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Examining the Role of Trait Resilience and Self-Compassion in Adaptive Responses to Stress: A Physiological Stress Response Study

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This dissertation, EXAMINING THE ROLE OF TRAIT RESILIENCE AND SELF-COMPASSION IN ADAPTIVE RESPONSES TO STRESS: A PHYSIOLOGICAL STRESS RESPONSE STUDY, by KAREN SHEBUSKI, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education & Human Development, Georgia State University.

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Shebuski, K., Davari, J., Cobourne, L., McLaulin, S., & Ashby, J. (August, 2019). *Examining physiological correlates of trait resilience: A stress response study.* Poster presented at the 2019 American Psychological Association annual meeting, Chicago, IL

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EXAMINING THE ROLE OF TRAIT RESILIENCE AND SELF-COMPASSION IN ADAPTIVE RESPONSES TO STRESS: A PHYSIOLOGICAL STRESS RESPONSE STUDY

by

KAREN SHEBUSKI

Under the Direction of Dr. Jeff Ashby

ABSTRACT

Psychological resilience is concerned with adaptive functioning in the face of stress, adversity, or trauma (Davydov, Stewart, Ritchie, & Chaudieu, 2010; Windle, 2011). Trait level psychological resilience refers to characteristics that may predispose adaptive responses to stress, trauma, and adversity (e.g., Connor & Davidson, 2003). Despite work suggesting the benefits of trait resilience (e.g., Hu, Zhang, & Wang, 2015), there are multiple self-report measures in existence with no identified measurement standard (Windle et al., 2011). Given differing conceptualizations of trait resilience, physiological measurement of stress response represents a viable and objective approach to examine psychological resilience (Walker, Pfingst, Carnevali, Sgoifo, & Nalivaiko, 2017), with some work suggesting that those high in trait level resilience

exhibit an adaptive and flexible physiological stress response to induced stressors (Lü, Wang, & You, 2016; Tugade & Fredrickson, 2004). However, findings have been mixed, in part due to the utilization of measures across studies that differ in their conceptualization of trait resilience. Further, research has not examined other variables with empirical and conceptual links to trait resilience within this context; such as self-compassion (e.g., Arch et al., 2014). The first chapter of this dissertation provides a review of the differing conceptualizations of psychological resilience and potential resilience enhancing interventions. The second chapter of this dissertation comprises a study that aimed to examine the relationship between four self-report measures of trait resilience and several cardiovascular indices of physiological stress response in order to determine which measure best captured an objective ability to adaptively respond to stress. Self-compassion was measured in order to examine the potential additive role of this variable. Despite the hypothesis that multiple measures of trait resilience would correlate significantly with an adaptive stress response and subsequently predict adaptive stress response in a simultaneous multiple regression model, results indicated non-significant relationships between all self-report measures and physiological indices. Subsequent analyses examining additional cardiovascular indices and curvilinear analyses were also non-significant. Implications, limitations, and directions for future research are discussed.

INDEX WORDS: Psychological Resilience, Self-Compassion, Stress Response

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1 PSYCHOLOGICAL RESILIENCE: PERTINENT INFORMATION AND INTERVENTION POINTS FOR COUNSELORS

The concept of psychological resilience is broadly concerned with adaptive functioning in the face of stress, adversity, or trauma (Davydov, Stewart, Ritchie, & Chaudieu, 2010; Fletcher & Sarkar, 2013; Windle, 2011). This concept is of particular relevance to mental health professionals, as most clients seek counseling in response to life stressors (Pérez-Rojas et al., 2017). Furthermore, targeting relevant factors in counseling that may bolster or increase resilience may aid clients in adjusting to stress, trauma, or other forms of adversity throughout the lifespan. Nonetheless, the depth and breadth of empirical research in this area has resulted in several differing conceptualizations of psychological resilience, leading scholars to conclude that there is no one universal definition of resilience available in the extant literature (Davydov et al., 2010; Windle, 2011). Given the complexity of resilience research, it can prove difficult for mental health professionals to consolidate information from divergent conceptualizations. To this end, this paper describes several prominent models of psychological resilience, describes the ways psychological resilience is currently conceptualized, and reviews the existing empirical literature regarding resilience enhancing interventions that may be implemented in a counseling context. In addition, several malleable psychological factors that may bolster resilience are underscored as potential intervention points for counselors.

The American Psychological Association (APA) defines resilience as a process through which one adapts in the face of adversities such as trauma, or other sources of significant stress such as threats to physical health, relationship issues, and financial or workplace stressors (APA, n.d.). Consistent with this definition, scholars have focused on adaptive responding in the presence of many different types of adversities, including resilience to forms of psychopathology

in the presence of labeled risk factors (Oddo, Knouse, Surman, & Safren, 2018; Trezise, McLaren, Gomez, Bice, & Hodgetts, 2017), resilience in response to acute or chronic forms of trauma or major life events (Miller et al., 2011; Overstreet et al., 2017; Galatzer-Levy, Huang, & Bonano, 2018), and resilience in response to daily life stressors (Almeida, 2005; Diehl & Hay, 2010). Resilience to acute stressors measured in controlled settings has also been examined as a means of investigating adaptive responding to more general forms of stress (Black, Balanos, & Whittaker, 2017; Lü, Wang, & You, 2016, Tugade & Fredrickson, 2004; Walker, Pfingst, Carnevali, Sgoifo, & Nalivailko, 2017). Despite differing conceptualizations, it is clear that resilience is relevant to counselors working to assist their clients in coping with daily life stress or more severe forms of stress experienced through trauma exposure.

Theoretical Models of Resilience

There are multiple theoretical lenses through which resilience has been conceptualized. Though resilience has been predominately studied in specific populations or in the context of particular stressors (Fletcher & Sarker, 2013), scholars have attempted to develop generalizable models of resilience. In general, existing models of resilience have been categorized into three approaches: those that depict resilience as a process by which one encounters a stressor and exhibits an outcome characterized by the return to pre-stressor functioning or growth (Mancini & Bonanno, 2009; Richarson, Neiger, Jenson, & Kempfer, 1990; Richardson,2002), those that depict resilience as a multidimensional construct that involves the interaction between inter and intrapersonal factors (Liu, Reed, & Girard, 2017), and those that depict resilience as a measurable construct that is comprised of a combination of personality traits and other psychological factors (Block & Kremen, 1996; Connor & Davidson, 2003).

Process and Outcomes Based Approaches

Richardson and colleagues' (1990; 2002) resiliency model illustrates resilience as a process that an individual moves through. Specifically, one encounters a stressor, or life event that necessitates the incorporation of new information into one's worldview, and subsequently copes in a way that allows the individual to obtain additional protective factors that may be used to cope with future stressors. The initial encounter with a stressor or life event is the catalyst that sets this process in motion.

Richardson and colleagues (1990) posited that individuals operate at a state of biopsychospiritual homeostasis, or a state of balance on physical, mental, and spiritual levels. This state of homeostasis is under constant bombardment by various stressors. Contrary to other theorists (Bonanno et al., 2012; Bonanno & Diminich, 2013), Richardson postulated that stressors are not negative by default, but may take the form of positive life events that necessitate change (e.g., an occupational promotion, marriage, etc.). Within this model, the individual's response to these threats against homeostasis depends largely upon the protective resources at their disposal and their appraisal of the potential threat. Richardson and colleagues (1990) described these protective factors broadly: citing emotional states such as happiness and optimism, faith, self-determination, and wisdom as factors that prevent disruption. If an individual is not equipped with the protective resources needed to mitigate the stressor or life event, a "disruption" occurs during which time the individual must reintegrate new information into their worldview.

Richardson proposed that following a disruption, there are several ways an individual may "reintegrate." One potential pathway, resilient reintegration, is characterized by growth following the stressor. In other words, one emerges from the reintegration process "better" than

before they experienced the stressor or life event. In contrast, one can undergo dysfunctional integration, characterized by a largely negative outcome that may include maladaptive coping such as substance abuse, or may return to pre-stressor homeostasis. From Richardson's standpoint, resilience is seen as a process that is set in motion by confrontation with a stressor or life event, followed by a reintegration process characterized by growth. This conceptualization of resilience is reminiscent of Tedeschi and Calhoun's (1996) argument that positive growth is possible following the occurrence of a traumatic stressor (i.e. posttraumatic growth).

Mancini and Bonanno (2009) developed an individual differences model of resilience. Though the model was intended for individuals who had recently experienced the loss of a spouse, it has since been generalized to illustrate potential outcomes following the experience of traumatic stressors and negative life events (Bonanno, et al., 2012; Bonanno & Diminich, 2013). Similar to Richardson's model, the individual differences model emphasized outcomes. While Richardson's model focused on adjustment to either major positive or negative life events, the individual differences model focused solely on trajectories of adaptation following negative life events or traumatic stressors. Following the initial development of the model, Bonanno and Diminch (2013) incorporated the differentiation between acute and chronic stressors within the model, which they termed impact and emergent resilience respectively. While impact resilience included trajectories following an acute stressor (i.e. a single instance of physical or sexual violence), emergent resilience included trajectories following chronic exposure to prolonged stressors (i.e. repeated childhood abuse or poverty).

The individual differences model is grounded in the belief that resilience cannot be directly measured, and instead must be inferred from outcomes. Similar to Richardson's model (1990; 2002), encountering a stressor sets in motion a process by which individuals may emerge

in different ways (one of which is indicative of resilience). Within the individual differences model, the development of psychological symptoms is the predominant outcome used to infer resilience. Scholars of this school of thought posited that there are several observable trajectories one may exhibit following stressor exposure. The least favorable outcome is labeled the chronic dysfunction trajectory, in which an individual exhibits elevated psychological symptoms that emerge soon after the stressor and persist for years afterwards. In contrast, a recovery trajectory is characterized by distress as indicated by elevated levels of psychological symptoms after the stressor, and a gradual return to baseline functioning. A resilience trajectory is characterized by an appropriate and temporary period of psychological distress following the stressor, and timely return to baseline levels of functioning afterwards. The distinguishing feature of the resilient trajectory is the length of distress experienced that significantly impacts functioning. Scholars have exerted care to distinguish resilience from resistance in this context. In other words, rather than a pathway that illustrates a trajectory in which individuals are 'unimpacted' by adverse events, the resilient trajectory illustrates that a rise in psychological distress following such events is normative and comprises a part of the trajectory (Bonanno et al., 2012; Bonanno & Diminich, 2013; Mancini & Bonanno, 2009).

Within the individual differences model, a resilient outcome is facilitated through two main processes: the appraisal of the stressor, and the availability of the individual's social resources. Individual factors such as personality, attachment, capacity for positive emotions, culture, physical health, and external resources such as financial status influence the appraisal process, which in turn impact the coping strategies utilized (Bonanno & Diminich, 2013). Notably, the individual differences model postulated that effective coping and resilient outcomes influence each other in a bidirectional nature. In other words, individuals who exhibit a resilient

trajectory after exposure to a stressor (and thus do not develop long term psychological symptoms at a level that impairs functioning) are able to employ adaptive coping strategies, which decreases psychological distress (Bonanno et al., 2012; Bonanno & Diminich, 2013; Mancini & Bonanno, 2009).

In sum, the individual differences model characterized resilience by transient distress followed by return to baseline functioning after encountering a stressful event. Notably, trajectory-based approaches may serve to categorize individuals as resilient or non-resilient based on levels of psychological symptoms following stressor events. Several authors have spoken out against these sorts of classifications (e.g., Almedom & Glandon, 2007) following early published work by Bonanno and colleagues (Bonanno, Galea, Bucciarelli, & Vlahov, 2006). Additionally, though the individual differences model posits that a resilient trajectory is the most common outcome exhibited in individuals following exposure to stressor events, some scholars have cast doubt on this notion. Specifically, potential methodological flaws have been identified in the growth mixture modeling approach used to support the notion that a resilient trajectory is commonplace following exposure to a stressor event (Infurna & Luthar, 2016; 2018).

Multidimensional Approaches

In response to trajectory and outcomes based approaches that primarily utilize the absence of long term psychological symptoms to infer resilience, multidimensional models have been proposed. These approaches place larger emphasis on the interplay between internal and external factors that may contribute to general adaptivity. One recently proposed model that depicts this shift is Liu, Reed, and Giard's (2017) multi-system model of resilience. Distinct from previously described process and outcomes based approaches, Liu and colleges' multi-

system model is not contingent upon the experience of a distinct stressor or traumatic event. Rather, the model encompasses a set of factors that interact with each other in different ways within different contexts.

The model is organized spherically into three tiers, with core resilience representing the innermost component, followed by internal resilience, and external resilience. Core resilience is comprised of intra-individual, or predominantly biological factors, and sex. An individual's "hard wired" physiological stress response systems are included at this level, along with one's overall level of physical health, and basic health related behaviors such as diet, exercise, and sleep. These factors are located at the innermost level of the model because the majority are, for the most part, considered to be relatively stable over time. As the model progresses outwards to internal resilience, interpersonal factors are described. Interpersonal factors include malleable factors that can be derived or developed through social resources available to the individual, such as family, educational institutions, or other available social groups. Though Liu and colleagues (2017) do not provide an exhaustive list of factors, they include autonomy, self-regulation, hardiness, psychological toughness, coping, style of appraisal, competence, and grit as candidates. At the outermost level of the model is external resilience, which is composed of systems based factors such as socioeconomic status, access to healthcare, and geological location (Liu Reed, & Giard, 2017).

Furthermore, Liu and colleagues (2017) described resilience as a constant interaction between internal and external factors throughout the lifespan. While the individual differences model acknowledges intrapersonal factors such as appraisal, the model is largely focused on long-term trajectories that infer resilience from the presence or absence of long term psychological symptoms. Conversely, the multisystem model stresses the interaction between

both internal and situational factors that may be unique to an individual and vary over time according to context. As a whole, this shift has allowed for a conceptualization that acknowledges the presence of larger structures as well as individual resources and skills that one may have at their disposal in the context of various stressors throughout the lifespan (Liu et al., 2017).

Trait Based Approaches

More recently, trait-based approaches of resilience have emerged. In this context, resilience has been conceptualized as set of personality traits, assets, or psychological resources that an individual may possess that contribute to or comprise the ability to respond to adversity in adaptive ways. Within this school of thought, psychological resilience is measured directly as a distinct construct rather than inferred through outcomes following a stressor or traumatic event. Nineteen distinct self-report measures of trait resilience have been developed in attempts to directly measure trait levels of resilience (see Windle, Bennett, & Noyes, 2011 for a thorough methodological review of resilience measures). Notably, each of these measures vary in the specific traits and resources argued to comprise the construct (Davydov et al., 2010). Two of the most widely used conceptualizations of resilience as a trait or set of traits are Block and Kremen's (1996) ego resilience and Connor and Davidson's (2003) trait resilience; both of which have resulted in the creation of self-report measures that have been widely used in empirical work (i.e. the Ego Resilience Scale, and the Connor Davidson Resilience Scale).

