five other resilience practices (sleep, active coping, growth reframing, social support, and applied mindfulness), which in turn leads to higher resilience. It was predicted that these other behaviors will mediate the effects of exercise on resilience. To assess model fit, three recommended fit indices described by Byrne (2010) and cut-off recommendations by Hu and Bentler (1999) were utilized, in addition to taking model integrity into account and theoretical justification. These fit indices include χ^2 *(ns),* RMSEA > .05, and

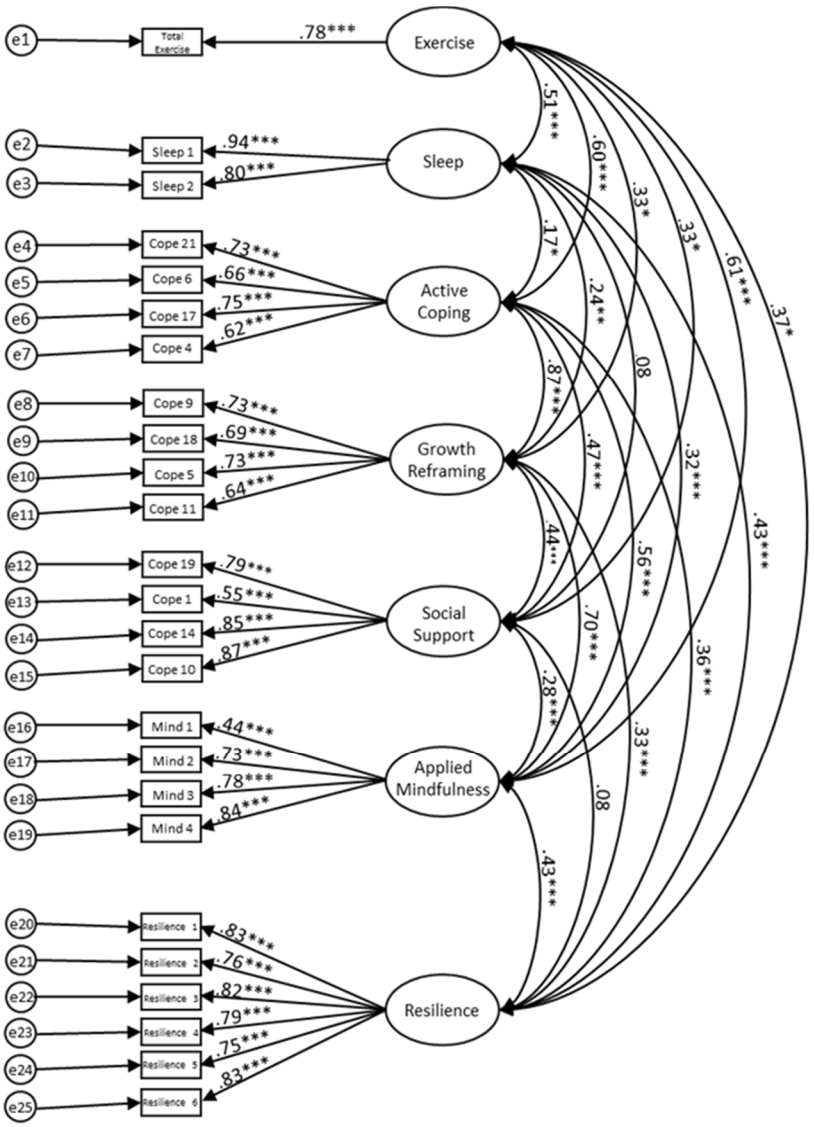
CFI < .95. The chi-square likelihood ratio statistic, χ^2, assessed the goodness of fit between the hypothesized model and the null model (no constraints). Because large sample sizes tend to create a statistically significant result, chi-square results are often used as a first step in determining overall fit. The root mean square error of approximation (RMSEA) has been recently regarded as one of the most informative criteria of model fit (Byrne, 2010). RMSEA accounts for error of approximation in the population by asking "How well would the model, with unknown but optimally chosen parameter values, fit the population covariance matrix if it were available." The discrepancy is expressed per df, making the index sensitive to number of estimated parameters in the model (i.e., model complexity). Values between .05 and .06 indicate good fit; values between .08 and .10 indicate mediocre fit. Finally, the comparative fit index (CFI) assessed the fit between the hypothesized model and the null model. The CFI has become a strongly recommended index for evaluating model fit; values greater than .95 indicate good model fit, with .90 indicating mediocre fit (Byrne, 2010; Hu & Bentler, 1999).

Measurement Model. Hold-out validation (i.e., external testing), is one of the most reliable ways to estimate predictive ability of a statistical model (Lee et al., 2018). Sometimes your initial data testing your model when you were assessing it or respecifying it can lead to inflated values or overfitted data. With the initial dataset there is no way to verify the patterns or trends that are occurring are real Thus, using random assignment, the data was divided in half. The approach followed the two-step evaluation of first the measurement model, and then the structural model. For the first half of the data, a measurement model was created in AMOS to assess overall model fit. The measurement model provided a CFA (See Figure 9). All regression weights were statistically significant, of reasonable magnitude, and had the appropriate sign. The

initial model had a statistically significant chi square test ($\chi^2_{(256,243)} = 545.726$) adequate with low CFI (.904) and high RMSEA (.068), indicating adequate but not good fit based on index criteria.

Figure 10

Standardized Parameter Estimates for Initial Model of Structure (Model 1)



Note. (N = 243) e = measurement error.. * $p < .05$, ** $p < .01$, ***$p < .001$.

To the degree that model misfit occurred, modification indices (M.I.s) and theoretical reasoning was utilized to re-specify the model. The model fit was evaluated on the basis of

parameter estimates and fit indices. When the model yielded mediocre to poor fit indices, the model generating approach described by Jöreskog (1993) was utilized. Specifically, nonsignificant paths and modification indices (covariances) of regression paths and error terms were examined to understand the influence of altering the model. When there was cogent rationale, re-specification (path modification by allowing paths to covary or deleting paths) was implemented. After a single action was taken, model was reran and the fit indices were reassessed before making another re-specification. Modification indices (Byrne, 2001) were evaluated to locate parameters that might be freed to covary. Because M.I.s are statistically driven, re-specifications were only made when cogent rationale supported the parameter change. Model fit is influenced by a variety of factors. Within this measurement model, the adequate fit was a result of two factors; some low correlations among the observed variables in addition to a complex model with a large number of variables, both of which are known to decrease CFI estimates (Kenny, 2015). While the measurement model is capable of being significantly improved through adjustments (e.g., allowing error terms/residuals to covary, deleting items/variables), to meet the current "good" model fit guidelines that are debated (e.g., Hair et al., 2017b, 2014), the exploratory nature of this study was to contribute to the foundation of theory. Because this study represents an initial theoretical application of spillover theory and catalytic relationships into the resilience literature, evidence of strong relationships between the study variables has not yet been established. Specifically, when taking a theoretical testing approach, particularly for new areas of research, model trimming/adding is advised against (e.g., Goodboy & Kline, 2017; Kline, 2005). In part, this is because during the early stages of theory testing the capacity for replication is particularly important and the extent to which sample specific variation may be contributing to model adjustments is unknown. Therefore, adjustments

to the measurement model were only taken where reasonable evidence was justified. The results of initial analyses and subsequent modifications are presented in Table 5.

Table 5

Initial Measurement Model Analysis and Subsequent Modification Results

Model	χ^2	*df*	Model Comparison	$\Delta\chi^2$	Δdf	CFI	RMSEA	AIC	BIC
M1 – CFA	545.73	256				.904	.068	733.73	756.36
M2 – e12< - >e13	503.07	255	M1 vs. M2	42.66	1	.918	.063	693.07	715.94
M3 – e23< - >e25	478.60	254	M2 vs. M3	24.47	1	.926	.060	670.60	693.71
M4 – e21< - >e23	459.76	253	M3 vs. M4	18.84	1	.932	.058	653.76	677.11

Note. (N = 243). CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = akaike information criterion, BIC = bayesian information criterion.