Ego resilience and Connor and Davidson's trait resilience have been used interchangeably with psychological resilience in empirical studies. Oshio and colleagues' (2018) found an inverse relationship between both constructs and stable personality traits such as neuroticism, and positive relationships with extroversion, openness, agreeableness, and

conscientiousness in meta analytic work. Hu and colleagues' (2015) found an inverse relationship between both constructs and negative indicators of mental health such as depression, anxiety, and low life satisfaction in cross sectional meta-analytic work. While ego resilience and Connor and Davidson's trait resilience differ in some respects, both appear to be beneficial. Due to the frequency with which these constructs are used, a description of these concepts is provided below.

Ego Resilience

In general, ego resilience (Block & Kremen, 1996) is described as a unitary construct that comprises the ability to adapt to factors in the environment that place demand on the individual. An individual who exhibits ego resiliency is believed to be able to effectively and flexibly adapt to the demands of the environment by returning to psychological balance. This trait is argued to comprise a component of an individual's personality system that provides protection from the development of negative outcomes in response to psychological stressors. Ego resilience is conceptualized on a continuous spectrum, with ego brittleness at the other extreme. Those who exhibit ego brittleness are argued to be at risk for developing negative outcomes in response to novel situations and environmental stressors. In an attempt to capture this construct, Block and Kremen (1996) developed the Ego Resilience Scale (ER-89; 1996); a fourteen item scale comprised of one unitary factor. The ER-89 attempts to measure ego-resilience by capturing an individual's cheerfulness, spontaneity, curiosity, sense of meaning in life, and sense of responsibility (Block & Kremen, 1996).

Scholars utilizing ego-resilience as an indicator of psychological resilience have suggested that the construct is related to adaptive outcomes following various stressors and in the midst of ongoing stressors. Though limited, scholars conducting prospective work have added

support to the notion that resilience may be a measurable construct that contributes to adaptivity following a stressor. For example, Fredrickson and colleagues (2003) found in their prospective study that ego-resilience measured prior to 9/11 attacks was predictive of lower levels of depressive symptoms following the event. Ego-resilience has also been examined in the midst of ongoing stressors. In a study of cancer patients undergoing treatment, ego-resilience was found to be positively correlated with self-reported quality of life (Harper et al., 2014). In the context of daily stressors and induced acute stress, ego resilience has been positively associated with adaptive responding. For example, Ong and colleagues (20016) found that ego resilience moderated the relationship between daily stress and negative emotionality, in the context of ongoing stressors. Moreover, in their psychophysiological study, Souza and colleagues (2013) found that ego-resilience was related to adaptive physiological responses to an induced acute stressor.

Connor & Davidson's Trait Resilience

Connor and Davidson (2003) described trait resilience as a set of personal qualities that allow one to thrive despite encountering adversity. To delineate this set of personal qualities, Connor and Davidson compiled the work of several theorists that have illuminated traits or qualities believed to be possessed by resilient individuals (Kobasa, 1979; Rutter, 1985; Lyons, 1991). This approach resulted in a list of 17 characteristics, including the tendency to view change or stress as a challenge, sense of humor, optimism, and faith. These traits were used to construct the Connor Davidson Resilience Scale (CD-RISC), one of the most widely used measures of trait resilience. As opposed to ego-resilience, which is conceptualized as a unitary construct, the original psychometric construction of the CD-RISC yielded five factors: (1) personal competence, high standards, and tenacity, (2) trust in one's instincts, tolerance of

negative affect and an individual's ability to be strengthened by prior stressors, (3) positive acceptance of change and secure relationships, (4) sense of control, and (5) spiritual influences (Connor & Davidson, 2003).

Similar to ego-resilience, Connor and Davidson's conceptualization of trait resilience has been shown to relate to outcomes following various stressors. For instance, CD-RISC scores mitigated the relationship between high levels of trauma exposure and PTSD symptoms in a sample of firefighters exposed to disaster scenarios, suggesting that trait resilience may comprise a protective factor against the development of distress (Lee, Ahn, Jeong, Chae, & Choi, 2014). Further, Pietrazak and colleagues (2009) found that CD-RISC scores significantly predicted lower levels of both PTSD and depressive symptoms after controlling for severity of combat exposure in their study of combat-exposed military servicemembers returning from deployment. Similar findings were reported by Ying and colleagues (2014) in their study of adolescents exposed to a large scale earthquake in China; CD-RISC scores were negatively related to PTSD symptoms, and moderated the relationship between indirect exposure and depressive symptoms. Though prospective work is needed, these relationships may be present longitudinally. For instance, Thompson and colleagues (2018) evaluated participants immediately after trauma exposure that resulted in serious injury, and found that the CD-RISC (administered at one month follow up) significantly predicted lower levels of future PTSD symptoms.

Resilience Enhancing Interventions

Overall, scholars have conceptualized resilience differently across the extant literature. However, separate lines of research have labeled protective factors and psychological factors that may enhance adaptive outcomes in the context of various stressors. These findings have led to the development of various structured interventions designed to enhance resilience, with one

recent review reporting a total of 48 randomized control trials designed to increase resilience based on varying definitions and outcomes (Chmitorz et al., 2018). Often marketed as "training programs", these interventions typically target specific populations (e.g., police officers, first responders, military servicemembers) in hopes of bolstering resilience. As noted in a recent review of intervention studies in this area (Chmitorz et al., 2018), extant interventions have focused on increasing levels of resilience at three time points: before a stressor is encountered, during exposure to a chronic stressor, and following stressor exposure. However, scholars have noted that most available training programs in this area target psychologically healthy participants who are not currently undergoing adverse situations with the intention of bolstering protective factors before the individual encounters adversity. (Forbes & Fikretoglu, 2018; Leppin et al., 2014).

Similar to the differentiation between psychological resilience conceptualized as a process and a trait, extant intervention work has targeted different factors in the hope of enhancing resilience. For example, some approaches have focused exclusively on building protective factors. For example, In early work Sadow and Hopkins (1993) focused on building an internal locus of control and self-efficacy in veterans experiencing substance use disorders and homelessness. These types of approaches have persisted, as illustrated by a study conducted in 2004 with a sample of governmental employees that aimed to build protective factors such as self-esteem, locus of control, and interpersonal relationships with the ultimate goal of bolstering the ability to reintegrate in the face of change (Waite & Richardson, 2004) Similarly, other intervention programs center on increasing stress management and coping strategies before relevant stressors are encountered. For example, Adler and colleagues (2015) aimed to equip military servicemembers during basic training with preemptive knowledge regarding signs of

stress reactions that they may experience in their role and provided strategies to manage these reactions using cognitive coping strategies and social support (Adler, Williams, McGurk, Moss, & Bliese, 2015). McKibben and colleagues (2009) argued that these types of interventions can serve to preemptively bolster protective factors or specific coping strategies in individuals exposed to high stress scenarios. For instance, infantry servicemembers who received this classification of training pre-deployment reported fewer PTSD symptoms post-deployment after controlling for combat exposure (Mckibben, Britt, Hoge, & Castro, 2009).

An additional set of interventions has concentrated on increasing self-reported levels of trait resilience by targeting multiple factors posited to facilitate positive outcomes. For example, Loprinzi and colleagues (2011) utilized a sample of patients recently diagnosed with breast cancer and attempted to increase self-reported levels of trait resilience by providing a brief intervention that targeted flexibility, gratitude, acceptance, sense of purpose, and compassion, along with facilitating peer support through the utilization of breast cancer survivors as mentors. Among outcome measures that included perceived stress and overall level of anxiety, researchers examined increases in CD-RISC scores as an index of whether the intervention contributed to increases in psychological resilience (Loprinzi, Prasad, Schroeder, & Sood, 2011). Similar interventions have been utilized in samples of participants exposed to chronic levels of stress, such as physicians and police officers (Chitra & Karunanidhi, 2018; Sood, Prasad, Schroeder, & Varkey, 2011), as well as those living with chronic illnesses (McGonagle, Beatty, & Joffe, 2014). While these scholars have targeted stress appraisal, self-efficacy, and internal sense of control, the primary outcome measure used to assess whether resilience was successfully bolstered was a trait based approach as measured by the CD-RISC.

As a whole, resilience enhancing interventions have varied vastly in their individual approaches. Scholars have critiqued the conceptual confusion regarding resilience as well as the methodology of studies, such as failing to include control groups (Chimitorz et al., 2018). Though meta-analytic work in this area is extremely limited, results of one meta-analysis revealed that resilience enhancing interventions may have a small to moderate effect size on trait level psychological resilience and mental health, but noted these results are likely influenced by publication bias (Leppin et al., 2014). Conceptual reviews have suggested that concluding whether such interventions are effective overall necessitates consistent conceptualization of resilience as well as consistent outcome measures (Forbes & Fiketoglu, 2018).

Potential Resilience Enhancing Intervention Points in Counseling

Despite the different definitions used, several malleable psychological factors may bolster resilience within a counseling context. Malleable traits that may comprise psychological resilience may be derived or learned through available social resources (Liu et al., 2017). As such, counselors play an important role in facilitating the development of factors that may bolster resilience before stressors are encountered by clients, while clients are encountering stressors that may be ongoing or persistent in nature, or potentially following the occurrence of a stressor. Though an exhaustive review of potential points for intervention is beyond the scope of this review, the following factors have been suggested as promising targets.

Accessibility of Positive Emotions

Accessibility of positive emotions comprises one promising intervention point in facilitating adaptivity (Galetzer-Levy, 2013; Moore et al., 2014) and may also assist in building trait levels of resilience (Cohn et al., 2009; Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Seaton & Beumont, 2015). Though a thorough discussion of this area is outside the scope of this

review, in general, the ability to access positive emotions in everyday life, and in the midst of daily stressors, is conceptualized as an adaptive process (see Fredrickson, 1998 for an early review on this concept). Several longitudinal and prospective studies have shed light on the importance of positive emotions before, during, and after stressors are encountered. Fredrickson et al. (2013) prospectively examined positive emotions as a predictor of distress following the September 11th attacks, and found that positive emotionality present in the immediate aftermath of the attacks fully mediated the relationship between self-reported trait levels of resilience reported pre-crisis and depressive symptoms at a measurement point following the attacks (Fredrickson, Tugade, Waugh, & Larkin, 2003). Moore and colleagues (2014) reported similar findings in their longitudinal examination of the role of positive affectivity in students residing in the Washington DC area during and after the DC sniper attacks in 2002. Though pre-crisis data were not collected, positive affectivity was found to be inversely related to psychological distress, and positively related to effective coping during the ongoing attacks (before the shooter was apprehended), immediately following the end of the attacks, and 6 months later (Moore et al., 2014). Perhaps most notably, Galatzer-Levy and colleagues (2013) examined the role of positive emotion in differentiating outcomes according to Bononno's (2013) trajectory approach. They found that positive emotionality in new police officers during training prospectively predicted a resilient trajectory characterized by lower levels of psychological distress after officers were exposed to a variety of stressors during their first 48 months of active service. Conversely, lower levels of positive emotionality during training prospectively predicted the emergence of chronic psychological distress that steadily increased during the first 48 months of active service (Galatzer-Levy et al., 2013).

Positive emotionality has also been examined in combination with trait conceptualizations of resilience. Relationships between trait levels of resilience and positive emotionality have been found across studies (Gloria & Steinhardt, 2016), and the ability to access positive emotionality in the midst of stressful events may assist individuals evidencing high levels of trait resilience in adapting effectively. For example, in one physiological study participants measuring high in trait resilience reported greater levels of positive emotionality in response to an induced stressor and subsequently exhibited a faster cardiovascular recovery (Tugade & Fredrickson, 2004). Finally, increases in positive emotionality have been related to increases in ego-resilience over time in several nonclinical samples, including college students (Cohn et al., 2009; Seaton & Beumont, 2015) and working adults (Fredrickson et al., 2008).

Overall, the presence or development of positive emotions may assist individuals in recovering effectively amidst various stressors and may influence how trait resilience works to facilitate adaptivity. Previous scholars have hypothesized that the presence of positive emotionality over time enables individuals to build and utilize a variety of coping resources that assist them in cultivating positive outcomes following stressors (see Fredrickson's Broaden-and-Build theory of positive emotion for a thorough description of this concept; Fredrickson, 2001). Within a counseling context, counselors may assist clients in cultivating the accessibility of positive emotions prior to the encountering of stressors or in the midst of stressors by assisting clients in exploring and engaging in activities and social relationships that generate positive emotionality.

Emotional Flexibility

While positive emotionality has been suggested as an important ingredient in cultivating resilience, some scholars have stated that this perspective is oversimplified. For example, Koole

and colleagues (2015) argued that resilience is concerned not only with the ability to access positive emotions in the wake of various stressors, but emotional flexibility. In other words, the individual exhibits an appropriate range of both positive and negative emotions in the presence of stress (Koole, Schwager, & Rothermund, 2015). As such, emotional flexibility, and psychological flexibility more generally, represent intervention points that may assist in building resilience in clients. Closely related to emotional flexibility, psychological flexibility represents an acceptance oriented approach to one's internal emotional experiences (Hayes, Luoma, Bond, Masuda, & Lillis, 2006).

Researchers who have conceptualized resilience as a process have spoken to the importance of emotional and psychological flexibility in facilitating adaptive responses to stressors. Multiple scholars have suggested that those with observed deficits in flexible emotional expression evidence higher levels of psychological distress after stressors such as recent loss of a loved one and combat trauma (Gupta & Bonanno, 2011; Rodin et al., 2017). Several authors have also implicated the role of psychological and emotional flexibility in the emergence of favorable outcomes following various forms of stress or trauma. This was illustrated by Bryan and colleagues in a prospective study that examined pre-deployment predictors of psychological distress in a sample of combat exposed Air Force personnel at several post-deployment measurement points. Authors reported that self-reported psychological flexibility pre-deployment significantly predicted lower levels of PTSD and depressive symptoms immediately after returning from deployment and 12 months later (Bryan, Ray-Sannerud, & Heron, 2015). Similar findings were reported in a longitudinal study examining patterns of adjustment in a sample of veterans returning from recent deployment (Meyer et al., 2019). Furthermore, emotion regulation difficulties have been implicated as a prospective

predictor of PTSD symptoms following large scale traumatic events such as mass shootings (Bardeen, Kumpula, & Orcutt, 2013). Though additional prospective work is needed, scholars in this area have suggested that the ability to appropriately experience, regulate, and manage emotions represents an important factor in the emergence of favorable outcomes following stressors.

Though not as prominent in the literature, emotional flexibility has been shown to be positively related to trait levels of resilience (e.g., Meyer et al., 2019) and is suggested as an additional factor that may comprise or contribute to trait resilience. For example, participants measuring high in trait resilience were found to exhibit heightened levels of flexibility in their physiological responses to emotionally valanced stimuli measured through facial electromyography (Shi, Sun, Wei, & Qiu, 2019; Waugh, Thompson, & Gotlib, 2011) and MRI scans examining affective areas of the brain (Waugh et al., 2008). As psychological flexibility and emotional flexibility have been implicated as important factors in studies that investigate resilience as a process and a trait; targeting these factors may represent a promising approach in counseling to bolster psychological resilience. For example, utilizing modalities designed to increase psychological flexibility such as Acceptance and Commitment Therapy (ACT; Hayes, Luoma, Bond, Masuda, & Lillis, 2006) or teaching skills designed to increase emotional awareness and emotion regulation (i.e. mindfulness skills and emotion regulation skills within Dialectical Behavior Therapy; Linehan, 2014) may assist clients in building resources necessary to cope effectively before a stressor is encountered, during the experience of an ongoing stressor, or after a stressor has occurred.

Self-Compassion

Self-compassion, or the ability to treat oneself with kindness in the face of difficult or painful emotions or in times of failure, may also be beneficial in bolstering resilience within a counseling context. Those that are highly self-compassionate are argued to meet painful emotions and thoughts with self-kindness, view shortcomings or difficulties as part of the larger human experience, and avoid overidentifying with painful thoughts and emotions (Neff, 2003). Self-compassion may comprise a useful resource that facilitates adaptive responses to stress and various forms of adversity, and potentially represents a characteristic of those measuring high in trait levels of resilience. Indeed, in controlled studies, individuals high in self-compassion have evidenced physiological responses indicative of flexibility and adaptability (Breines et al., 2014; Luo, Quao, & Che, 2018) in response to induced stress. Emerging evidence has also illuminated positive relationships between trait levels of resilience and self-compassion in several samples, including college students (Tang, 2009) and those with chronic illness (Nery-Hurwit, Yun, & Ebbeck, 2018; Hayter & Dorstyn, 2014).

Perhaps most notably, authors that have conducted longitudinal work examining the development of psychological distress over time have suggested that self-compassion may contribute to lower psychological distress associated with a stressor. For example, Hiraoka and colleagues (2015) found that levels of self-compassion measured at baseline significantly predicted lower levels of PTSD symptoms during follow up measurement in a sample of combat exposed veterans (Hiraoka et al., 2015). Zeller and colleagues (2015) reported similar results in their study that utilized a sample of youth exposed to the same natural disaster; suggesting that self-compassion measured shortly following the disaster significantly predicted lower levels of psychological distress at subsequent measurement points (Zeller, Yuval, Nitzan-Assayag, &

Bernstein, 2015). Furthermore, Meyer and colleagues (2019) conducted a study examining self-compassion as a predictor of recovery from PTSD, and found that self-compassion measured at baseline predicted increased levels of symptom reduction in a sample of combat veterans after controlling for severity of combat exposure and time since trauma exposure (Meyer, et al., 2019). Though prospective work is needed to examine self-compassion as a pre-stressor predictor of adaptive responding following these stressors, existing evidence points towards the notion that self-compassion may play a role in facilitating recovery from various stressors.

Given emerging evidence, self-compassion may also comprise a promising intervention point in counseling to build resilience in clients. Within a counseling context, building self-compassion may consist of less formalized interventions, such as assisting clients in adapting critical self-talk. Formalized interventions that have been shown to increase levels of self-compassion may also be helpful in this regard. Specifically, Compassionate Mind Training (CMT; Gilbert 2009) and Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 2003) comprise formal approaches that may assist clients in increasing levels of self-compassion (e.g., Beumont, Galpin, & Jenkins, 2012; Birnie, Speca, & Carlson, 2010).

Conclusion

The varying conceptualizations of psychological resilience present in the current literature have been provided, underscoring potential intervention points to bolster psychological resilience within a counseling context. Though there continue to be differing definitions of resilience, counselors have an important role to play in assisting clients in adapting to stress or trauma, and building baseline protective factors prior to encountering life stressors. Strategies to build accessibility of positive emotionality, emotional flexibility, and self-compassion represent promising avenues for counselors to foster resilience in clients. As the literature continues to

grow and advance, the role of counselors in facilitating adaptivity in the context of stress and adversity remains a cornerstone to the profession.

References

American Psychological Association (n.d.). *The road to resilience.* Retrieved from https://www.apa.org/helpcenter/road-resilience.

Adler, A.B., Williams, J., McGurk, D., Moss, A., & Bliese, P.D. (2015). Resilience training with soldiers during basic combat training: Randomization by Platoon. *Applied Psychology: Health and Well-Being, 7*(1), 85-107.

Almeida, D.M. (2005). Resilience and vulnerability to daily stressors assessed via diary methods. *Current Directions in Psychological Science, 14*(2), 64-68.

Almedom, A.M., & Glandon, D. (2007). Resilience is not the absence of PTSD any more than health is the absence of disease. *Journal of Loss and Trauma, 12*, 127-143.

Bardeen, J.R., Kumpula, M.J., & Orcutt, H.K. (2013). Emotion regulation difficulties as a prospective predictor of posttraumatic stress symptoms following a mass shooting. *Journal of Anxiety Disorders, 27*, 188-196.

Beumont, E., Galpin, A., & Jenkins, P. (2012). 'Being kinder to myself': A prospective comparative study exploring post-trauma therapy outcome measures, for two groups of clients, receiving either cognitive behaviour therapy or cognitive behaviour therapy and compassionate mind training. *Counselling Psychology Review, 27*(1), 31-43.

Birnie, K., Speca, M., & Carlson, L.E. (2010). Exploring self-compassion and empathy in the context of mindfulness-based stress reduction (MBSR). *Stress and Health, 26*, 359-371.

Black, J.K., Balanos, G.M., & Whittaker, A.C. (2017). Resilience, work engagement and stress reactivity in a middle-aged manual worker population. *International Journal of Psychophysiology, 116*, 9-15.

Bonanno, G.A., Wortman, C.B., & Nesse, R.M. (2004). Prospective patterns of resilience and maladjustment during widowhood. *Psychology and Aging, 19*(2), 260-271.

Bonanno, G.A., & Diminich, E.D. (2013). Annual research review: Positive adjustment to adversity-trajectories of minimal-impact resilience and emergent resilience. *The Journal of Child Psychology and Psychiatry, 54*(4), 378-401.

Block, J., & Kremen, A.M. (1996). IQ and ego-resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology, 70*(2), 349-361.

Breines, J.G., Thoma, M.V., Gianferante, D., Hanlin, L., Chen, X., & Rohleder, N. (2014). Self-compassion as a predictor of interleukin-6 response to acute psychosocial stress. *Brain, Behavior, and Immunity, 37*, 109-114.

Bryan, C.J., Ray-Sannerud, B., & Heron, E.A. (2015). Psychological flexibility as a dimension of resilience for posttraumatic stress, depression, and risk for suicidal ideation among Air Force personnel. *Journal of Contextual Behavioral Science, 4*, 263-268.

Cohn, M.A., Fredrickson, B.L., Brown, S.L., & Mikels, J.A. (2009). Happiness unpacked: Positive emotions increase life satisfaction by building resilience. *Emotion, 9*(3), 361-368.

Connor, K.M., & Davidson, J.R.T. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety, 18*, 76-82.

Davydov, D.M., Stewart, R., Ritchie, K, & Chaudieu, I. (2009). Resilience and mental health. *Clinical Psychology Review, 30*, 479-495.

Diehl, M. & Hay, E.L. (2010). Risk and resilience factors in coping with daily stress in adulthood: The role of age, self-concept incoherence, and personal control. *Developmental Psychology, 46*(5) 1132-1146.

Fletcher, D., & Sarkar, M. (2013). Psychological Resilience: A review and critique of definitions, concepts, and theory. *European Psychologist, 18*(1), 12-23.

Fredrickson, B.L. (1998). What good are positive emotions? *Review of General Psychology, 2*(3), 300-319.

Fredrickson, B.L. (2001). The role of positive emotions in positive psychology: The broaden-and-build-theory of positive emotion. *American Psychologist, 56*(3), 218-226.

Fredrickson, B.L., Tugade, M.M., Waugh, C.E., & Larkin, G.R. (2003). What good are positive emotions in crises? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. *Personality Processes and Individual Differences, 84*(2), 365-376.

Fredrickson, B.L., Cohn, M.A., Coffey, K.A., Pek, J., & Finkel, S.M. (2008). Open hearts build lives: Positive emotions, induced through loving-kindness meditation, build consequential personal resources. *Journal of Personality and Social Psychology, 95*(5), 1045-1062.

Galatzer-Levy, Brown, A.D., Metzler, T.J., Neylan, T.C., & Marmar, C.R. (2013). Positive and negative emotion prospectively predict trajectories of resilience and distress among high-exposure police officers. *Emotion, 13*(3), 545-553.

Galatzer-Levy, I.R., Huang, S.H., & Bonanno, G.A. (2018). Trajectories of resilience and dysfunction following potential trauma: A review and statistical evaluation. *Clinical Psychology Review, 63*, 41-55.

Gilbert, P., & Procter, S. (2006). Compassionate mind training for people with high shame and self-criticism: Overview and pilot study of a group therapy approach. *Clinical Psychology and Psychotherapy, 13*, 353-379.

Gloria, C.T., & Steinhardt, M.A. (2016). Relationships among positive emotions, coping, resilience, and mental health. *Stress and Health, 32*, 145-156.

Gupta, S., & Bonanno, G.A. (2011). Complicated grief and deficits in emotional expressive flexibility. *Journal of Abnormal Psychology, 120*(3), 635-643.

Harper, F.W.K., Goodlett, B.D., Trentacosta, C.J., Albrecht, T.L., Taub, J.W., Phipps, S., & Penner, L.A. (2014). Temperament, personality, and quality of life in pediatric cancer patients. *Journal of Pediatric Psychology, 39*(4), 459-468.

Hayes, S.C., Luoma, J.B., Bond, F.W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour Research and Therapy, 44*, 1-25.

Hayter, M.R., & Dorstyn, D.S. (2014). Resilience, self-esteem and self-compassion in adults with spina bifida. *Spinal Cord, 52,* 167-171.

Hu, T., Zhang, D., & Wang, J. (2015). A meta-analysis of the trait resilience and mental health. *Personality and Individual Differences, 76*, 18-27.

Infurna, F.J., & Luthar, S.S. (2016). Resilience to major life stressors is not as common as thought. *Perspectives on Psychological Science, 11*(2), 175-194.

Infurna, F.J., & Luthar, S.S. (2018). Re-evaluating the notion that resilience is commonplace: A review and distillation of directions for future research, practice, and policy. *Clinical Psychology Review, 65*, 43-56.

Hiraoka, R., Meyer, E.C., Kimbrel, N.A., DeBeer, B.B., Fulliver, S.B., & Morissette, S.B. (2015). Self-compassion as a prospective predictor of PTSD symptom severity among trauma-exposed U.S. Iraq and Afghanistan war veterans. *Journal of Traumatic Stress, 28*, 127-133.

Jativa, R., & Cerezo, M.A. (2014). The mediating role of self-compassion in the relationship between victimization and psychological maladjustment in a sample of adolescents. *Child Abuse and Neglect, 38,* 1180-1190.

Kabat-Zinn, J. (2003). Mindfulness-Based Stress Reduction (MBSR). *Constructivism in the Human Sciences, 8*(2), 73-107.

Kobasa, S.C. (1979). Stressful life events, personality, and health: An inquiry into hardiness. *Journal of Personality and Social Psychology, 37*(1), 1-11.

Koole, S.L., Schwager, S., & Rothermund, K. (2015). Resilience is more about being flexible than about staying positive. *Behavioral and Brain Sciences, 38*, 36-37.

Lee, J., Ahn, Y., Jeon, K., Chae, J., & Choi, K. (2014). Resilience buffers the impact of traumatic events on the development of PTSD symptoms in firefighters. *Journal of Affective Disorders, 162*(20), 128-133.

Leppin, A.L., Bora, P.R., Tilburt, J.C., Gionfriddo, M.R., Zeballos-Palacios, C., Dulohery, M.M., Sood, A…& Montori, V.M. (2014). The efficacy of resiliency training programs: A systematic review and meta-analysis of randomized trials. *Plos One, 9*(10), 1-15.

Linehan, M. (2014). *DBT Skills Training Manual*. New York, NY: Guilford Press.

Liu, J.J.W., Reed, M., & Girard, T.A. (2017). Advancing resilience: An integrative, multi-system model of resilience. *Personality and Individual Differences, 111*, 111-118.

Loprinzi, C.E., Prasad, K., Schroeder, D.R., & Sood, A. (2011). Stress management and resilience training (SMART) program to decrease stress and enhance resilience among breast cancer survivors: A pilot randomized clinical trial. *Clinical Breast Cancer, 11*(6), 364-368.

Lü, W., Wang, Z., & You, X. (2016). Physiological responses to repeated stress in individuals with high and low trait resilience. *Biological Psychology, 120*, 46-52.

Luo, X., Qiao, L., & Che, X. (2018). Self-compassion modulates heart rate variability and negative affect to experimentally induced stress. *Mindfulness, 9*, 1522-1528.

Lyons, J. (1991). Strategies for assessing the potential for positive adjustment following trauma. *Journal of Traumatic Stress, 4*(1), 93-111.

Mancini, A.D., & Bonanno, G.A. (2009). Predictors and parameters of resilience to loss: Toward and individual differences model. *Journal of Personality, 77*(6), 1805-1832.

Masten, A.S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist, 56*(3), 227-238.

MacBeth, A., & Gumley, A. (2012). Exploring compassion: A meta-analysis of the association between self-compassion and psychopathology. *Clinical Psychology Review, 32*, 545-552.

Meyer, E.C., Kotte, A., Kimbrel, N.A., DeBeer, B.B., Elliot, T.R., Gulliver, S.B., & Morissette, S.B. (2019). Predictors of lower-than-expected posttraumatic symptom severity in war veterans: The influence of personality, self-reported trait resilience, and psychological flexibility. *Behaviour Research and Therapy, 113*, 1-8.

Meyer, E.C., Szabo, Y., Frankfurt, S.B., Kimbrel, N.A., DeBeer, B.B., & Morissette, S.B. (2019). Predictors of recovery from post-deployment posttraumatic stress disorder symptoms in war veterans: The contributions of psychological flexibility, mindfulness, and self-compassion. *Behaviour Research and Therapy, 114*, 7-14.

Moore, P.J., Chrabaszcz, J.S., Peterson, R.A., Rohrbeck, C.A., Roemer, E.C., & Mercurior, A.E. (2014). Psychological resilience: The impact of affectivity and coping on state anxiety

and positive emotions during and after the Washington DC sniper killings. *Anxiety, Stress, and Coping, 27*(2), 138-155.

McKibben, E.S., Britt, T.W., Hoge, C.W., & Castro, C.A. (2009). Receipt and rated adequacy of stress management training is related to PTSD and other outcomes among Operation Iraqi Freedom veterans. *Military Psychology, 21*, S68-S81.

Miller, G.E., Lachman, M.E., Chen, E., Gruenewald, T.L., Karlamangla, A.S. & Seeman, T.E. (2011). Pathways to resilience: Nurturance as a buffer against the effects of childhood poverty on metabolic syndrome at midlife. *Psychological Science, 22*(12), 1591-1599.