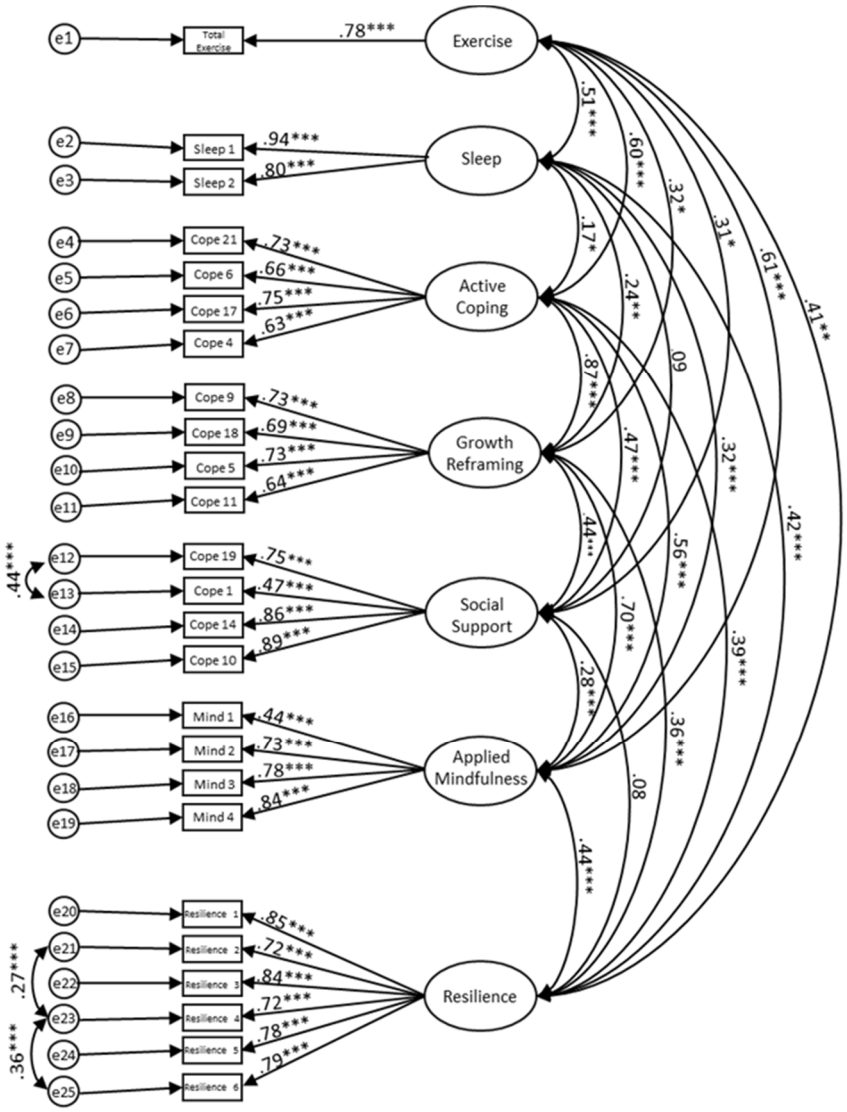
In the first step, covariance between error 12 and error 13 was allowed. In the second step, a covariance between error 23 and error 25 was allowed. In the third step a covariance between error 21 and error 23 was allowed. While there were additional modification indices suggested in order to get an even stronger fit, there was not further justification to allow any more covariances or additional paths (See Figure 11). For the three modifications made to the measurement model, two modifications comprised of negatively worded items whose error terms were allowed to covary, the third modification included error terms both targeting instrumental social support. These two items are similarly worded, and reasonably share variance, thus were allowed to covary (i.e., “I have been getting help and advice from other people” and “I have been trying to get advice or help from other people about what to do”). These items showed large modification indices and all sets of covariances were within each respective latent variable. The final measurement model fit was $\chi^2_{(253,243)} = 459.76$; $\Delta\chi^2 = 85.96$; CMIN/DF = 1.82; CFI = .932; RMSEA = .058.

Reliability and validity. Reliability and validity of the measurement model was assessed in a variety of ways. Reliability ranged from α = .76 -.92 (See Table 2). The traditional estimates

of composite reliability (CR) indicated each measure had strong internal consistency meeting threshold with estimates greater than .70 (Hair et al., 2017b, 2014). Additionally, estimates of convergent (AVE > .50) and discriminant validity (MSV > AVE and absolute values of intercorrelations with other study variables < √AVE) among study measures fell within acceptable ranges.

Figure 11

Standardized Parameter Estimates for Respecified Model of Measurement (Model 4)



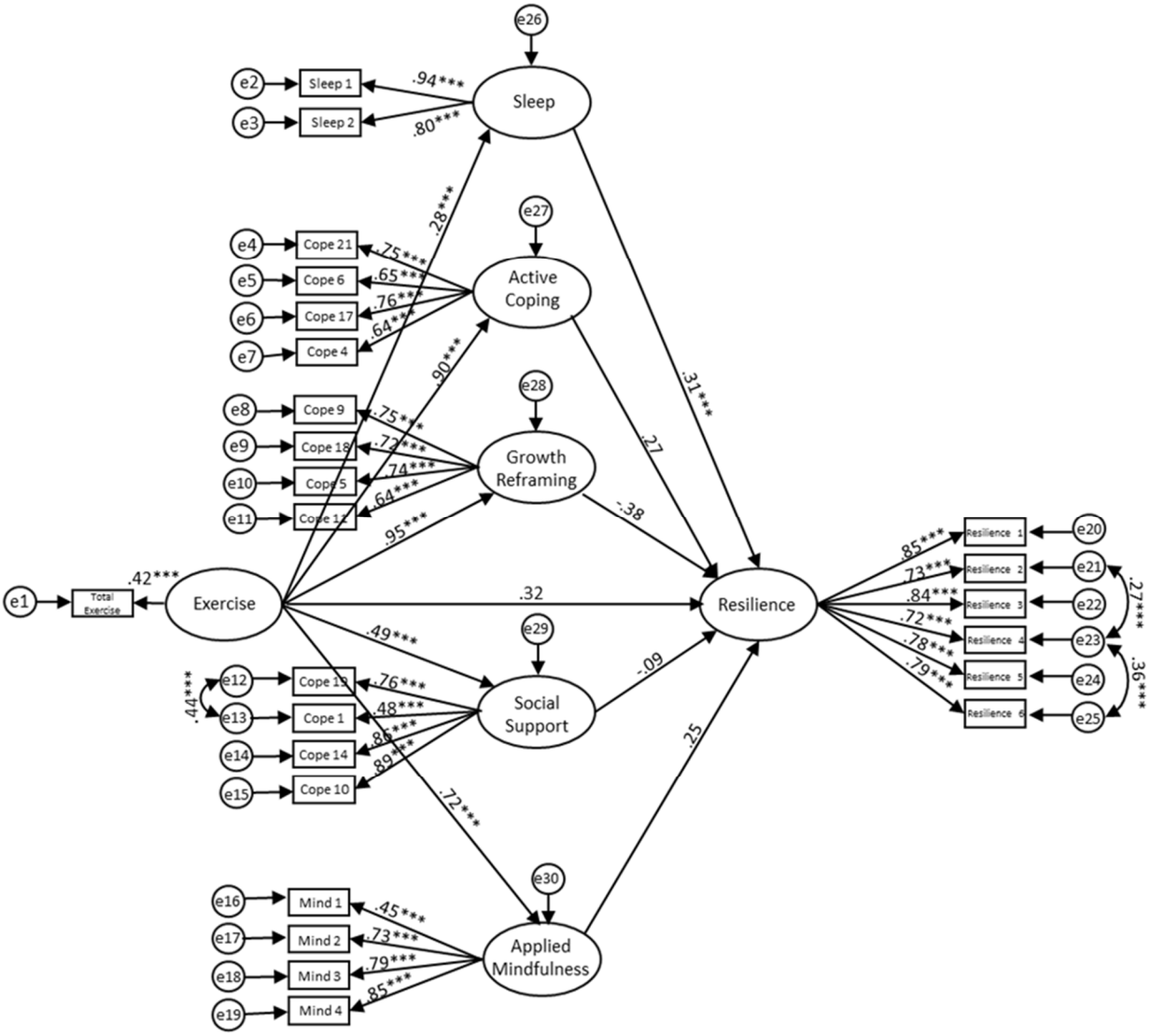
Note. e = measurement error. $N = 243$. * $p < .05$, ** $p < .01$, ***$p < .001$.

Structural Model. After the results of the CFA were assessed and the model adjusted to have a better fit of the data, each individual mediation and the overall structural model using path analysis was tested (See Figure 12). Path analysis uses the observed composite variables instead of the latent variables. With this respecified model, the items were imputed into observed variables to perform path analysis on the structural model with a different sample. However, using one data set optimizes results that may be due to chance. Hence, the model was tested on both halves of the randomly assigned data to see the extent to which each data set fits the model. If fit indices are acceptable (e.g., cut-off scores stated in above section for chi-square, RMSEA, and CFI), it indicates the model is a good representation of the extent to which physical exercise catalyzes other resilience practices which in turn enhance resilience.

This hypothesis was tested in SEM using path analysis for three reasons. First, other multiple regression tools (i.e., SPSS and PROCESS) are not capable of testing the proposed model of six mediations. Secondly, using SEM is a better analytic tool compared to other multiple regression tools when the model is overidentified (Keith, 2015), which is the case for the full model. This means that the degrees of freedom in this case are greater than zero, meaning the model could be wrong and there could be multiple solutions, or in this case assessing better or worse fit of the data to the model in order to confirm the relationship between variables. Third, while conducting each analysis with latent variables it could provide a more robust analysis by accounting for a greater amount of measurement error. Additionally, the complication of specifying the suggested constraints becomes more complex and infeasible as the number of observed items per latent variable increases (Weiss, 2010).

Figure 12

Standardized Parameter Estimates for Path Analysis of Group 1



Note. (*N* = 243). e = measurement error. *N* = 243. * $p < .05$, ** $p < .01$, ***$p < .001$.

Final measurement model fit on the first half of the data was $\chi^2_{(263,243)} = 503.12$; CMIN/DF = 1.91; CFI = .921; RMSEA = .061. The structural model has good fit for the path analysis, confirming that data is consistent with exercise acting as a catalyst for the five other resilience practices.

Table 6

Modification Results for First Half of Randomly Assigned Participants

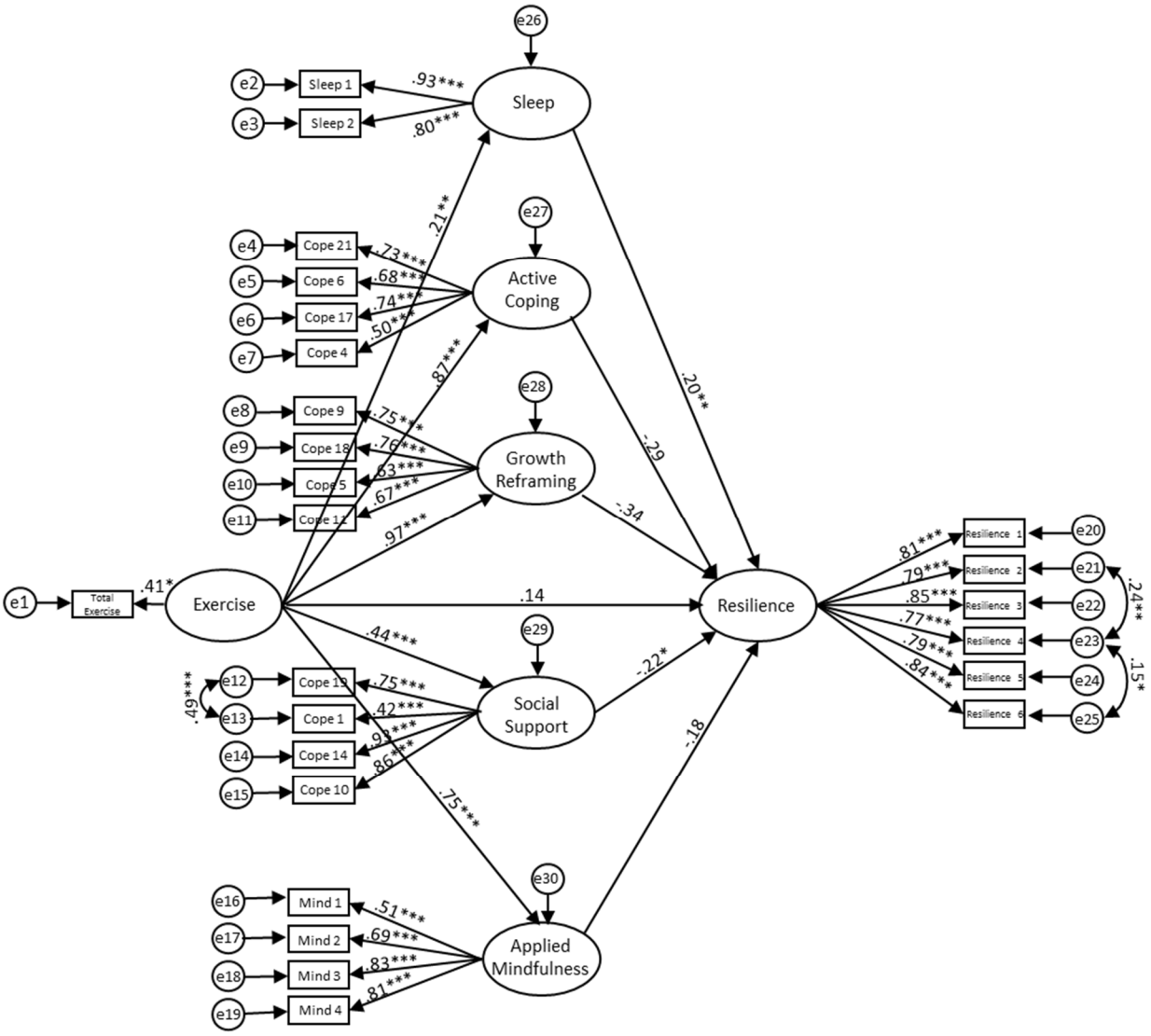
Model	χ^2	*df*	Model Comparison	CFI	RMSEA	AIC	BIC
M1 – Group1	503.12	263		.921	.061	677.12	698.07

Note. (*N* = 243). CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = akaike information criterion, BIC = bayesian information criterion.

Final measurement model fit on the second half of the data was $\chi^2_{(244,263)} = 522.177$; CMIN/DF = 1.99; CFI = .917; RMSEA = .064. While slightly less strong when compared to the first half of random sample, the measurement fit indices still are adequate ranges for the hypothesis consistent with exercise acting directly on resilience but also acting as a catalyst to the other resilience practices which all (except social support) in turn were related to resilience. Thus, hypothesis 3 that the exercise model would a strong operating catalyst by having a well operating structural model was supported.

Figure 13

Standardized Parameter Estimates for Path Analysis of Group 2



Note. (*N* = 244). e = measurement error. *N* = 243. * $p < .05$, ** $p < .01$, ***$p < .001$.

Table 7

Modification Results for Second Half of Randomly Assigned Participants

Model	χ^2	*df*	Model Comparison	CFI	RMSEA	AIC	BIC
M1 – Group2	522.18	263		.917	.064	696.18	717.03

Note. (*N* = 244). CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = akaike information criterion, BIC = bayesian information criterion.

Hypothesis 4: Exercise Is the Optimal Catalyst for Resilience Practices

For the final hypothesis, six models were constructed in AMOS using the modified CFA variables to assess the final proposed hypothesis. This hypothesis proposed that exercise will be the best model fit when compared to models with the other resilience practices as catalysts. Path analysis in SEM was utilized to gain the fit indices for each of the six non-nested models. To assess model fit of each, the three recommended fit indices described by Byrne (2010) and cut-off recommendations by Hu and Bentler (1999) were utilized, as described above. For *nested* models, comparing models is done with a chi-square difference test. This indicates whether one model is performing significantly better and by how much. In this analysis there were six *non-nested* models. First, I visually compared AICs (Akaike Information Criterion; Akaike, 1974) which is a mathematical fit index for evaluating model fit. A model is considered better if it has a smaller AIC statistic (Akaike, 1974). For many researchers, comparing AICs in this fashion makes most sense when comparing two non-nested models against one another (Akaike, 1974), but others argue that AIC comparisons do not indicate whether one model is significantly better than another model, and that it is a coarse index (Kass & Raftery, 1995; Preacher & Merkle, 2012).

To compare non-nested models, Akaike's Information Criterion (AIC) and the Bayes Information Criterion (BIC) was reported. These criteria simultaneously consider statistical goodness-of-fit, number of estimated parameters, and sample size. The BIC differs in that it imposes greater penalties for model complexity. For both indices, in general, when the values of two or more models are compared, the smaller values represent the better fitting model. Vuong's (1989) likelihood-ratio-based test through Merkle & You's (2014) nonnest2 package in R was utilized to compute the test statistics on the basis of the fitted models' output. This is a two-step

testing procedure by Vuong (1989). The first step tests whether the two models are distinguishable or indistinguishable from one another. This is assessed with the variance test, if p is < .05 then the models are distinguishable. At which point you move onto the second step, the likelihood ratio test (LRT), which tests whether or not the two models' fits are equal or if one is a statistically better fit of the data. If in step one the models were indistinguishable, then they cannot be statistically tested using LRT thus you would then refer to the AIC indices of each model. All six models were run and assessed for fit statistics to compare which resilient practice catalyst model offers the best fit of the data. All had significant chi squares, but three models (exercise, active coping, and growth reframing) had adequate fit for CFI and RMSEA (Table 8).

Table 8

Initial SEM Analysis and Subsequent Modification Results

Model	χ^2	*df*	CFI	RMSEA	AIC	BIC
M1 –Exercise	719.26	263	.925	.060	893.26	903.10
M2 –Sleep	1,223.57	263	.843	.087	1,397.57	1,407.41
M3 –Active Coping	728.98	263	.924	.060	902.98	912.81
M4 –Growth Reframing	700.54	263	.929	.059	874.54	1884.38
M5 –Social Support	1,247.81	263	.840	.087	1,415.81	1,425.30
M6 –Applied Mindfulness	822.43	263	.907	.067	1,007.43	1,017.26

Note. (*N* = 487). CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = akaike information criterion, BIC = bayesian information criterion.