Nery-Hurwit, M., Yun, J., & Ebbeck, V. (2018). Examining the roles of self-compassion and resilience on heatlh related quality of life for individuals with multiple sclerosis. *Disability and Health Journal, 11*, 256-261.

Oddo, L.E., Knouse, L.E., Surman, C.B.H., & Safren, S.A. (2018). Investigating resilience to depression in adults with ADHD. *Journal of Attention Disorders, 22*(5), 497-505.

Ong, A.D., Bergeman, C.S., Bisconti, T.L., & Wallace, K.A. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Personality Processes and Individual Differences, 91*(4), 730-749.

Ong, A.D., Fuller-Rowell, T.E., & Bonanno, G.A. (2010). Prospective predictors of positive emotions following spousal loss. *Psychology and Aging, 25*(3), 653-660.

Oshio, A., Taku, K., Hirano, M., & Saeed, G. (2018). Resilience and big five personality traits: A meta-analysis. *Personality and Individual Differences, 127*, 54-60.

Overstreet, C., Stratton, K.J., Berenz, E., Sheerin, C., Hawn, S., Roberson-Nay, R., & Amstadter, A. (2017). Resilience to interpersonal trauma and decreased risk for psychopathology in

an epidemiologic sample. *Journal of Psychopathology and Behavioral Assessment, 39,* 506-513.

Pérez-Rojas, A., Lockard, A.J., Bartholomew, T.T., Janis, R.A., Carney, D.M. Xiao, H., Youn, S.J…& Hayes, J.A. (2017). Presenting concerns in counseling centers: The view from clinicians on the ground. *Psychological Services, 14*(4), 416-427.

Philippe, F.L., Laventure, S., Beulieu-Pelletier, Lecours, S., & Lekes, N. (2011). Ego-resiliency as a mediator between childhood trauma and psychological symptoms. *Journal of Social and Clinical Psychology, 30*(6), 583-598.

Pietrzak, R.H., Johnson, D.G., Goldstein, M.B., Malley, J.C., & Southwick, S.M. (2009). Psychological resilience and postdeployment social support protect against traumatic stress and depressive symptoms in soldiers returning from operations Enduring Freedom and Iraqi Freedom. *Depression and Anxiety*, 1-7.

Rainone, N., Chiodi, A., Lanzillo, R., Magri, V., Napolitano, A., Brescia Morra, V., Valerio, P., & Freda, M.F. (2017). Affective disorders and health-related quality of life (HRQoL) in adolescents and young adults with Multiple Sclerosis (MS): The moderating role of resilience. *Quality of Life Research, 26,* 727-736.

Richardson, G.E. (2002). The metatheory of resilience and resiliency. *Journal of Clinical Psychology, 58*(3), 307-321.

Richardson, G.E., Neiger, B.L., Jensen, S., & Kumpfer, K.L. (1990). The resiliency model. *Health Education, 21*(6), 33-39.

Rodin, R., Bonanno, G.A., Rahman, N., Kouri, N.A., Bryant, R.A., Marmar, C.R., & Brown, A.D. (2017). Expressive flexibility in combat veterans with posttraumatic stress disorder and depression. *Journal of Affective Disorders, 207,* 236-241.

Rutter, M. (1985). Resilience in the face of adversity: Protective factors and resistance to psychiatric disorder. *British Journal of Psychiatry, 147*, 598-611.

Rutter, M. (1987). Psychosocial resilience and protective mechanisms. *American Journal of Orthopsychiatry, 57*(3), 316-331.

Sadow, D., & Hopkins, B. (1993). Resiliency training and empowerment among homeless, substance-abusing veterans. *Research Communications in Psychology, Psychiatry, and Behavior, 18*(3-4), 121-128.

Seaton, C.L., & Beumont, S.L. (2015). Pursuing the good life: A short-term follow-up study of the role of positive/negative emotions and ego-resilience in personal goal striving and eudaimonic well-being. *Motivation and Emotion, 39*, 813-826.

Shi, L, Sun, J., Wei, D., & Qiu, J. (2019). Recover from the adversity: Functional connectivity basis of psychological resilience. *Neuropsychologia, 122*, 20-27.

Sood, A., Prasad, K., Schroeder, D., & Varkey, P. (2011). Stress management and resilience training among department of medicine faculty: A pilot randomized clinical trial. Journal of *General Internal Medicine, 26*(8), 858-861.

Souza, G.G.L., Magalehães, L.N., Da Cruz, T.A.R., Mendonca-De-Souza, M., Duarte, A.F.A., Fischer, N.S., Souza, W.F…& Volchan, E. (2013). Resting vagal control and resilience as predictors of cardiovascular allostasis in peacekeepers. *Stress: The International Journal on the Biology of Stress, 16*(4), 377-383.

Tang, W.K. (2019). Resilience and self-compassion related with achievement emotions, test anxiety, intolerance of uncertainty, and academic achievement. *Psychological Studies, 64*(1), 92-102.

Tedeschi, R.G., & Calhoun, L.G. (1996). The posttraumatic growth inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress, 9*(3), 455-471.

Thompson, N.J., Fiorillo, D., Rothbaum, B.O., Ressler, K.J., & Michopoulos, V. (2018). Coping strategies as mediators in relation to resilience and posttraumatic stress disorder. *Journal of Affective Disorders, 225,* 153-159.

Trezise, A., McLaren, S., Gomez, R., Bice, B., & Hodgetts, J. (2017). Resiliency among older adults: Dispositional hope as a protective factor in the insomnia-depressive symptoms relation. *Aging and Mental Health, 22*(8), 1094-1102.

Trompetter, H.R., Kleine, E., & Bohlmeijer, E.T. (2016). Why does positive mental health buffer against psychopathology? An exploratory study on self-compassion as a resilience mechanism and adaptive emotion regulation strategy. *Cognitive Therapy and Research, 41*, 459-468.

Tugade, M.M., & Fredrickson, B.L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology, 86*(2), 320-333.

Waite, P.J., & Richardson, G.E. (2003). Determining the efficacy of resiliency training in the work site. *Journal of Allied Health, 33*(3), 178-183.

Walker, F.R., Pfingst, K., Carnevali, L., Sgoifo, A., & Nalivaiko, E. (2017). In the search for integrative biomarker of resilience to psychological stress. *Neuroscience and Biobehavioral Reviews, 74,* 310-320.

Waugh, C.E., Wager, T.D., Fredrickson, B.L., Noll, D.C., & Taylor, S.F. (2008). The neural correlates of trait resilience when anticipating and recovering from threat. *Social Cognitive and Affective Neuroscience, 3*(4), 322-332.

Waugh, C.E., Thompson, R.J., & Gotlib, I.H. (2011). Flexible emotional responsiveness in trait resilience. *Emotion, 11*(5), 1059-1067.

Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical Gerontology, 21,* 152-169.

Windle, G., Bennett, K.M., & Noeys, J. (2011). A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes, 9*(8), 1-18.

Ying, L., Wu, X., Lin, C., & Jiang, L. (2014). Traumatic severity and trait resilience as predictors of posttraumatic stress disorder and depressive symptoms among adolescent survivors of the Wenchuan earthquake. *Plos One, 9*(2), 1-7.

Zeller, M., Yuval, K., Nitzan-Assayag, Y., & Bernstein, A. (2015). Self-compassion in recovery following potentially traumatic stress: Longitudinal study of at-risk youth. *Journal of Abnormal Child Psychology, 43*, 645-653.

2 EXAMINING THE ROLE OF TRAIT RESILIENCE AND SELF-COMPASSION IN ADAPTIVE RESPONSES TO STRESS: A PHYSIOLOGICAL STRESS RESPONSE STUDY

Trait level psychological resilience refers to characteristics that may predispose adaptive responses to stress, trauma, and adversity (Connor & Davidson, 2003; Windle, Bennett, & Noyes, 2011). Despite work suggesting the benefits of trait resilience (e.g., Hu, Zhang, & Wang, 2015; Lee, Ahn, Jeong, Chae, & Choi, 2014), there are a plethora of self-report measures in existence with no identified measurement standard (Windle et al., 2011). Given differing conceptualizations of trait resilience across self-report measures, physiological measurement of stress response represents a viable and objective approach to examine psychological resilience (Walker, Pfingst, Carnevali, Sgoifo, & Nalivaiko, 2017), with some scholars suggesting that those high in trait resilience exhibit an adaptive and flexible physiological response to induced stressors (e.g., Lü, Wang, & You, 2016; Tugade & Fredrickson, 2004). However, findings have been mixed, in part due to the utilization of measures across studies that differ in their conceptualization of trait resilience.

While there have been a limited number of studies examining the relationship between trait resilience and physiological response, other variables that may contribute to stress response alongside trait resilience have not been examined. For instance, self-compassion (Neff, 2003), a construct that has been empirically linked to trait resilience (e.g., Hayter & Dorstyn, 2014; Shebuski, Bowie, & Ashby, 2020) represents a variable that may contribute additional explanatory value in predicting adaptive stress response alongside trait resilience. Nonetheless, despite the conceptualization of self-compassion as a resiliency factor (e.g., Arch et al., 2014) and the argument that self-compassionate individuals may exhibit adaptive responses to stress

(e.g., Luo, Qiao, & Che, 2018), there have been no studies examining both trait resilience and self-compassion simultaneously in response to an induced stressor. The present study will examine the relationship between several widely used measures of trait resilience and physiological response and recovery from an induced stressor, and subsequently examine the role of self-compassion as an additive factor that may contribute to an adaptive physiological stress response alongside trait resilience.

Literature Review

Trait Resilience

Psychological resilience has generally been understood as the ability to "bounce back" in the face of adversity (APA, n.d.). However, as multiple scholars have noted, the term psychological resilience has not been universally defined (Ayed, Toner, & Priebe, 2018; Luthar, Cicchetti, & Becker, 2000; Windle, 2011). One approach is the conceptualization of resilience as a trait level characteristic or set of psychological resources that may predispose an individual to respond to adversity in adaptive ways (Block & Kremen, 1996; Connor & Davison, 2003; Friborg, Barlaug, Martinussen, Rosenvinge, & Hjemdal, 2005). Scholars have underscored the beneficial impact of trait resilience, with work suggesting negative relationships with indicators of psychological distress such as depression and anxiety (Hu et al., 2015), PTSD symptoms following the experience of various traumas (Harper et al., 2014; Lee et al., 2014; Pietrzak, Johnson, Goldstein, Malley, & Southwick, 2009; Ying, Wu, Lin, & Jiang, 2014) and distress following daily stressors (Ong, Bergeman, Bisconti, & Wallace, 2006).

Despite these findings, several measurement issues have persisted in the literature. First, there are currently 19 self-report measures of psychological resilience in the literature; each of which take their own approach to conceptualizing and measuring resilience (Windle et al., 2011).

While some measures conceptualize trait resilience as a unitary personality trait comprising overall adaptability to environmental factors (Block & Kremen, 1996), others assert that trait resilience is comprised of five (Connor & Davidson, 2003) and six (Friborg et al., 2005) factors including traits such as personal competence, sense of humor, and perception of future. Further still, other instruments aim to capture the construct by simply assessing an individual's perception of how well they "bounce back" from stress (Smith et al., 2008). Use of these varying measures in the literature has led scholars to conclude that there is no current 'gold standard' of measurement (Windle et al., 2011), and state that research in this area is hindered by poor construct definition (Davydov, Stewart, Ritchie, & Chaudieu, 2010) and inherent self-report biases (Walker et al., 2017).

Trait Resilience and Physiological Stress Response

In response to these issues, scholars have called for the examination of physiological measurements in combination with self-report measures of trait resilience (Obradović, 2012; Walker et al., 2017). Specifically, assessing physiological response and recovery from an induced stressor in combination with self-report measures comprises one way to objectively assess whether heavily utilized measures of trait resilience are indeed capturing an ability to "bounce back" and subsequently label potential biomarkers of those exhibiting trait level resilience (Walker et al., 2017). Though a small body of research has examined these relationships (e.g., O'Donahue, Mesagno, & O'Brien, 2019), results have been mixed.

Findings from an emerging body of literature in this area have varied in both design and results. Work utilizing the Ego Resilience Scale (ER-89; Block & Kremen, 1996), a measure conceptualizing trait resilience as a unidimensional construct representing overall adaptability, has suggested that those measuring high on this instrument evidence a shorter response duration

in areas of the brain associated with stress following exposure to threatening images (Waugh, Wager, Fredrickson, Noll, & Taylor, 2008). Similarly, higher self-reported scores on this measure have been linked to efficient cardiovascular recovery from induced stressors (Souza et al., 2013; Tugade & Frederickson, 2004). Participants measuring high on the Connor Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003), a measure including multiple factors, have been found to exhibit lower cortisol/DHEA ratios at baseline (suggestive of a regulated stress response system; Petros, Opacka-Juffry, & Huber, 2013), and exhibit efficient cardiovascular recovery from induced stressors (Lü et al., 2016). In contrast, work utilizing the Resilience Scale for Adults (RSA; Friborg et al., 2005), a measure including six factors, has suggested no relationship between the overall measure and cardiovascular response or recovery (Corina & Adriana, 2013). In sum, though a small body of research has suggested a relationship between several measures of trait resilience and the ability to physiologically recover measured using physiological indices, work in this area is variable and has yet to determine which self-report measure(s) of trait resilience are most associated with an adaptive physiological stress response.

Self-Compassion and Trait Resilience

Of the studies that have reported significant relationships between trait resilience and objective physiological stress response, few have examined additional variables that may contribute to adaptive stress response alongside trait resilience. Variables that have been examined concurrently in psychophysiological studies of trait resilience have been limited to stress appraisal (García-León, Pérez-Mármol, Gonzalez-Pérez, García-Ríos, & Peralta-Ramírez, 2019), emotion regulation (Waugh, Thomas, & Gotlib, 2011), and positive emotionality (Tugade & Fredrickson, 2004). Self-compassion, or the tendency to treat oneself with kindness in the face

of hardship (Neff, 2003) represents a variable that may contribute to adaptive stress response alongside trait resilience; with scholars referring to self-compassion as a "resiliency trait" (Arch, Landy, & Brown, 2016, p. 35) and a potential "stress resilience factor" (Arch et al., 2014, p. 50). As a construct, self-compassion includes three facets; the propensity to treat oneself with kindness instead of judgement during times of hardship, the ability to view one's failings or weaknesses through a lens of common humanity, and the capacity to hold unpleasant thoughts and feelings in mindful awareness instead of allowing oneself to become overidentified with them (Neff, 2003). Consistent with this conceptualization, research has suggested that those that are high in self-compassion tend to perceive less stress in their lives (Hall, Row, Wuensch, & Godley, 2013) and respond to stressful situations in adaptive ways (Leary, Tate, Adams, Allen & Hancock, 2007). Given that those high in trait resilience have also been shown to evidence similar means of adaptive coping (Li & Nishikawa, 2012), it is reasonable to postulate that self-compassion and trait resilience may represent resources that exist concurrently. Indeed, positive relationships between self-compassion and several measures of trait resilience have been found in a variety of samples (Nery-Hurwit, Yun, & Ebbeck, 2018; Shebuski et al., 2020; Sünbül & Güneri, 2019; Tang, 2019). One possibility is that self-compassion comprises an emotion regulation strategy (e.g., Hall et al., 2013) employed by trait resilient individuals during times of stress or hardship.