The smallest (best data fit) AIC was for the growth reframing catalyst model (AIC= 874.54), and the largest (lowest fit) AIC was for the sleep catalyst model (AIC= 1,397.57). To further understand the best fitting model of the data, Vuong's (1989) criteria of testing for distinguishability and likelihood ratio testing was followed. The exercise model was not distinguishable from the active coping or growth reframing models, but the active coping and growth reframing models were distinguishable between one another with growth reframing as the stronger fit of the data. See Table 9 for the variance tests, likelihood ratio tests, and AIC of

every model comparison. See Table 10 for a visual comparison of which models were distinguishable from one another. Lastly, see figures 12-14 for the model paths of each catalyst model. It appears that the growth reframing, exercise, and active coping catalytic models are the best performing and thus best catalysts of other resilience practices leading to resilience. Growth reframing and exercise are the two best fitting models because they are not statistically distinguishable from one another.

Table 9

Vuong's Non-nested Model Comparisons

Model Comparison	Variance Test	Distinguishable?	LRT	Best Fitting Model	AIC 1st Model	AIC 2nd Model
M1 –Exercise v. M2 –Sleep	$p < .05$	Yes	$p < .05$	M1	893.26	1,397.57
M1 –Exercise v. M3 –Active Coping	$p > .05$	No	N/A	N/A	893.26	902.98
M1 –Exercise v. M4 –Growth Reframing	$p > .05$	No	N/A	N/A	893.26	874.54
M1 –Exercise v. M5 –Social Support	$p < .05$	Yes	$p < .05$	M1	893.26	1,415.81
M1 –Exercise v. M6 –Applied Mindfulness	$p < .05$	Yes	$p < .05$	M1	893.26	1,007.43
M2 –Sleep v. M3 –Active Coping	$p < .05$	Yes	$p < .05$	M3	1,397.57	902.98
M2 –Sleep v. M4 –Growth Reframing	$p < .05$	Yes	$p < .05$	M4	1,397.57	874.540
M2 –Sleep v. M5 –Social Support	$p > .05$	No	N/A	N/A	1,397.57	1,415.81
M2 –Sleep v. M6 –Applied Mindfulness	$p < .05$	Yes	$p < .05$	M6	1,397.57	1,007.43
M3 –Active Coping v. M4 –Growth Reframing	$p < .05$	Yes	$p < .05$	M4	902.98	874.54
M3 –Active Coping v. M5 –Social Support	$p < .05$	Yes	$p < .05$	M3	902.98	1,415.81
M3 –Active Coping v. M6 –Applied Mindfulness	$p < .05$	Yes	$p < .05$	M3	902.98	1,007.43
M4 –Growth Reframing v. M5 –Social Support	$p < .05$	Yes	$p < .05$	M4	874.54	1,415.81

M4 –Growth Reframing v. M6 – Applied Mindfulness	$p < .05$	Yes	$p < .05$	M4	874.54	1,007.43
M5 –Social Support v. M6 – Applied Mindfulness	$p < .05$	Yes	$p > .05$	N/A	1,415.81	1,007.43

Note. ($N = 487$). LRT = likelihood ratio test; AIC = akaike information criterion.

Table 10

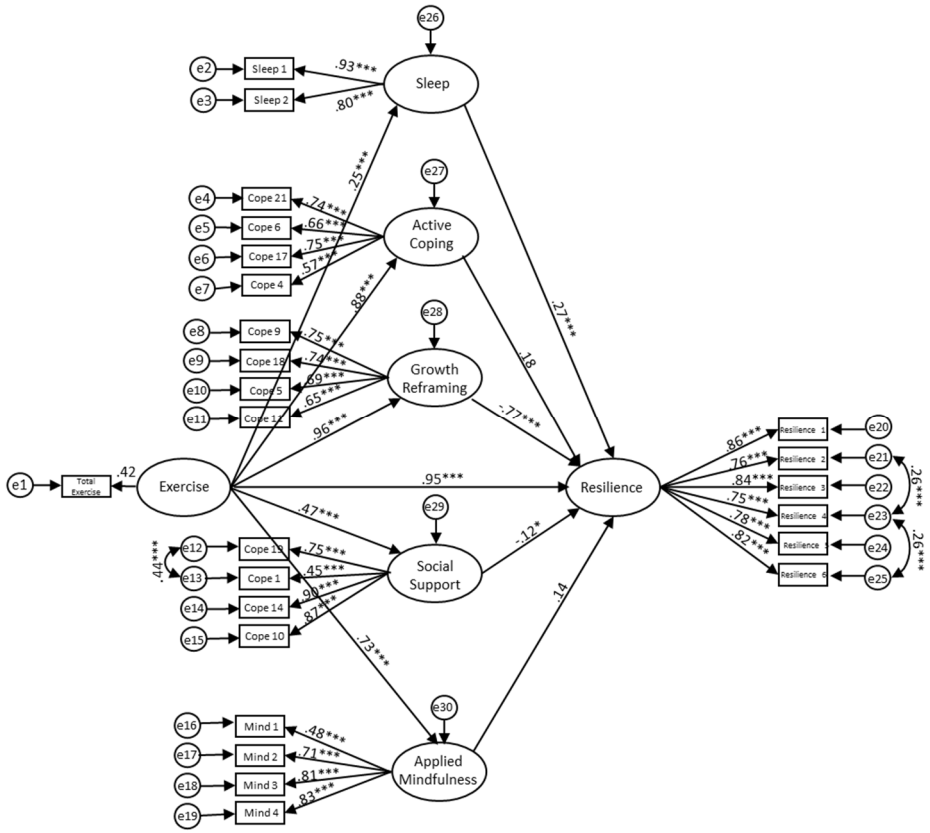
Non-Nested Model Comparisons by Which Ones Were Distinguishable

	AIC	Growth Reframing	Exercise	Active Coping	Applied Mindfulness	Sleep	Social Support
Practice							
1. Growth Reframing	875	--	N	Y	Y	Y	Y
2. Exercise	893	N	--	N	Y	Y	Y
3. Active Coping	903	Y	N	--	Y	Y	Y
4. Applied Mindfulness	1,007	Y	Y	Y	--	Y	Y
5. Sleep	1,398	Y	Y	Y	Y	--	N
6. Social Support	1,416	Y	Y	Y	Y	N	--

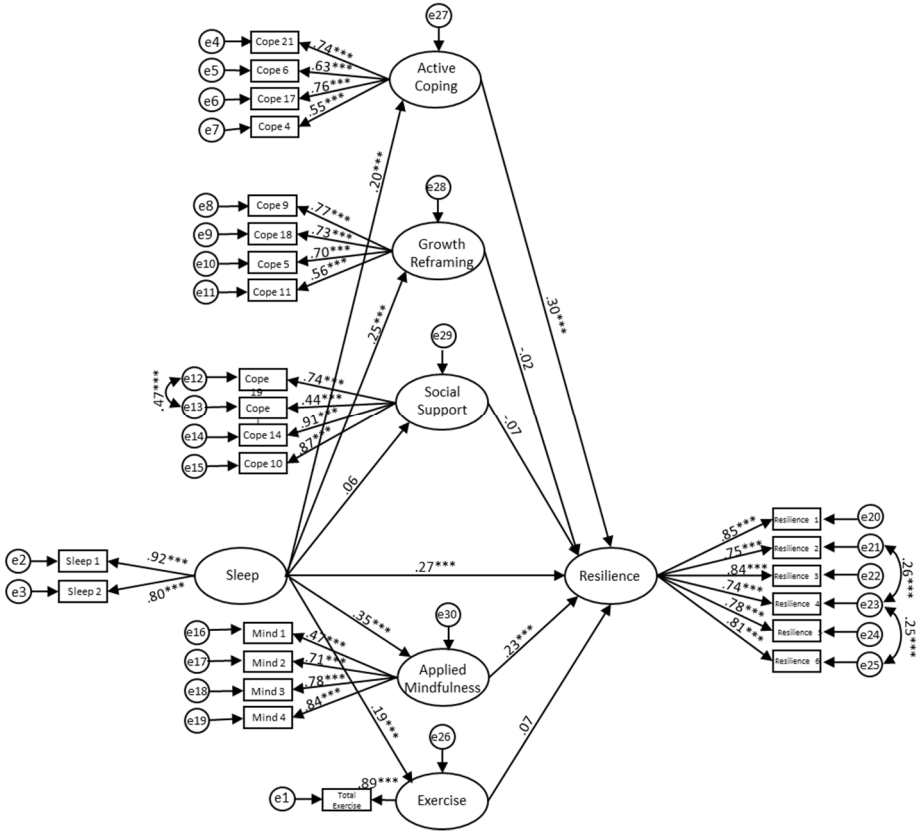
Note. (N =487). Y= Yes this practice is significantly different. N=No this practice is not significantly different. The practices are ordered in best fitting AIC (growth reframing) to worst fitting AIC (social support) thus the smaller of the two informs you which one is statistically performing better.

Figure 12

Standardized Parameter Estimates for Models of Structure for Each Resilience Practice Operating as the Catalyst (M1 –Exercise, M2 –Sleep)



*M1-Exercise as catalyst



*M2-Sleep as catalyst

Note. (N = 487). e = measurement error. * p < .05, ** p < .01, ***p < .001

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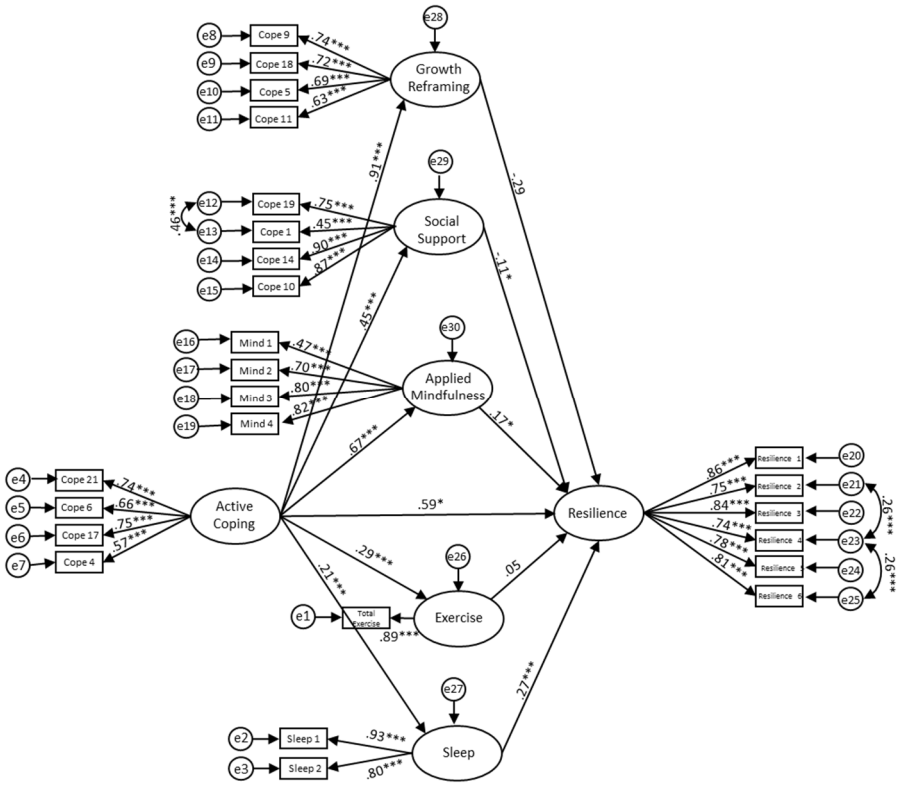
Figure 13

Standardized Parameter Estimates for the Resilience Practice Operating as the Catalyst (M3 –Active Coping, M4 –Growth Reframing)



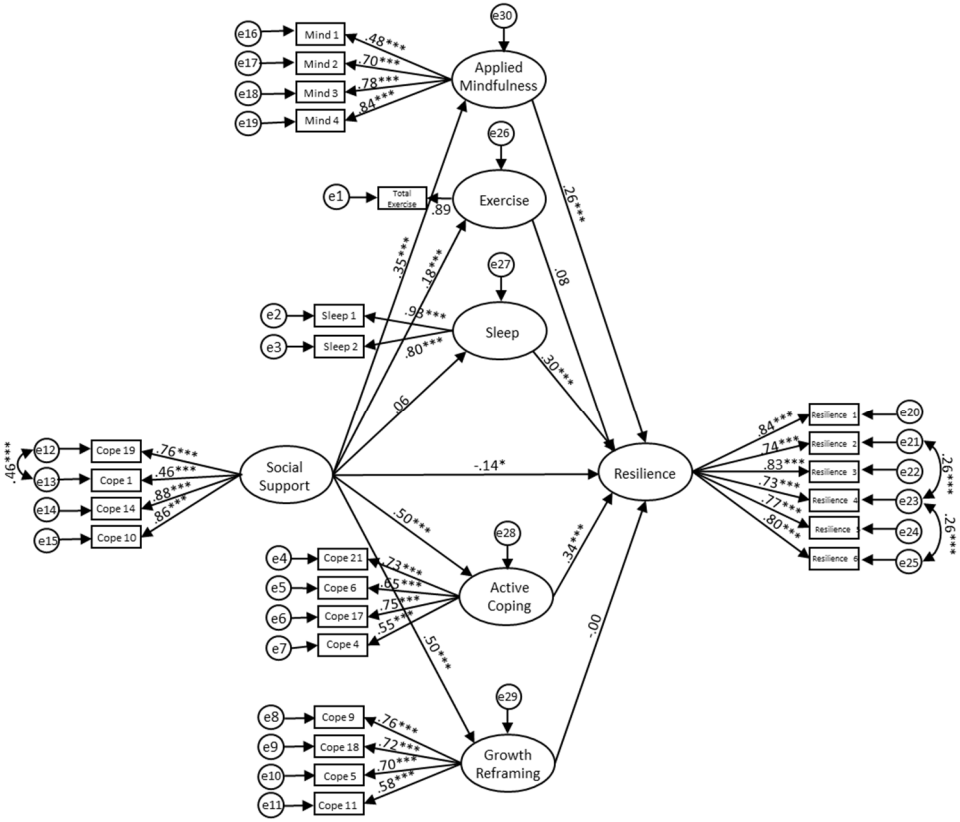
*M3-Active Coping as catalyst

*M4- Growth Reframing

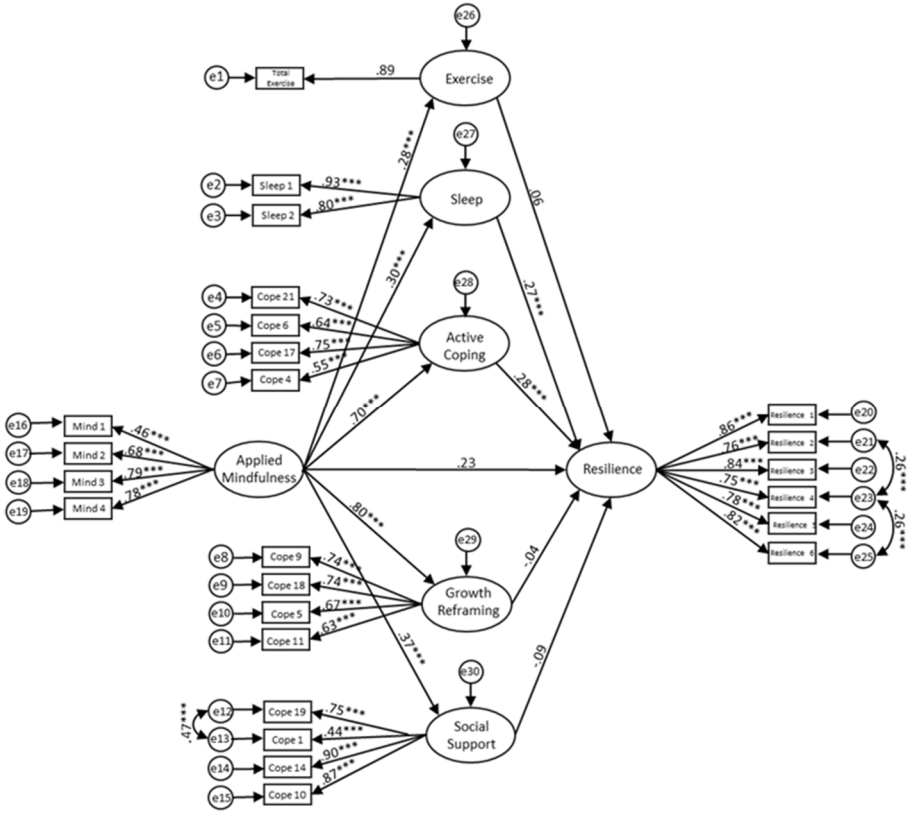
Note. (N = 487). e = measurement error. * $p < .05$, ** $p < .01$, ***$p < .001$.

Figure 14

Standardized Parameter Estimates for the Resilience Practice Operating as the Catalyst (M5 –Social Support, M6 –Applied Mindfulness)



*M5- Social Support as catalyst



*M6- Applied Mindfulness

Note. E = measurement error. $N = 487$. * $p < .05$, ** $p < .01$, ***$p < .001$.