The notion that self-compassionate individuals may respond to stress in adaptive ways has also been reflected in psychophysiological studies. Self-compassion has been found to significantly predict lower inflammatory stress response (Breines et al., 2014; 2015), and those high in self-compassion have been found to exhibit heightened levels of cardiovascular flexibility in their response to stress (Luo et al., 2018). Finally, increased self-compassion

following brief targeted interventions has been linked with adaptive cardiovascular response to induced stressors (Petrocchi, Ottaviani, & Couyoumdijian, 2017). Despite these findings, the additive benefit that self-compassion may contribute in predicting an adaptive physiological response to stress alongside trait resilience has not been examined.

The Present Study

A growing body of literature has suggested that those high in trait level resilience may exhibit adaptive and flexible physiological responses to stress (e.g., Lü, et al., 2016; Tugade & Fredrickson, 2004). However, findings have been mixed in part due to the varying conceptualizations employed by the multitude of measures in existence (Windle et al., 2011). Thus, it remains unclear which measures of trait resilience are related to objective physiological stress response and recovery. Further, while scholars have suggested a connection between trait resilience, stress appraisal, and positive emotionality in the context of physiological stress response (García-León et al., 2019; Tugade & Fredrickson, 2004), there are currently no studies examining whether related constructs such as self-compassion add additional explanatory value with regard to adaptive physiological stress response.

The goals of the present study were three-fold. First, in order to determine which measures of trait resilience are related to adaptive physiological stress response, the relationship between four widely used measures of trait resilience and physiological stress response were examined. Next, in order to determine which instrument best captures an adaptive physiological stress response, measures found to be significantly related to adaptive stress response were to be examined in a simultaneous regression model predicting physiological stress response (research question 1). Lastly, in order to determine whether self-compassion contributes additional variance in predicting an adaptive stress response self-compassion was to be entered in a

predictive model alongside the measure of trait resilience determined to best capture adaptive stress response (research question 2). In sum, the researcher aimed to clarify whether existing measures of trait resilience are indeed capturing an ability to physiologically "bounce back" from a stressor and determine whether additional psychological factors (e.g., self-compassion) assist in facilitating an adaptive physiological response to stress.

Hypotheses

The current study tested several hypotheses. First, it was hypothesized that several measures of trait resilience would be significantly related to indices of physiological stress response and recovery. Second, it was hypothesized that several measures of trait resilience would be significantly and positively correlated with overall heart rate variability (HRV); such that at higher levels of self-reported trait resilience, higher levels of HRV observed from baseline to recovery were expected. Similarly, it was hypothesized that several measures of trait resilience would be significantly and negatively correlated with duration of cardiovascular response; such that at higher levels of self-reported trait resilience, a lower number of seconds spent physiologically reactive to the stressor was expected. Given the conflicting findings and small body of research in this area, no specific hypotheses were made regarding which measure of trait resilience would best capture physiological stress response. Lastly, it was hypothesized that self-compassion would contribute unique variance above and beyond that contributed by trait resilience in a hierarchical linear regression model predicting physiological stress response.

Methodology

Participants

Undergraduate students were recruited through Georgia State University's Department of Counseling and Psychological Services Research Participation System (SONA). A total of 216

participants completed part one of the study. Of those 216 participants, 109 did not sign up to complete the in person component of the study. This left a total of 107 participants who completed both portions of the study. Dependent mean comparisons examining the responses of participants who chose to sign up to complete part two of the study and those that did not indicated that there were no significant differences in self-compassion or trait resilience on all measures used between these two groups. Of the 107 participants with complete self-report and physiological data, physiological data collected during part two of the study were discarded from six participants due to software malfunction during the procedure. Physiological data from an additional six participants were discarded due to the number of erroneous beats labeled by r-peak detection software (e.g., participants whose data recordings had 10 or more percent of beats estimated by the software due to motion artifacts or arrythmia; Mindware Technologies, 2017). Of the six discarded participants, one participant endorsed taking prescribed medications. The other five participants did not endorse health related items during part 1 (known heart conditions, abuse of drugs or alcohol, or currently smoking cigarettes) or part 2 screening items. By and large, these discarded participants appeared to exhibit a significant number of motion artifacts in their data that precluded accurate calculation of cardiovascular indices. In total, 96 participants with complete self-report and physiological data were utilized for analyses. This total number met the threshold needed for adequate statistical power to detect a moderate effect size in the proposed analyses (85 participants; Cohen, 1998).

About 22.9% of participants identified as men (n = 22) and 77.1% identified as women (n = 74). Participants ranged in age from 18 to 71 (M = 24.4, SD =8.72) with the vast majority of participants (n = 93) reporting an age ranging from 18-43. The sample was predominately composed of participants who identified as Black/African American, with 42.7% identifying as

Black/African American (*n* = 41), 21.9% identifying as White (*n* = 21), 15.6% identifying as Latino/a/x (*n* = 15), 13.5% identifying as Asian or Asian-American (*n* = 13), and 6.3% identifying as Bi-racial/multi-racial (*n* = 6). 87.5% of participants identified as straight/heterosexual (*n* = 84), 5.2% identified as bisexual (*n* = 5), 2.1% identified as gay (*n* = 2), 2.1% identified as lesbian (*n* = 2), 2.1% identified as pansexual (*n* = 2), and 1 participant indicated that they did not wish to respond to this item.

Measures

Self-Report Measures of Trait Resilience. The following four measures of trait resilience were utilized due to the frequency of their use in the literature (Windle et al., 2011), and their inclusion in previous studies of resilience and physiological stress response (Black, Balanos, & Whittaker, 2017; Corina & Adriana, 2103; Lü et al., 2016; Souza et al., 2013; Tugade & Fredrickson, 2004; Waugh et al., 2011) and related biomarker studies (García-León et al., 2019; Petro et al., 2013; Waugh, et al., 2008).

The Connor-Davidson Resilience Scale. The Connor-Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003) is designed to measure characteristics of a resilient individual. The original psychometric analysis following creation of the measure suggested a five-factor model of resilience: personal competence, high standards, and tenacity (factor 1), trust in one's instincts, tolerance of negative affect, and strengthening effects of stress (factor 2), positive acceptance of change and secure relationships (factor 3), control (factor 4), and spirituality (factor 5; Connor & Davidson, 2003). The measure contains 25 items scored on a 5-point Likert scale with responses ranging from "not true at all" to "nearly all the time". The CD-RISC yields one total score ranging from 0-100, with higher scores indicating higher levels of resilience. The measure has evidenced good test-retest reliability (Connor & Davidson, 2003; Rainey, Petrey,

Reynolds, Agtrap, & Warren, 2014) and excellent internal consistency, with studies reporting alpha values ranging from 0.91-0.93 in clinical and non-clinical samples (Bezdjian, Schneider, Burchett, Baker, & Garb, 2016; Chen, Chen, & Bonanno, 2018). Example items include "Having to cope with stress can make me stronger" and "I am not easily discouraged by failure." The CD-RISC total score was utilized as an index of trait level resilience as conceptualized by Connor and Davidson (2003). The CD-RISC evidenced excellent reliability in the present study, yielding an alpha value of 0.92.

The Resilience Scale for Adults. The Resilience Scale for Adults (RSA; Friborg, et al., 2005) is a 33-item instrument designed to measure trait level resilience along with several interpersonal resources thought to contribute to psychological resilience. The original psychometric analysis following the creation of the measure suggested a six-factor model of resilience: perception of self (factor 1), perception of future (factor 2), structured style (factor 3), social competence (factor 4), family cohesion (factor 5), and social resources (factor 6). Items are organized using a semantic differential format; such that potential responses for each item range from 1-5 with a semantic cue at each end of the Likert scale. For example, one item states "In difficult times I have a tendency to…" with potential responses ranging from "view everything gloomy" to "find something good that can help me thrive" listed on a 5-point Likert scale. The RSA has evidenced adequate reliability in clinical and non-clinical samples (Friborg et al., 2005; Poloni et al., 2018). The RSA yields one total score, with higher scores indicating higher levels of resilience. Subscale scores may also be calculated for each of the five subscales. In order to examine relationships between the measure as a whole and the other variables of interest, the RSA total score was utilized as an index of trait level resilience as conceptualized by Friborg and colleagues (2005). The RSA produced an alpha value of 0.89 in the present study.

Ego Resilience Scale. The Ego-Resilience Scale (ER-89; Block & Kremen, 1996) is a measure designed to capture an individual's dispositional ability to maintain equilibrium in response to environmental stressors and demands. The measure contains 14 items scored on a 4-point Likert scale with potential responses ranging from "does not apply at all" to "applies very strongly". The original psychometric analysis reported a one factor model and subsequent work has demonstrated suitable reliability of the measure (Block & Kremen, 1996; Burrow, Hill, Ratner, & Fuller-Rowell, 2018). Example items include "I like to do new and different things" and "I get over my anger at someone reasonably quickly". The measure yields one total score ranging from 14-56 with higher scores indicating higher levels of resilience. The total ER-89 score was utilized as an index of trait level resilience as conceptualized as Block and Kremen (1996) in order to examine the measure as a whole in relation to the other variables of interest. The ER-89 produced an alpha value of 0.78 in the present study.

Brief Resilience Scale. In slight contrast to the measures described above that focus predominately on subsets of dispositional traits believed to comprise a resilient individual (e.g., trust in one's instincts, spirituality etc.), the Brief Resilience Scale (BRS; Smith et al., 2008) is designed to directly assess an individual's perception of their ability to recover from stressors or general adversity in an adaptive manner. The measure consists of six items scored on a 5-point Likert scale with potential responses ranging from "strongly disagree" to "strongly agree". Example items include "I usually come through difficult times with little trouble" and "I have a hard time making it through stressful events" (reverse scored). The BRS yields one total score ranging from 6-30 with higher scores indicating higher levels of resilience. The BRS has evidenced good reliability, with alpha values ranging from 0.80-0.90 in a set of clinical and non-clinical samples during the initial construction of the measure (Smith et al., 2008). Recent work

has reported alphas above 0.8 (Leontjevas, Beek, Lataster, & Jacobs, 2014). The BRS produced an alpha value of 0.88 in the present study.

Self-Compassion. The Self-Compassion Scale (SCS; Neff, 2003) was utilized to measure trait level self-compassion. The SCS is a 26-item measure that yields one total score ranging from 26-130, with higher scores indicating higher levels of self-compassion. The SCS also produces several subscale scores that align with the theoretical components of self-compassion; self-kindness, self-judgement, common humanity, isolation, mindfulness, and over-identified. Each item is scored on a 5-point Likert scale, with potential responses ranging from "almost never" to "almost always". Example items include "when I fail at something important to me I become consumed by feelings of inadequacy" (reverse scored) and "I try to see my failings as part of the human condition". The SCS has been utilized with both clinical and non-clinical samples and has evidenced excellent internal consistency (with typical alpha values ranging from 0.92-0.94; Castilho, Pinto-Gouveia, & Duarte, 2015; Neff, 2003). The total SCS score was utilized as an index of overall self-compassion. The SCS produced an alpha value of 0.94 in the present study.

Subjective Distress. The Subjective Units of Distress Scale (SUDS; Wolpe & Lang, 1964) was utilized as a subjective measure of stress during the in-person portion of the study. The one-item measure used for the present study was derived from a prolonged exposure workbook (Back et al., 2014). The SUDs is a single item measure designed to obtain an individual's state-level distress. The item is scored on an 11-point Likert scale with potential responses ranging from "no distress/totally relaxed" to "highest anxiety/distress that you have ever felt". The SUDS was administered three times during the in-person portion of the study

(once during the baseline phase, once during the stressor phase, and once during the recovery phase).

Health Habit Surveys. A short survey assessing health factors that may impact cardiovascular data was administered. Three items were administered to participants during the completion of other self-report measures. Items were constructed based on items listed in similar studies of resilience and physiological stress response (e.g., Black et al., 2017; Lü et al., 2016; Petros et al., 2013; Souza et al., 2013). These items assessed for a self-reported history of heart disease or other heart problems, history of alcohol or drug abuse, and whether participants currently smoke cigarettes. An additional set of items was completed before stress induction assessing the participant's behavior before beginning the study (whether they consumed caffeine within the past 3 hours, whether they were currently taking any prescribed medications other than oral contraceptives, and whether they were currently experiencing an illness or infection of any kind). Responses on health habit items were not used to exclude participants from completing the study. Rather, responses were examined for participants identified by data editing software to have an excess of detected artifacts or erroneous beats.

Objective Distress. Objective physiological response to and recovery from the induced stressor in this study was measured using Mindware Electrocardiography (ECG) equipment and Biolab acquisition software. Cardiovascular data were continuously gathered with a sampling frequency of 1000 Hz during the in-person component of the study. Electrode placement followed a standard Lead II configuration (consistent with previous research in this area; Lü et al., 2016). This study utilized two cardiovascular indices in order to capture physiological stress response and recovery; Heart rate variability (HRV) and duration of cardiovascular response.

Heart Rate Variability. Heart rate variability (HRV) was utilized as a measure of overall physiological adaptivity to the stressor, with higher HRV indicative of increasing levels of physiological adaptability. HRV is generally defined as a measure of temporal change in heart rate from beat-to-beat that reflects parasympathetic and sympathetic nervous system output (Task Force, 1996). Low heart rate variability is believed to be reflective of inadequate response of the parasympathetic nervous system to regulate physiological reactivity or an overactivation of the sympathetic nervous system (Task Force, 1996). A robust body of research has labeled reduced HRV as a risk factor in the development of mental and physical health concerns (e.g., Carney, & Freedland, 2009; Thayer, Yamamoto, & Brosschot, 2010). Following artifact correction, HRV was computed using Mindware Heart Rate Variability software utilizing the root mean square of successive RR interval differences (RMSSD); a commonly used time-domain quantification of HRV (Shaffer & Ginsberg, 2017). One overall RMSSD value was computed from each data recording (beginning with the baseline phase and ending with the recovery phase) as an index of overall physiological adaptability throughout the duration of the study.

Duration of Cardiovascular Response. In addition to HRV, duration of cardiovascular response was utilized as a continuous measure of physiological recovery; an index that scholars have called for in research concerning resilience and stress response, (Walker et al., 2017). Consistent with previous studies (Tugade & Fredrickson, 2004; Fredrickson & Levenson, 1998), after artifact correction, the average heart rate was calculated for each study phase using Mindware HRV software. Next, a 95 percent confidence interval was computed for each participant's average heart rate value during the baseline phase of the study. Using second-to-second heart rate data output, the point at which the participant's heart rate left the calculated

confidence interval during the stressor phase was located, and the total number of seconds between this point and the point at which the participant's heart rate returned to and remained within their baseline confidence interval for at least 10 consecutive seconds was calculated. This total number of seconds that each participant was considered "reactive" to the stressor was utilized as an index representing the length of time until cardiovascular recovery was achieved.