Chapter IV: Discussion

The purpose of this study was to explore the catalytic relationships between resilience practices: exercise, sleep, active coping, growth reframing, social support, and applied mindfulness with resilience. Organizations value resilient individuals because they can perform and flourish in today's environment. Advice on how to increase one's resilience typically includes many practices that individuals should engage in (Ackerman, 2017; Luthans et al., 2010; Tabibnia & Radecki, 2018; Yost, 2016). This study was an exploration into the best place for individuals to start, and what strategies could be invested in or promoted by teams, organizations, and society as a whole as foundation for resilience building. The study looked at the practices in terms of how they may catalyze one another in order to increase one's resilience during challenging times. Consistent with previous research, results suggested that exercise (Childs & de Wit, 2014; Zhang & Chen, 2019), sleep (McCuistion, 2016), active coping (Folkman & Moskowitz, 2004, 2000), growth reframing (Ong et al., 2010), and applied mindfulness (Brown & Ryan, 2003; Carmody & Baer, 2008; Leary, 2004) significantly predict resilience. Results also implied that the practices combined predicted approximately one-quarter of participant resilience, as well as, exercise, sleep, active coping, social support, and applied mindfulness showed unique variance even when controlling for the others. Social support was the only resilience practice not significantly related.

In terms of catalytic power, there was support for exercise acting as a catalyst for most of the other resilience practices. This would signify that starting with exercise in order to build overall resilience is an advantageous place to start in comparison to other resilience practices. Although, surprisingly, the growth reframing model, exercise model, and active coping model, all showed catalytic potential to strengthen overall resilience (e.g., the catalytic model data had

adequate fit). While exercise did outperform many of the other catalyst models, it performed equally well to growth reframing and active coping. Although, growth reframing did outperform active coping, leaving the conclusion that two of the best strategies to start with is growth reframing or exercise.

Inconsistent with previous research (Cohen, 2004; Srivastava et al., 2006), the results did not find that that social support was not directly related to resilience. Several potential reasons may be operating in the current study. Although social support was measured in the current study with a well validated measure; because of COVID-19, many participants may have had limited opportunities to physically engage with other people and elicit social support because of the isolation orders in several states. Social support over the phone or video may not be the same. To face another person on video, the way our bodies are square off, how close our faces are to the screen, seeing our own face in a mirror for 8+ hours, would typically as an in-person experience would psychologically sendoff signals of feeling threatened rather than supported (Bailenson, 2021). Albeit social support was still significantly and positively related to many of the other practices that were predictive of resilience, it did not operate as a catalyst for the other behaviors. Thus, social practices did not seem to be as catalytic as physiological or cognitive resilience practices in the COVID-19 environment. Second, other types of social interactions that were not assessed may have been important. For example, research suggests that giving social support (e.g., serving and helping others) may also increase individual resilience (Cialdini & Kenrick, 1976) and thus should be further studied in the future.

Mind-Body Interlock

Additionally, consistent with previous research, a combination of the physiological (i.e., exercise) and cognitive (i.e., growth reframing and active coping) practices was important

throughout all four hypotheses in terms of their strength in relationship to resilience, and strength in relationship among all the practices. The best fit catalytic resilience models were growth reframing, exercise, and active coping, which indicates support for the growing body of research that cognitive and physiological strategies are central to resilience building and possibly the strongest initial building blocks (Kim & McKenzie, 2014). Not only did these models have the strongest catalytic relationships within them, but they also had the strongest relationships with all the other practices. The weakest catalytic relationships were shown in the sleep and social support models.

For centuries, the connection between the body and the mind has been studied. Theories date back to ancient philosophers questioning how the mind and body are related, work together, affect one another, and how to begin to explain that relational phenomenon. There is research now that shows there is a bidirectional relationship between the two, even though we often treat them separately (Wells-Fedderman et al., 1995). Rene Descartes was one of the first thinkers that claimed that because they are two distinct entities, one can exist without the other (i.e., dualism), but in terms of overall health research there is more understanding of how even as separate entities the mind controls the body and how the body can control the mind (McLeod, 2018). Some theorists claim that our bodily states are what influence our psychological states (i.e., behavioralist), others focus more on mental abilities or psychological experiences being the starting point (i.e., cognitivist), and some embody a combined approach of holding both equally and acknowledge that there is a mutual interaction between them (i.e., constructivism; Ertmer & Newby, 2013). Similarly, to Judge et al.'s (2001) exploration of the seven potential models explaining the relationship between job satisfaction and job performance, the physiological and cognitive practices may influence one another in a combination of one of those models (See

Appendix G). Of these models, it could be argued that model 3 (that physiological practices lead to cognitive practices, while simultaneously, cognitive practices lead to physiological practices) may be one of the strongest potential models in terms of catalyzing practices to increase resilience because the body and mind are concurrently operating together to catalyze other mechanism like social or spiritual practices.

The World Health Organization considers good wellbeing to include both physical and mental health, stating "Poor mental health is a risk factor for chronic physical conditions. People with chronic physical conditions are at risk of developing poor mental health." (WHO, 2012). This study taps into this relationship that in order to really trigger resilience practices and increase resilience you need to start with your body and your mind, they need each other to work together to increase your capacity to engage in additional resilience practices. The endorphins released while exercising, are also called happy chemicals, they enable your capacity to see things in a more positive framework (Craft & Perna, 2004; Johnsgard, 1989). Furthermore, previous research has shown that cognitive strategies are found to be stronger when an individual has engaged in physical exercise or physical activity (Kim & McKenzie, 2014). Exercise may lead to one having a clearer head, thus fostering coping strategies such as reframing a negative situation, seeking information to solve problems, and taking the problem one step at a time (Kim & McKenzie, 2014). Contrarily, when you have a negative outlook of the world, or allow negative situations to create stress, cortisol, a not happy chemical is released. This chemical can revert your health, cause your body to not be able to exercise in the way it normally would, it could counteract the power of endorphins (Phillips et al., 2013). Further research needs to be assessed on how these physiological and cognitive practices may be informing one another as a strong component for increase in overall resilience.

Theoretical Implications

Spillover Theory

There is evidence that behavioral spillover among resilience practices is theoretically occurring. With a construct like resilience where there are so many mechanisms working together in order to make one more resilient, understanding spillover could help further define resilience as a construct. Relationships between resilience practices changed based on which practice was being tested as the catalyst. Even the weakest catalytic models, showed many significant paths leading to resilience through other practices. Similar to Multiple Health Behavior Change research, the current study suggests that further research is promising to experimentally study the catalytic (spillover) relationships between resilience practices (Prochaska et al., 2912; Prochaska, 2008). This would allow studies to pursue the most catalytic practices. Additionally, this study did not investigate what other behaviors may interfere with resilience practices (e.g., negative spillover to such things as an increase in required stay at home orders, thus a decrease in time with friends, an increase in flexible work schedules from home causing a decrease in healthy sleep patterns). Similarly, future research may also investigate the behaviors that are decreased when one engages in the resilience practices (e.g., when utilizing applied mindfulness more often one may see a decrease in a negative behavior such as anxiousness or worry; however, one could also see a decrease in a positive behavior such as the ability to focus on past and future issues due to increased thoughts of awareness of the present time). Future work should consider what other negative behaviors are decreased because of engagement in resilience practices that could minimize stress or further enhance one's resilience (Smith et al., 2020; Bretland et al., 2015).

Resilience Across Levels and Cultures

During the COVID-19 pandemic, one's everyday working life tends to be more isolated and boundaryless (Koh & Liew, 2020). While this study is aimed at the individual level of overall resilience practices, complex adaptive systems theory can also be applied to discuss how these practices interact within organizations. Specifically, how the culture of facing challenges is still being fostered by the organization's employees. In complex adaptive systems (CAS), it is acknowledged that it is not always the people that are the key in creating dynamic systems, but the processes instilled within that system or culture that affect how the system or people interact with one another (Schneider & Somers, 2006) and how patterns can "arise from disorder through simple but powerful rules that guide change" (Folke, 2006, p. 257). Leaders and organizations wanting resilient employees and teams during these challenging and disorderly times, may have the best advantage by leveraging processes they already have in place to promote the most impactful resilience practices (Casti, 1994). This simple catch fire approach could then be two-fold both internally for an individual and externally from themselves to others in their teams and in the organization. Furthermore, an organization and leaders that are promoting strategic resilience practices for individuals are activating the individual's resilience by having these practices catalyze other practices in their daily life, strengthening their overall resilience. Additionally, this promotion in individuals is activating the system as a whole with resilience among employees potentially spilling over and catalyzing one another, creating sustainable patterns and a learning resilience culture. As noted later, organizations may promote resilience practices such as exercise by having onsite fitness facilities, reimbursing gym memberships, or further education in how one's working life is affected by their physical and mental health. The current study suggests that individuals engaging in these behaviors will be more likely to engage

in other resilience behaviors. CAS theory suggests that these individual behaviors may spillover to other people, such as coworkers, in the individual's social system (Aral & Nicolaides, 2017). The spillover of resilient behaviors to other organizational members represents another important area for future research.

Additionally, the importance of resilience across different groups and different cultures represents another important theoretical question. This research study was an exploratory start to how resilience practices work with one another within a U.S. sample at a historically challenging point in time. While it was an ideal time to study resilience practices being needed and utilized, it also is an opportunity to think deeper about how these results would or would not transfer in other countries, or during varying challenges and adversity unlike the COVID-19 pandemic. There is debate in the literature as to whether or not resilience is the same across cultures and time, and the possibility that both notions are true depending on the research question at hand. In addition, future research is likely to find some elements and relationships are common across humanity and some vary by person and culture.

There is evidence that commonality across cultures, time, religions, and upbringings in terms of a more ubiquitous list of human virtues exist (Dahlsgaard et al., 2005). One of these core values includes perseverance that is described similarly to resilience. Resilience during the COVID-19 pandemic represents a sample of the difficult situations that people have and continue to face. By analogy, the Global Leadership and Organizational Behavior Effectiveness (GLOBE) Research Program studied 62 cultures to determine if there is commonality in what leadership should exhibit (Den Hartog, et al., 1999). They found that there are many aspects of transformational/charismatic leadership that are strongly and universally endorsed, that could be initial evidence that resilience and the practices that build resilience could be studied across

cultures in this way. They also found other elements that were culturally specific. Future resilience research will likely need to follow a similar path. Some of the catalytic practices, elements of resilience, and the relationships between them may be universal and others are likely to vary. The current research project was focused on identifying common elements within the US population. Future research should consider universal and specific elements. Focusing only on universal constructs is problematic and focusing only on specific elements for every global sub-group is also problematic limiting the ability to provide general guidance and potentially labeling some groups as more or less resilient than others.

With these caveats in mind, the study of resilience in subgroups could generate important new insights. An individual or group defining and responding to a challenging or adverse event depends on perception of how severe that event may seem, or how much resilience is perceived to be necessary. This perception is based on an individual's intersectionality of values, morals, beliefs, worldview, upbringing, familial teachings, and so on (Raghavan & Sandanapitchai, 2019; Triandis, 1972). Thus, coping with difficult times could be different among groups and studying these differences could provide important insights. Many of the resilience studies to date are done with a potentially westernized lens to trauma or challenging times. Resilience practices selected may be different across cultures contingent on the challenging event one is facing and based on cultural experiences. For example, testing a larger battery of resilience practices across cultures could identify if the physiological and cognitive interlock still applies. That being said, when testing for resilience across cultures in a working context, future research should be weary to not ask questions of their data that could unintentionally hurt overall understanding of resilience in different groups rather than champion them.

Implications for Practice

Where to Start

On a practical level, benefits of resilience have been established such as a greater capacity for growth in challenging times (Dweck, 1986), less burnout, lower absenteeism (Avey et al., 2006), greater resistance to stress (Childs & de Wit, 2014; Ong et al., 2006), and overall greater physical health and sense of wellbeing (Ho et al., 2015; Tugade, & Fredrickson, 2004). Given how strongly resilience is related to well-being, understanding the causes of resilience is important. Study findings started to tap into the practical scenarios that inspired this study such that many resilience strategies are discussed in the literature or in the workplace, but are not often mentioned in terms of, "start with this strategy" or "if you engage in this strategy these other ones then come more naturally." Thus, the results suggest the best strategy to start with in order to build resilience is either growth reframing or exercise (See Appendix H for more applicable examples).

To promote exercise, organizations might encourage and promote time to be taken by employees to get out of their house and take a walk, workout in their living room on their lunch, provide on-site fitness facilities, or gym membership reimbursement (Friedman, 2014; Gil-Beltrán et al, 2020). Some organizations pay employees for 30 minutes of exercise daily, and the Central Intelligence Agency has established three hours a week of excused absence for exercise. As mentioned in the literature review, during the current times we are inspired by what we hear about friends and colleagues doing through pictures and stories because we do not see one another in person. As an organization encourage teams to share with each other once a week a picture of what they did, what they cooked, what makes them happy and to inspire and challenge others on their team (Aral & Nicolaides, 2017; Church, 2017).

To promote growth reframing, organizations may have guest speakers address growth reframing strategies in an online seminar, or encourage team calls that are not work related and meant to be social (Callan, 1993). Additionally, organizations can systemically change the verbiage and culture to contain a growth reframing outlook. For example, during the pandemic some organizations and leaders are addressing the overwhelmingness of the unknown, acknowledging employee fears, the losses, the innovative opportunities, or being transparent and reassuring (Honigmann, 2021). Organizations can incorporate messaging and tools in their performance management systems around how to address challenges and see them as growth opportunities that can grow them as a person or grow their career (McCall et al., 1988; Yost & Plunkett, 2010). There can be mentoring session on how to learn from these experiences, reflect on them (DeRue et al., 2012), and take that learning forward to future challenges and sharing your learning with coworkers (DeRue & Wellman, 2009).

Conservation Resources Theory and Organizations

Organizations should consider other external factors first before giving employees resilience resources. Conservation of Resources Theory (COR; Hobfoll, 2001) examines internally how people are motivated socially, biologically, and cognitively through gaining, retaining, and protecting our resources. Stress is inherently induced for someone when put in a situation that requires them to expend resources. One is fighting the urge of potentially depleting more resources, when they are naturally motivated to retain and protect the ones they already have while under stress. When under stress, one is often motivated to do one or multiple of three things: protect, procure and preserve our resources. These resources can be tangible items, current roles or conditions, internal values or characteristics, or energies. Depending on what state each individual or team is in, they have potentially already lost resources, are fighting to

keep the ones they have, or by being encouraged to "learn to be resilient" are depleting even more of the potentially few resources they have left. In a study following Airman who had experienced severe trauma and significant stress serving in the U.S. Air Force, the airmen already had significantly depleted resources and thus minimal ability for resource gain (Vinokur et al., 2011). An organization may need to consider what other aspects can give employees resource gain before asking them to deplete resources to engage in building resilience practices. Often when resources are being depleted during stressful times (i.e., the COVID-19 pandemic), employees have lost resources like job security, trust, wellbeing, sense of belonging, work life balance, optimism, et cetera. Ideas an organization could consider that can be resource replenishing include: ensured job security, family considerations, individual characteristics or values being met in the culture of the workplace, encouraged strict working vs. home hours, et cetera. Taking other factors that lead to stress or contribute to it during high stress times may be a better place for organizations to start before depleting too many resources by providing new learning of new skills.

Often when discussing stress or challenging moments, employers provide employees the opportunity to gain new resilience skills to face these challenging moments. Yet, what resources are employees giving up or trading (i.e., time, energy, etc.) in order to learn these new important skills that the organization is supporting or providing? Readiness is not always assessed when the assumption is that everyone is always ready for training or resources that offer increased positive outcomes for both personal and professional life. Organizations may consider how to replenish resources, or remove resource depleters as a first step in the resilience building action plan, before asking employees to use more of their resources during a stressful event to take a resilience training program.

Future Use of Resilience Survey

Given that resilience is not specific to a particular industry, profession, or job level, the findings are relevant to a large population of individuals under a stressful historical event. Dealing with hardship is something that everyone in every walk of life, at varying degrees deals with. Anything from a natural disaster to loss of a job, to family death, to long workdays, a difficult leader, to a pandemic, are needs for resilience. The protocol and measures used in this study are a good starting point for how testing associations of resilience practices could be further developed and investigated. If this study were to be replicated there is evidence that if some groups were to engage actively in just growth reframing, exercise, or active coping it could show which naturally affects other practices and overall resilience in comparison to a group not focused on any one practice in particular. Additionally, the measure used provides a valuable tool to help individuals grow. The items tap into how one is engaging with each construct, also allowing it to be a tool that one could use to improve upon.

Limitations and Future Research

As with any research study, particularly within a developing field, there are limitations. The potential for future research to expand on this study's parameters will provide a contribution to the understanding of how resilience practices can work to together to further equip one for future challenges or adversity. Three specific areas that can be strengthened in follow up studies relate to internal and construct validity.

In this study, I examined the relationships between resilience and five resilience practices but cannot make causal inferences between the predictors and criterion (Shadish et al., 2002). Further experimentation is needed to determine if increases in some resilience practices engage other practices, thereby increasing overall resilience. Additionally, future research is needed to

expand our understanding of how people can develop these resilience practices. Longitudinal studies could assess the extent to which resilience practices are predictive of long-term thriving and short-term surviving over time.