Procedure

The present study consisted of two components: an online portion during which participants completed self-report measures and an in-person portion during which participants were exposed to an acute stressor while having cardiovascular data continuously recorded.

Part 1: Baseline Self-Report Measures

The purpose of the first portion of the study was to gather self-reported levels of trait resilience and self-compassion. Obtaining these data prior to exposure to the stressor ensured that acute stress exposure did not impact self-reports. Participants completed part one of the study using Qualtrics online software, and were administered a demographic survey, health habit items, the Self-Compassion Scale (SCS), and all four measures of trait level resilience (CD-RISC, RSA, ER-89, & BRS). The survey contained two validity items as well as items from several measures with differing item content in order to increase engagement. The order of measures presented were randomized within the software.

Following the completion of these measures, participants were re-directed to the SONA system, where they were instructed to select a time slot to present for the in-person component of the study. Prior to presenting for their selected timeslot, the researcher contacted the participant by email to instruct them to refrain from engaging in rigorous exercise the day that they were to participate in the study (strength training, running etc.), to refrain from consuming caffeine three

hours before their designated timeslot, and to wear loose comfortable clothing to ensure comfort during electrode placement.

Part 2: In-Person Stress Induction

The purpose of the second portion of the study was to induce an acute stressor within a controlled environment. The procedure used was derived from Tugade and Fredrickson's (2004) abbreviated Trier Social Stress task. In total, part 2 of the study involved approximately 30 minutes of continuously recorded cardiovascular data per participant. Consistent with previous work in this area (e.g., Tugade & Fredrickson, 2004; Lü et al., 2016), continuous data were divided into baseline, stressor, and recovery phases. Each study phase met the suggested time cutoff needed to reliably calculate cardiovascular data (five minute acclimation, five minute baseline, five minute stressor, and ten minute recovery Task Force, 1996; Laborde, Mosley, & Thayer, 2017). Step-by-step procedures for each study phase are detailed below.

Acclimation and Baseline Phases. Upon arriving for the in-person portion of the study, participants were re-presented with the informed consent document before continuing their participation. Next, participants completed the additional set of health habit questions and rated their current stress level using the SUDS in order to capture baseline subjective stress level. Participants were affixed with electrodes in a standard Lead II configuration (Mindware Technologies, n.d.) with one electrode placed underneath the right clavicle, one electrode placed under the ribcage on the leftmost side of the body, and the ground electrode placed under the ribcage on the rightmost side of the body). Lead wires were secured to the skin with medical tape to minimize movement during recording. The researcher then instructed the participant to sit quietly to view a neutral video (*Coral Sea Dreaming*- a video containing scenes of swimming fish) for 10 minutes. The researcher then exited the room and initiated Biolab acquisition

software to begin continuously recording cardiovascular data. The first five minutes of the recording constituted an acclimation period and were not used in the calculation of indices used for analyses. The last five minutes of this phase were extracted as a measure of baseline cardiovascular functioning.

Stressor Phase. After 10 minutes had elapsed, the researcher indicated the end of the baseline phase within the acquisition software and re-entered the room to begin the stressor phase of the study. In order to elicit stress, an abbreviated Trier Social Stressor Task (Kirschbaum, Pirke, & Hellhammer, 1993; Tugade & Fredrickson, 2004) was conducted. This procedure has been shown to elicit both subjective and physiological stress in previous research (Tugade & Fredrickson, 2004), and in a recent small-scale pilot study (Shebuski, Davari, Cobourne, McLaulin, & Ashby, 2019). The researcher instructed the participant that they would be delivering a 5-minute speech about "why you are a good friend" (topic consistent with Tugade & Fredrickson, 2004). Participants were instructed that they would have 5 minutes to prepare their speech alone. They were instructed that after their 5-minute preparation time had elapsed, they would deliver the speech to a video camera that would live stream to an adjacent room where a panel of three researchers would evaluate their speech based on content, clarity, and delivery skills. The participant was informed that the researcher would remain in the room with them while they delivered their speech and would prompt them to continue should they stop speaking before their allotted 5-minutes had elapsed. Participants were also instructed that they would not be provided with writing utensils or paper to gather their thoughts. The researcher then responded to any questions the participants had and left the room for 5 minutes to indicate the beginning of the stressor phase within the acquisition software and allow the participant to prepare. In reality (and consistent with Tugade & Fredrickson, 2004), the participant did not

deliver their speech, the camera shown to participants was not operational, and no other researchers were awaiting the delivery of the participant's speech. In other words, the 5-minute speech preparatory phase comprised the stressor portion of the study.

Recovery Phase. Following the 5-minute stressor phase of the study, the researcher indicated the end of the stressor phase within the acquisition software and re-entered the room. The SUDS was administered in order to gauge the participant's subjective level of stress immediately before they believed they would begin delivering their speech. After administering the SUDS, the researcher informed the participant that they would not be able to give their speech due to technological difficulties with the live-stream video equipment. Participants were assured that they would not be completing the speech and were instead instructed to sit quietly and view a relaxing video for an additional 10 minutes in order to complete the rest of the study. The researcher instructed the participant to remain still and quiet for 10 minutes while they viewed the same video presented during the baseline phase. The researcher then left the room and indicated the start of the recovery phase within the acquisition software.

Debriefing. Following the 10-minute recovery period, the researcher indicated the end of the data recording within the acquisition software, re-entered the room and administered the SUDS once more in order to gauge the participant's subjective stress level during the recovery phase of the study. The electrodes were removed from the participant and verbal debriefing commenced. The researcher informed the participant of the deception present in the study (e.g., informed the participant that there was never going to be a speech task, explained that the introduction of the speech task was designed to evoke stress, and that the purpose of introducing the task was to observe physiological response and recovery from stress). Following verbal debriefing, each participant received a list of free counseling resources and confirmed whether or

not they were comfortable with their data being used after learning about the true nature of the study.

Analyses

Preliminary Analyses

Based on published recommendations (Task Force, 1996), artifacts were identified and corrected prior to obtaining overall RMSSD and computation of reactivity duration. Next, descriptive statistics were computed for all study variables, and all variables were examined for univariate normality. To confirm that the abbreviated Trier task elicited physiological stress, dependent mean comparisons were conducted to examine whether average heart significantly increased from baseline phase to stressor phase, and whether average heart rate significantly decreased from stressor to recovery phase. Similarly, in order to confirm that the abbreviated Trier task elicited subjective levels of stress, dependent mean comparisons were conducted to examine whether SUDS ratings significantly increased from baseline phase to stressor phase, and whether SUDS ratings significantly decreased from stressor phase to recovery phase.

Research Question 1

In order to determine which measure(s) of trait resilience best capture an adaptive response to stress in the present study, the researcher initially planned to construct a simultaneous multiple regression model with selected trait resilience measures as the predictor variables and physiological indices of stress response as the dependent variable. Simultaneous regression was appropriate for this question, as there is no extant research that would indicate a theoretical order in which predictor variables should be entered into the model (Wampold & Freund, 1987). Consistent with published recommendations (Wampold & Freund, 1987), first, bivariate relationships were examined between all measures of trait resilience, HRV, and

duration of cardiovascular response in order to determine the strength and direction of existing relationships between measures of trait resilience and indices of physiological stress response and recovery. Next, assumptions for multiple regression were to be ensured (e.g., Cohen & Cohen, 1983) and measures of trait resilience that were found to be significantly related to HRV or duration of cardiovascular response were to be entered into simultaneous linear regression models (the first model with HRV as the dependent variable and the second model with duration of cardiovascular response as the dependent variable). In order to determine which measure(s) of trait resilience *best* predicted physiological stress response in each model (and in which order), individual beta weights for each measure entered into the models were to be examined. By using this method, the researcher aimed to "rank order" the measures of trait resilience deemed to significantly predict physiological stress response in each model and determine which instrument best captured physiological response to the induced stressor.

Research Question 2

In order to determine if self-compassion added meaningful value in predicting physiological stress response alongside trait resilience, the researcher planned to conduct a hierarchical multiple regression model. First, bivariate relationships were to be examined between the measure of trait resilience determined to best capture physiological stress response, self-compassion, HRV, and duration of cardiovascular response. Assumptions of multiple regression were then to be ensured. Pending significant relationships between trait resilience and self-compassion, and self-compassion and indices of physiological stress response, two separate regression models were to be constructed (one with HRV as the dependent variable and one with duration of cardiovascular response as the dependent variable). Trait resilience was to be entered into the model first, followed by self-compassion in order to determine if self-compassion

contributed unique predictive value alongside the measure of trait resilience deemed to best capture physiological stress response.

Results

Preliminary Analyses

Missing data analyses indicated that about 18.75% of participants in the sample had a small amount of missing data present within the self-report measures completed during part one of the study (n = 18). Individual item level descriptives indicated that missing data ranged from 1 to 2.1% at the item level. Little's MCAR indicated that data were missing completely at random, χ^2 (2048, N = 97) = 590.58, $p > 0.05$. Given the small amount of missing data present and results of Little's MCAR, expectation maximization was utilized to replace missing values in the data set (Schlomer, Bauman, & Card, 2010).

Prior to examining bivariate relationships, descriptive statistics were computed for each variable (see Table 1). Average RMSSD values obtained in the present study fell into the normative range for time domain measures of HRV in previously published works (Dantas et al, 2018; Kobayashi, Park, & Miyazaki, 2012). All self-report variables and cardiovascular outcomes were next assessed for normality using Shapiro-Wilk tests of normality. Results indicated that all self-report measures of trait resilience were normally distributed. The overall RMSSD value and duration of cardiovascular response were found to be non-normally distributed. Further examination of histograms for these variables indicated that the overall RMSSD value and duration of cardiovascular response exhibited positively skewed distributions. In line with published recommendations (Tabachnick & Fidell, 2019), and similar to previous works utilizing physiological measures (e.g., Shaffer & Ginsberg, 2017), a logarithmic transformation was performed on both cardiovascular indices. Normality testing following this

transformation indicated that the procedure was successful in producing a normal distribution for the overall RMSSD value, while duration of cardiovascular response remained non-normal. Given these findings, bivariate relationships were examined between self-report measures and overall HRV using Pearson correlations. Due to the violation of the assumption of normality, a non-parametric alternative (Spearman's rho) was utilized to examine relationships between self-report measures and duration of cardiovascular response.

Multivariate outliers were detected and removed by examining Mahalanobis distance values prior to conducting analyses to examine curvilinear relationships between self-report measures and HRV (described later in this section). Significant multivariate outliers were defined as those that exceeded acceptable distance ranges according to the appropriate Chi-Square critical values (Tabachnick & Fidell, 2019). Examination of these values revealed two significant multivariate outliers in the model examining the CD-RISC (n = 94), one for the model examining the RSA (n = 95), four for the ER-89 (n = 92), one for the BRS (n = 95), and three for the SCS (n = 93). In order to ensure that these extreme values did not bias results, these cases were excluded from curvilinear analyses described later in this section.

Next, to examine whether the abbreviated Trier task was successful in eliciting subjective and objective stress in participants, dependent mean comparisons were conducted utilizing the average heart rate computed during each study phase and subjective ratings of stress given by participants via the SUDS scale during each study phase. A set of dependent t-tests was conducted to examine whether average heart rate significantly increased in response to the stressor task (from the baseline phase to the stressor phase), and whether average heart rate significantly decreased with the removal of the stressor task (from the stressor phase to the recovery phase). Results indicated that average heart rate significantly increased from baseline

phase (M = 80.90, SD = 11.11) to stressor phase (M = 90.02, SD = 13.78; $t(95) = -11.84$, $p < 0.001$). Similarly, average heart rate significantly decreased from stressor phase (M = 90.02, SD = 13.78) to recovery phase (M = 80.52, SD = 11.06; $t(95) = 12.73$, $p < 0.001$). These findings suggest that the abbreviated Trier task was, on average, successful in inducing physiological stress in participants. This finding is similar with others that have implemented an abbreviated trier task (e.g., Tugade & Fredrickson; a change of 14 beats per minute from baseline to stressor) and full Trier tasks (Van Hedger, Necka, Barakzai, & Norman, 2017; a change of 10 beats per minute). However, some works that has implemented full Trier tasks have reported larger changes in HR from baseline to stressor (about 17 beats per minute; Lü et al., 2016).

Due to the non-normal distribution of average SUDS ratings given by participants during all phases of the study, a set of Wilcoxon Signed-Rank Tests was conducted to examine whether SUDS ratings significantly increased in response to the stressor task (from the baseline phase to the stressor phase), and whether SUDS ratings significantly decreased with the removal of the stressor (from the stressor phase to the recovery phase). Results indicated that median SUDS ratings increased significantly from baseline phase (Mdn = 10) to stressor phase (Mdn = 40, $z = -8.01$, $p < 0.001$). Similarly, median SUDS ratings significantly decreased from stressor phase (Mdn= 40) to recovery phase (Mdn =10 $z = -8.43$, $p < 0.001$). These findings suggest that the abbreviated Trier task was successful in inducing subjective stress in participants.

Correlational Analyses

First, bivariate correlations were examined between all self-report measures used in the present study. Pearson correlations revealed that self-compassion was significantly and positively correlated with the CD-RISC ($r = 0.61$, $p < 0.01$), the RSA (r =0.62 , $p < 0.01$), the ER-89 ($r = 0.54$, $p < 0.01$), and the BRS ($r = 0.69$, $p < 0.01$). All measures of trait resilience

were also found to be significantly and positively related to one another (see Table 2; *r* values ranging from 0.52- 0.73).

Next, bivariate relationships were examined between all four measures of trait resilience, self-compassion, and overall HRV from the onset of the baseline phase to the end of the recovery phase (see Table 2) The logarithmically transformed RMSSD value ($RMSSD_{ln}$) was used as the overall index of HRV in order to ensure normality. Pearson correlations revealed no significant linear relationships between overall HRV and the CD-RISC (r = -0.005, p = 0.965), RSA (r = -0.08, p = 0.45), ER-89 (r = 0.11, p = 0.28), or the BRS (r = -0.08, p = 0.46). Similarly, results revealed no significant linear relationship between self-compassion and overall HRV (r = -0.14, p = 0.22).

In order to thoroughly examine any potential existing linear relationships between self-compassion, trait resilience, and overall HRV, subscales included within the SCS and the RSA were also examined. Pearson correlations revealed a significant negative relationship between the Common Humanity subscale of the SCS and overall HRV (r = -0.20, p = 0.048), such that at higher levels of Common Humanity, lower overall HRV for the duration of the study was observed. No significant linear relationships emerged between any of the five subscales of the RSA and overall HRV.