Additionally, while this study discussed the activation or spillover of one resilience practice to another, it is likely that resilience and resilience practices could have a bidirectional or cyclical relationship. Future studies could further explore directionality of resilience and resilience practices. Furthermore, future work is also needed to assess the sustainability and spillover of resilience practices over longer periods of time. Future research may also consider exploring other outcomes such as psychological well-being or valued work outcomes such as job performance to see how the strategies may influence those outcomes.

Another limitation worth noting is the evident history threat of COVID-19 concurrently operating along the timeline of the study. This is an interesting limitation in terms of there is a chance that the observed significant results were magnified due to the pandemic (e.g., greater variance in the practices and resilience of participants or the pandemic may have served as a moderator making some practices more or less important (e.g., the potential that social support played less of a role).

While the measure used to assess resilience represented the current definition of resilience (e.g., not just surviving but also bouncing back and growing from an event), resilience can be defined in many different ways across varying contexts. This can be an issue in determining to what degree the selected measures are indeed measuring what they are supposed to be measuring (Shadish et al., 2002). Resilience research in the workplace was considered still in its "infancy" in the past seven years and still has some argument in how to conceptualize it in differing contexts (Britt et al., 2016; McLarnon & Rothstein, 2013). Furthermore, the current

study did not assess any physiological measures of resilience such as reduced blood pressure, lower resting heart rate, increased mood, which would strengthen future research in this area.

Conclusion

The world and the world of work will continue to remain dynamic and identifying the practices that can help increase resilience will only increase in importance over time. Exploring what strategies allow individuals, teams, groups, organizations, and society to not only survive adversity but move through it and emerge stronger on the other side is what the world may need right now coming out of the COVID-19 pandemic. This study identified that of the learnable and developable practices that had the most catalytic effect on other practices were ones that tended to be physiological or cognitive. This study showed physiological and cognitive practices as strong catalysts, suggesting that those looking to increase resilience could do so by starting with one of those types of practices. This study shows the beginning understanding that resilience can be catalytic, contagious, and have spillover effect. As mentioned in the beginning resilience practices are contagious. Possibly every time we choose resilience, everyone around us will be more resilient, thus society becomes more resilient. With more understanding of how to catalyze resilience practices within ourselves and among one another, perhaps as a society we too will navigate the current pandemic and come out on the other side a little better and a little more resilient.

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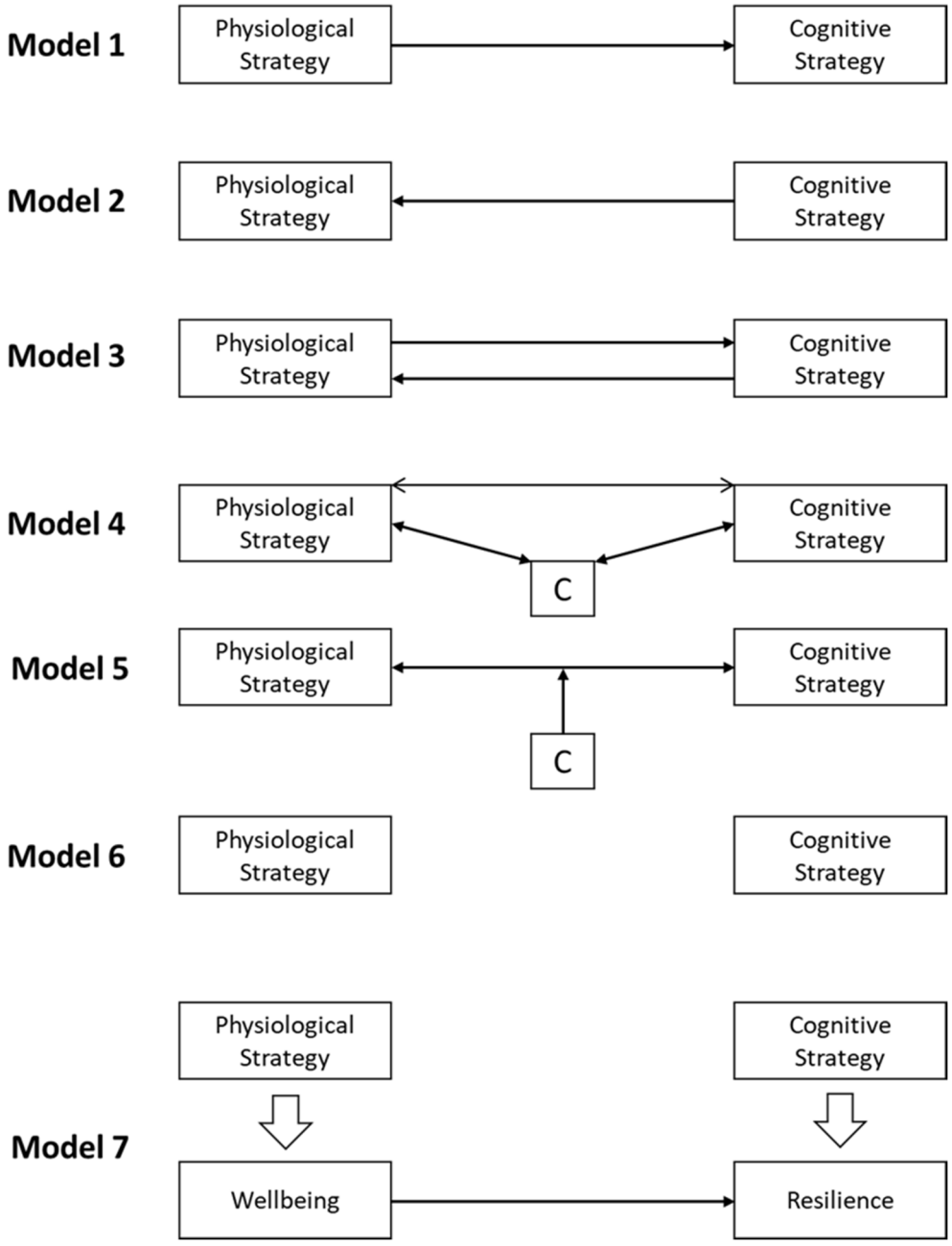
Appendix F

Demographic Questions

Demographics	
Directions: Please provide the following information:	
D1. What is your age?	
	_____ (please enter the number of years)
D2. Please indicate your ethnicity. Mark all that apply: (optional)	
	1. Asian or Asian American 2. Black or African American 3. Hispanic, Latinx 4. White, Caucasian 5. American Indian/ Native American 6. Other (write in): _____
D3. Please indicate your gender (optional)	
	• Male • Female • Prefer to self-describe: _____

Appendix G

Catalytic Relationships between Physiological and Cognitive Resilience Practices



*Note. Models of the catalytic relationship between physiological strategies and cognitive strategies. (Note that in models 4 and 5, C denotes a third variable) Examples mirrored from Judge et al., 2003

Appendix H

Key Takeaways: Go dos for individuals and organizations

Resilience Practice	Behavior 1 (Individual)	Behavior 2 (Organizational)
Growth Reframing	• Journal about adverse event or thought and write out three positive outcomes that have or could come from it. • Use learning from these challenging experiences, positively reflect on them (DeRue et al., 2012), and take that learning forward to future challenges (DeRue & Wellman, 2009).	• Incorporate messaging and tools in performance management systems on addressing challenges and seeing them as growth opportunities that can grow individuals and/or grow careers (McCall et al., 1988; Yost & Plunkett, 2010). • Organizational cultures need focus on the unique value and contribution of all employees in times of challenge or adversity (Yost & Chang, 2009)
Exercise	• Think about the impact your behavior and your health has on others around you and your loved ones, think about how they rely on you to be healthy to motivate yourself (Grant & Hofman, 2011; Rothman et al., 2015). • Get 21 minutes of strenuous exercise to relieve stress and state anxiety (i.e., walk the stairs in your building, vacuum your living room, go for a jog, etc.) • Look for inspiration from family or friends, create accountability groups.	• Implement policy initiatives that include key documents or health education leaflets that allow people the opportunity to create "if-then plans" (Rothman et al., 2015; Gollwitzer, 1999). • Pay employees for 30 Minutes of exercise daily • Encourage teams to share with each other once a week a picture of what they did that was active, what they cooked, what makes them happy and to inspire and challenge others on their team (Aral & Nicolaides, 2017; Church, 2017).
Active Coping	• Identify and define the problem at hand, helping to reduce your cognitive load. • Break up the challenge you are facing into many achievable steps. Celebrate yourself as you make it through each of these goals (Weick, 1984).	• Design thinking as a method for problem solving is built on the concept that successes and failures are expected and instructive and solutions often come from focusing on strengths (Brown, 2009). • Audit your structures, processes, and team functioning. Identify what the barriers are and the impact of these barriers (Galetti et al., 2019).