Next, bivariate relationships were examined between all four measures of trait resilience, self-compassion, and duration of cardiovascular reactivity. Due to the high level of skewness in duration of cardiovascular reactivity, Spearman's correlations were utilized to examine these relationships. Consistent with previous work utilizing this physiological metric, (Tugade & Fredrickson, 2004) one participant was not included in the following analysis because they did not reach cardiovascular recovery at any point following introduction of the stressor. Results

indicated no significant relationships between duration of cardiovascular reactivity and the CD-RISC (r_s= 0.13, p = 0.19), RSA (r_s= = 0.18, p = 0.08), or ER-89 (r_s= = 0.11, p = 0.28), or between self-compassion and duration of cardiovascular reactivity (r_s = 0.14, p = 0.19). However, results revealed a significant positive relationship between the BRS and duration of cardiovascular reactivity (r_s= = 0.21, p = 0.04). This finding suggests that contrary to hypotheses, higher scores on the BRS were associated with a longer duration of cardiovascular response before recovery was reached.

As with overall HRV, in order to illuminate any potential existing relationships between variables of interest and duration of cardiovascular reactivity, relationships were also examined between this metric and subscales within the SCS and RSA. Spearman's correlations indicated there were no significant relationships between any of the SCS subscales and duration of cardiovascular reactivity. Spearman correlations examining RSA subscales revealed a significant positive correlation between the Structured Style subscale of the RSA and duration of cardiovascular reactivity (r_s= = 0.24, p = 0.02), as well as the Family Cohesion subscale and duration of cardiovascular reactivity (r_s= = 0.21, p = 0.04). These findings suggest that contrary to hypotheses, higher scores on these subscales were associated with a longer duration of cardiovascular response to the induced stressor.

Correlational Analyses with Additional Cardiovascular Variables

Due to non-significant linear relationships between more than one measure of trait resilience and either index of cardiovascular response and recovery, the proposed simultaneous regression analyses were not able to be conducted (research question 1). Similarly, due to the non-significant relationship between self-compassion and either cardiovascular index, the proposed hierarchical regression analysis was not conducted (research question 2). Though not

originally included in the analysis plan, several additional indices of cardiovascular reactivity and recovery used in previous studies (e.g., Corina & Adriana, 2013; Kibler, 2018; Lü et al., 2016) were computed. These metrics were examined on an exploratory basis in order to thoroughly assess any extant relationships between self-compassion, trait resilience measures, and physiological indices in the present study that may not have been fully captured by the originally hypothesized cardiovascular metrics.

First, congruent with previous psychophysiological studies (Kibler, 2018; Llabre, Spitzer, Saab, Ironson, & Schneiderman, 1991, Lü et al., 2016), reactivity and recovery indices were computed. The reactivity index represents the change in heart rate from baseline phase to stressor phase (i.e., a quantification of how much a participant's heart rate changed in response to the stressor) and was computed by subtracting the average heart rate during the baseline phase of the study from the average heart rate during the stressor phase of the study for each participant. Similarly, a recovery index, which represents the amount of change in a participant's heart rate from the baseline phase to the recovery phase (i.e., a quantification of how much a participant recovered from the stressor relative to their baseline average heart rate) was calculated by subtracting the average heart rate during the baseline phase from the average heart rate during the recovery phase. While recovery indices equal to or less than 0 represent "complete" recovery, positive values represent increasing levels of incomplete recovery (Llabre et al., 1991). Finally, in order to quantify the amount of change in average heart rate from the stressor phase to the recovery phase, a deceleration index was computed for each participant (Corina & Adriana, 2013) by subtracting the average heart rate during the recovery phase from the average heart rate during the stressor phase.

Shapiro-Wilks tests for normality were conducted for each additional metric. Tests of normality and visual examination of histograms indicated that the reactivity and deceleration indices were significantly skewed in the positive direction. Square root transformations (according to the shape of the respective distributions; Tabachnick & Fidell, 2019) were performed to ensure the assumption of normality. Pearson correlations revealed no significant linear relationships between self-compassion, the reactivity index, the recovery index, or the deceleration index. Similarly, no significant linear relationships emerged between any of the four trait resilience measures and these metrics (see Table 2).

Investigation of Curvilinear Relationships

Given the largely null findings with regard to linear relationships between measures of trait resilience, self-compassion, and cardiovascular response and recovery, the researcher examined potential non-linear relationships between self-report measures and originally hypothesized cardiovascular indices. These analyses were conducted on an exploratory basis in an attempt to assess whether there were any significant relationships between self-report measures and physiological response and recovery in the present study. Specifically, these relationships were examined between self-compassion, all four measures of trait resilience, and overall HRV ($RMSSD_{ln}$value). Potential curvilinear relationships were not examined with regard to duration of cardiovascular reactivity due to the large amount of skewness that remained in this variable despite logarithmic and square root transformations.

A polynomial regression analysis was conducted in order to assess the presence of potential quadratic or cubic effects. Specifically, an exploratory hierarchical multiple regression was conducted with the overall score for each self-report measure (followed by their subsequent quadratic and cubic terms) as the predictor variables and overall HRV ($RMSSD_{ln}$) as the

dependent variable. Consistent with previous work examining HRV (e.g., Duarte & Pinto-Gouveia, 2017) the linear term for the total score of each measure was entered into the first block of the regression, followed by the quadratic term and cubic term in subsequent blocks. Using this method, the contributions of linear, quadratic, and cubic terms may be examined in order to detect the presence of potential quadratic or cubic effects. As recommended by Tabachnick & Fidell (2019), each term was mean-centered prior to analysis. For example, to examine whether the relationship between the CD-RISC and overall HRV may be better captured by a quadratic or cubic relationship, the mean centered CD-RISC score was entered into the first block, followed by the mean centered quadratic term in the second block, and the mean centered cubic term in the third block. This procedure was repeated for each self-report measure. Analyses indicated that the quadratic and cubic terms did not account for a significant amount of variance in overall HRV in their respective models for any of the trait resilience measures or the SCS (see Table 3 for a summary of these results). Overall, results in this area indicate that in the current study, there were no significant linear, quadratic, or cubic relationships to be found between self-compassion, trait resilience measures, and overall HRV[1].

Discussion

Though originally proposed higher order analyses were not conducted due to lack of significant findings needed to satisfy required assumptions, the present study yielded findings that are important to the larger body of literature pertaining to trait resilience. First and foremost, the stressor task utilized during this study was found to successfully induce both physiological and subjective stress within the current sample. Though a variety of stressor tasks have been used to induce stress in studies examining trait resilience and physiological stress response (e.g., full Trier tasks including speech delivery and subsequent math tasks), this finding indicates that the

1 Several variables were examined as potential moderators in the relationships between self-report measures and both physiological outcomes (gender, neuroticism, perfectionism, and depression). Analyses indicated no significant results for any of the potential moderators.

abbreviated task (adapted from Tugade & Fredrickson, 2004) may represent an efficient and less resource intensive method to induce stress within controlled settings.

With regard to initial correlational findings, this study found that higher levels of self-compassion were associated with higher levels of trait resilience as measured by all four instruments used. The positive relationships found in this study are congruent with theoretical work that has suggested that self-compassion may be closely related or perhaps a component of a larger body of resources that may comprise psychological resilience as a whole (e.g., Arch et al., 2016). Similarly, all four measures of trait resilience used in this study were either moderately or strongly correlated with one another, with the CD-RISC and the RSA evidencing the strongest positive relationship. These relationships suggest that despite the differing conceptualizations of trait resilience utilized to construct each measure, these constructs were strongly related to one another, such that high levels of trait resilience reported on one measure corresponded with high levels of trait resilience obtained on the other three measures. This finding is notable, as there is currently a dearth of studies examining multiple measures of trait resilience in conjunction with others in the present body of literature.

Despite initial hypotheses, findings suggested that the majority of the trait resilience measures used in the current study were not related to overall HRV or duration of cardiovascular response. First, there were no significant linear, quadratic, or cubic relationships found between the four instruments used to measure trait resilience and overall HRV during the study. Despite nonsignificant results, these findings are notable, as there are few studies in existence that have examined the relationship between measures of trait resilience and HRV during the course of an induced stressor. Souza et al., 2013 reported a positive relationship between the ER-89 and HRV change scores from baseline to stressor and from stressor to recovery indexed using the first two

minutes of each study phase (indicating greater response and subsequent recovery from the stressor). However, Schwerdtfeger & Dick (2018) found no relationship between trait resilience and HRV during exposure to work-related stressors in a sample of firefighters using a measure of psychological resilience not included in the present study (Wagnild & Young, 1993). Notably, the present study examined HRV over the course of the entire study in an effort to capture overall physiological adaptability from baseline through recovery rather than work that has extracted HRV during specific points in a stress induction protocol or computed change scores. As such, these null findings are notable on a methodological level, as they suggest that the measures of trait resilience used were not related to overall adaptability (HRV) measured continuously during the course of an induced stressor. Nonetheless, given the different methods used to induce stress used in previous studies examining HRV as a physiological outcome (e.g., induced vs. work-related stressors), divergent ways in which HRV was indexed over the course of the studies (extraction of change scores vs. continuous 24-hour recordings using ambulatory devices), comparisons of results between studies is difficult.

Contrary to findings reported by Tugade & Fredrickson (2004) specific to the ER-89, measures of trait resilience and duration of cardiovascular response were also largely non-significant in the present study. No significant relationships emerged between three of the four trait resilience measures and this index of physiological recovery. Unexpectedly, higher scores on the BRS were found to be associated with a longer duration of cardiovascular reactivity rather than a shorter duration. As trait resilience as conceptualized by the creators of the BRS (Smith et al., 2008) pertains primarily to an individual's *perception* of their ability to "bounce back", this finding adds evidence to the notion that psychometric instruments designed to measure trait resilience may tap into unintentional self-report biases on the part of participants (Walker et al.,

2017). In other words, results suggest that participants' perception of their ability to recover quickly and effectively from stress did not coincide with their objective ability to do so based on the duration of their cardiovascular response to the induced stressor during the study.

Though the overall score on the RSA was not significantly related to duration of cardiovascular response, scores on several subscales were associated with a longer duration of reactivity. Specifically, higher scores on the Structured Style and Family Cohesion subscales were associated with a longer duration of time until cardiovascular recovery was reached. The Structured Style subscale, which is designed to capture a proclivity for planning and organization, is described as a protective intrapersonal resource within the RSA (Friborg et al., 2005). To date, only one study has examined the relationship between the RSA and cardiovascular response to induced stress (by examining degree of heart rate reactivity and deceleration) and found no significant relationships (Corina & Adriana, 2013). However, it is possible that having a high preference for structure may have resulted in an increased amount of time needed to physiologically recover within the context of the stressor induced in this study given that participants were asked to generate material (plan a speech without aids) relatively quickly. These findings also indicate that higher levels of family cohesion (level of connection between family members, shared sense of values etc.) were related to an increased amount of time needed to reach cardiovascular recovery after the introduction of the stressor. Though previous longitudinal work has suggested that family cohesion is associated with lower levels of psychological distress following traumatic stressors (indicating that this resource may play a role in facilitating adaptive psychological responses to stressors; Zerach, Solomon, Horesh, & Ein-Dor, 2013), findings from the present study suggest that increasing levels of this resource were

related to increasing amounts of time to physiologically "bounce back" from the stressor induced in this study.

Analyses that examined relationships between trait resilience measures and cardiovascular change scores (heart rate reactivity index, recovery index, and deceleration index) were also non-significant. These findings indicate that the measures of trait resilience used were not related to the amount of change in heart rate between baseline and stressor phases (reactivity index), stressor and recovery phases (deceleration index) or from baseline to recovery phase (recovery index). These findings are contrary to those of Souza and colleagues (2013), who reported a significant positive relationship between the ER-89 and reactivity and recovery indices computed from cardiovascular interbeat interval data. However, consistent with the present findings, a recent study that utilized a serial addition test found no relationship between the BRS and a computed reactivity index derived from heart rate data (Black et al., 2017). Given that these studies utilized vastly different samples (a sample of Brazilian soldiers and a sample of older adults respectively), and different forms of induced stressors, a clear pattern of relationships in this area remains unclear.

Analyses examining relationships between self-compassion, overall HRV, and duration of cardiovascular reactivity were also largely non-significant. Specifically, there were no significant relationships between overall self-compassion and levels of physiological adaptivity as represented by overall HRV or between self-compassion and time taken to physiologically recover from the stressor. Though one recent study has suggested that self-compassion is related to higher levels of HRV in the context of induced stress (Luo et al., 2018), this and similar works have examined these relationships utilizing group level comparisons in those with high and low levels of self-compassion (e.g., Breines et al., 2013). Additionally, much of the work in this area

has involved stress induction procedures that were preceded or followed by either self-compassion induction procedures or interventions designed to increase self-compassion prior to stressor exposure (e.g., Arch et al., 2014; Petrocchi et al., 2017). It may be possible that these rrelationships do not hold when examined as continuous variables or without the presence of an induction procedure or intervention designed to prime self-compassion prior to an induced stressor. Despite largely null findings, the Common Humanity Subscale, which represents the tendency to view overall suffering or failure as a part of the larger human experience was found to relate to lower levels of overall HRV as opposed to higher HRV over the course of the study. This finding suggests that an increased tendency to universalize hardship was associated with less physiological adaptivity to the stressor induced in this study as quantified by overall HRV.

As a large component of the literature base related to resilience pertains to psychological recovery following exposure to severe forms of stress (such as trauma exposure; e.g., Bonanno & Diminich, 2013), it may be possible that instruments designed to measure trait level resilience coincide more closely with an ability to psychologically recover from more severe forms of stress or trauma than with physiological recovery from normative stressors. Though prospective work examining pre-existing levels of psychological resources prior to exposure to extreme adversity or trauma is needed, the measures utilized in this study have been shown to coincide with lower levels of psychological distress following stressor exposure. For example, some work among samples exposed to a variety of traumatic stressors has suggested that those scoring higher on the CD-RISC evidence lower levels of psychological distress during follow-up measurement points (e.g., Thompson, Fiorillo, Rothbaum, Ressler, & Michopoulos, 2018). Similarly, higher scores on the RSA, ER-89, and BRS have been associated with lower levels of psychological distress following natural disasters (Wang & You, 2016), combat exposure

(Schaubroeck, Riolli, Peng, & Spain, 2011), and other forms of work-related trauma in samples of first-responders (Kim, Park, & Kim, 2018). As psychological response to severe and traumatic stressors and physiological response to normative stressors induced within a controlled environment may differ, the utility of the self-report measures utilized in this study should not be discounted based on these findings alone.

Limitations and Directions for Future Research

The findings in this study should be interpreted in light of several limitations. First, the present sample was comprised predominately of young adults, which limits the generalizability of these findings. Next, though the abbreviated Trier task utilized in the present study was successful in inducing physiological and subjective stress in participants, there is the potential that physiological data may have been different had participants carried through with a speech task. As previous studies in this area have utilized full Trier tasks during which participants were asked to deliver a speech to a panel of judges (e.g., Lü et al., 2016; Souza et al., 2013) or performed various cognitive task (Black et al., 2017), there is the potential that HRV and duration of reactivity may have been different had participants completed a speech rather than stopping at speech preparation. Furthermore, though the present study included the assessment of subjective distress during each phase of the study, an overall measure of how stressful or challenging participants found the speech preparation task relative to other stressors was not included. As previous scholars have implicated task appraisal as a factor that may influence the degree to which individuals physiologically respond to stress (e.g., Laurent, Lucas, Pierce, Goetz, & Granger, 2016), future studies could extend the present findings by adding a measure of overall task appraisal to examine in relation to the physiological indices and trait resilience measures used in this study. Relatedly, one avenue for future exploration might include the

examination of trait resilience measures in combination with additional variables that may impact stress response. For example, in a recent meta-analysis, Ottaviani and colleagues (2016) reported that those with higher levels of cognitive perseveration evidence lower levels of HRV. Future work in this area may benefit from including additional variables that may impact how participants respond on a psychological and physiological level to induced stress alongside measures of trait resilience.

In addition, though the present study strived to gather as much information as possible related to health factors that may impact cardiovascular functioning and instructed participants to refrain from activities that may invoke deviations in normal cardiovascular functioning (e.g., recent caffeine consumption, physical exercise, presence of an illness) participants were not excluded from participation in the study based on their responses to these items. As there are many factors, physiological and otherwise, that have the potential to influence cardiovascular functioning, the possibility that health factors (known or unknown by the participant) may have had some impact on physiological data gathered in this study cannot be fully eliminated.

Lastly, as the current study utilized only cardiovascular data to represent physiological stress response, potential relationships between the variables of interest and other physiological indicators were not able to be examined. This comprises an important limitation, as previous work has also examined relationships between single measures of trait resilience and salivary cortisol (Petros et al., 2013), systolic and diastolic blood pressure (Tugade & Fredrickson, 2004), skin conductance, and facial electromyography (Waugh et al., 2011). As recommended by Walker (2017), future research would benefit from the examination of more than one source from which physiological responses are computed within a stress induction protocol. One option may be to utilize multiple sources of physiological data, as some previous works have (Tugade &

Fredrickson, 2004). Similarly, as there is no current universal protocol that is used to induce stress across these studies, or a standard set of physiological indices used to quantify stress response, future work may also benefit from an increase in standardization in study procedures. As this area of research continues to develop, this may increase the ability of researchers in this area to label discernable trends between studies.

Conclusion

By and large, results of the present study suggest that an adaptive physiological response to an induced normative stressor may not be captured by several widely used measures of trait level psychological resilience. Despite a call for the labeling of biomarkers in conjunction with self-report measures (Walker et al., 2017), the present study did not find any significant relationships between four measures of trait resilience and adaptive physiological response to stress as quantified by overall HRV and duration of cardiovascular response over the course of an induced normative stressor. As this area of research is currently in its infancy, future work examining these relationships is clearly warranted in order to continue to further the conceptual understanding of psychological resilience, its relationship to physiological adaptivity in response to stress, and the instruments being used to assess these constructs.

Table 1

Descriptive Statistics for Variables of Interest

Variable	*N*	*Mean*	*SD*	*Range*
CD-RISC	96	69.94	14.06	31-100
RSA	96	125.30	18.17	76-159
ER-89	96	41.52	6.31	25-56
BRS	96	19.98	4.74	8-30
SCS	96	3.10	0.74	2-5
RMSSD	96	36.43	19.31	11.81-109.74
Duration of Cardiovascular Reactivity	95	203.81	181.41	16-746
Acceleration Index	96	9.11	7.54	-4.62- 45.94
Deceleration Index	96	9.49	7.31	-2.71- 42.01
Recovery Index	96	-0.38	3.20	-8.51 – 6.89

Note. CD-RISC = Connor Davidson Resilience Scale total score; RSA = Resilience Scale for Adults total score; ER-89 = Ego Resilience Scale total score; BRS = Brief Resilience Scale total score; SCS = Self-Compassion Scale total score; RMSSD = overall HRV value, Duration of Cardiovascular Reactivity = number of seconds until cardiovascular recovery was reached following introduction to stressor.

Table 2

Pearson Correlations for Self-Report Measures and Cardiovascular Indices

	Variables	1	2	3	4	5	6	7	8	9
1.	CD-RISC	-								
2.	RSA	.73**	-							
3.	ER-89	.66**	.52**	-						
4.	BRS	.67**	.56**	.55**	-					
5.	SCS	.61**	.62**	.54**	.69**	-				
6.	$RMSSD_{ln}$	-.00	-.08	.11	-.08	-.14	-			
7.	Reactivity Index	.07	.09	.07	.14	.15	-.08	-		
8.	Deceleration Index	.14	.09	.08	.11	.09	-.12	.87**	-	
9.	Recovery Index	-.13	-.03	.01	.03	.08	-.01	.25*	-.19	-

*. Correlation significant at the 0.05 level
**. Correlation significant at the 0.01 level

Note. CD-RISC = Connor Davidson Resilience Scale total score; RSA = Resilience Scale for Adults total score; ER-89 = Ego Resilience Scale total score; BRS = Brief Resilience Scale total score; SCS = Self-Compassion Scale total score; $RMSSD_{ln}$ = logarithmically transformed RMSSD value, Reactivity Index = square root transformation of computed reactivity index; Recovery Index = square root transformation of computed recovery index.

Table 3

Summary of Polynomial Regression Analyses

Measure	*Model*	*Predictor Variable*	β	*t*	*p*	R^2	ΔR^2
CD-RISC	Linear	ae	.068	.654	.51	.005	.005
	Quadratic	CD-RISC total	.079	.758	.45		
		CD-RISC total **2	-.150	-1.45	.15	.027	.022
	Cubic	CD-RISC total	.057	.256	.79		
		CD-RISC total **2	-.151	-1.44	.15		
		CD-RISC total **3	.025	.110	.91	.027	.000
RSA	Linear	RSA total	-.021	-.203	.84	.000	.000
	Quadratic	RSA total	-.016	-.155	.87		
		RSA total **2	-.118	-1.14	.25	.014	.014
	Cubic	RSA total	.062	.264	.79		
		RSA total **2	-.114	-1.09	.27		
		RSA total **3	-.087	-.371	.71	.016	.001
ER-89	Linear	ER-89 total	.138	1.32	.18	.019	.019
	Quadratic	ER-89 total	.132	1.23	.22		
		ER-89 total **2	-.027	-.254	.80	.020	.001
	Cubic	ER-89 total	.207	1.09	.27		
		ER-89 total **2	-.033	-.303	.76		
		ER-89 total **3	-.091	-.476	.63	.022	.003
BRS	Linear	BRS total	-.022	-.215	.83	.000	.000
	Quadratic	BRS total	-.011	-.107	.91		
		BRS total**2	-.154	-.491	.13	.024	.024
	Cubic	BRS total	.019	.088	.93		
		BRS total **2	.148	-1.33	.18		
		BRS total **3	-.035	-.161	.87	.024	.000
SCS	Linear	SCS total	-.115	-1.10	.27	.013	.013
	Quadratic	SCS total	-.116	-1.10	.27		
		SCS total **2	.095	.097	.36	.022	.009
	Cubic	SCS total	.177	.869	.38		
		SCS total **2	.131	1.24	.21		
		SCS total **3	-.342	-1.67	.09	.052	.030

References

American Psychological Association (n.d.). *The road to resilience.* Retrieved from https://www.apa.org/helpcenter/road-resilience.

Arch, J.J., Landy, L.N., & Brown, K.W. (2016). Predictors and moderators of biopsychological social stress responses following brief self-compassion meditation training. *Psychoneuroendocrinology, 69,* 35-40.

Arch, J.J., Brown, K.W., Dean, D.J., Landy, L.N., Brown, K.D., & Laudenslager, M.L. (2014). Self-compassion training modulates alpha-amylase, heart rate variability, and subjective responses to social evaluative threat in women. *Psychoneuroendocrinology, 42*, 49-58.

Ayed, N., Toner, S., & Priebe, S. (2018). Conceptualizing resilience in adult mental health literature: A systematic review and narrative synthesis. *Psychology and Psychotherapy: Theory, Research, and Practice,* 1-43.

Back, S.E., Foa, E.B., Killeen, T.K., Mills, K.L., Teesson, M., Cotton, B.D., Carroll, K.M., & Brady, K.T. (2014). *Concurrent treatment of PTSD and substance use disorders using prolonged exposure (COPE): Patient workbook*. Oxford University Press, New York: NY.

Bezdjian, S., Schneider, K.G., Burchett, D., Baker, M.T, & Garb, H.N. (2016). Resilience in the United States Air Force: Psychometric properties of the Connor-Davidson Resilience Scale (CD-RISC). *Psychological Assessment, 29*(5), 479-485.

Black, J.K., Balanos, G.M., & Whittaker, A.C. (2017). Resilience, work engagement and stress reactivity in a middle-aged manual worker population. *International Journal of Psychophysiology, 116*, 9-15.

Block, J., & Kremen, A.M. (1996). IQ and ego-resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology, 70*, 349-361.

Bonanno, G.A., & Diminich, E.D. (2013). Annual research review: Positive adjustment to adversity-trajectories of minimal-impact resilience and emergent resilience. *The Journal of Child Psychology and Psychiatry, 54*(4), 378-401.

Breines, J.G., McInnis, C.M., Kuras, Y.I, Thoma, M.V., Gianferante, D., Hanlin, L., Chen, X., & Rohleder, N. (2015). Self-compassionate young adults show lower salivary alpha-amylase responses to repeated psychosocial stress. *Self and Identity, 14*(4), 390-402.

Breines, J.G., Thoma, M.V., Gianferante, D., Hanlin, L., Chen, X., & Rohleder, N. (2014). Self-compassion as a predictor of interleukin-6 response to acute psychosocial stress. *Brain, Behavior, and Immunity, 37*, 109-114.

Burrow, A.L., Hill P.L., Ratner, K., & Fuller-Rowell, T.E. (2018). Derailment: Conceptualization, measurement, and adjustment correlates of perceived change in self and direction. *Journal of Personality and Social Psychology, 51*(5), 643-652.

Carney, R.M., & Freedland, K.E. (2009). Depression and heart rate variability in patients with coronary heart disease. *Cleveland Clinic Journal of Medicine, 76*, S13-S17.

Castilho, P., Pinto-Goveia, J., & Duarte, J. (2015). Evaluating the multifactor structure of the long and short versions of the self-compassion scale in a clinical sample. *Journal of Clinical Psychology, 71*(9), 856-870.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd ed.).* Hillsdale, NJ: Erlbaum.

Cohen J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences.* Hillside, NJ: Lawrence Erlbaum Associates, Inc.

Connor, K., & Davidson, J. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety, 18*(2), 76-82.

Corina, D., & Adriana, B. (2013). Impact of work related trauma on acute stress response in train drivers. *Procedia: Social and Behavioral Sciences, 84*, 190-195.

Chen, S., Chen, T., & Bonanno, G.A. (2018). Expressive flexibility: Enhancement and suppression abilities differentially predict life satisfaction and psychopathology symptoms. *Personality and Individual Differences, 126*, 78-84.

Dantas, E.M., Kemp, A.H., Andreão, R.V., Dias da Silva, V.J., Brunoni, A.R., Hoshi, R.A., Bensenor, I.M…& Mill, J.G. (2018). Reference values for short-term resting-state heart rate variability in healthy adults: Results from the Brazilian longitudinal study of adult health- ELSA-Brazil study. *Psychophysiology, 55*, 1-12.

Davydov, D.M., Stewart, R., Ritchie, K, & Chaudieu, I. (2009). Resilience and mental health. *Clinical Psychology Review, 30*, 479-495.

Duarte, J., & Pinto-Gouveia, J. (2017). Positive affect and parasympathetic activity: Evidence for a quadratic relationship between feeling safe and content and heart rate variability, *Psychiatry Research, 257*, 284-289.

Fredrickson, B.L., & Levenson, R.W. (1998). Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition and Emotion, 12*(2), 191-220.

Friborg, O., Barlaug, D., Martinussen, M., Rosenvinge, J.H., & Hjemdal, O. (2005). Resilience in relation to personality and intelligence. *International Journal of Methods in Psychiatric Research, 14*(1), 29-42.

García-León, M.A., Pérez-Mármol, J.M., Gonzalez-Pérez, R., García-Ríos, M. & Peralta-Ramírez, M.I. (2019). Relationship between resilience and stress: Perceived stress,

stressful life events, HPA axis response during a stressful task and hair cortisol. *Physiology and Behavior, 202,* 87-93.

Hall, C.W., Row, K.A., Wuensch, K.L., & Godley, K.R. (2013). The role of self-compassion in physical and psychological well-being. *The Journal of Psychology, 147*(4), 311-323.

Harper, F.W.K., Goodlett, B.D., Trentacosta, C.J., Albrecht, T.L., Taub, J.W., Phipps, S., & Penner, L.A. (2014). Temperament, personality, and quality of life in pediatric cancer patients. *Journal of Pediatric Psychology, 39*(4), 459-468.

Hayter, M.R., & Dorstyn, D.S. (2014). Resilience, self-esteem and self-compassion in adults with spina bifida. *Spinal Cord, 52,* 167-171.

Hu, T., Zhang, D., & Wang, J. (2015). A meta-analysis of the trait resilience and mental health. *Personality and Individual Differences, 76,* 18-27.

Kibler, J.L.(2018). An extension of the perseverative cognition hypothesis to posttraumatic stress disorder symptomatology: Cardiovascular recovery in relation to posttraumatic stress disorder severity and cognitive appraisals of stress. *Journal of Traumatic Stress, 31*, 25-34.

Kim, J.I., Park, H., & Kim, J. (2018). The mediation effect of PTSD, perceived job stress and resilience on the relationship between trauma exposure and the development of depression and alcohol use problems in Korean firefighters: A cross-sectional study. *Journal of Affective Disorders, 229*, 450-455.

Kirschbaum, C., Pirke, K.M., & Hellhammer, D.H. (1993). The 'Trier Social Stress Test'- A tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology, 28*(1-2), 76-81.

Kobayashi, H., Park, B., & Miyazaki, Y. (2012). Normative references of heart rate variability and salivary alpha-amylase in a healthy young male population. *Journal of Physiological Anthropology, 31*(9), 1-8.

Laborde, S., Mosley, E., & Thayer, J.F. (2017). Heart rate variability and cardiac vagal tone in psychophysiological research- Recommendations for experiment planning, data analysis, and data reporting. *Frontiers in Psychology, 8*, 1-18.

Laurent, H.K., Lucas, T., Pierce, J., Gotez, S., & Granger, D.A. (2016). Coordination of cortisol response to social evaluative threat with autonomic and inflammatory responses is moderated by stress appraisals and affect, *Biological Psychology*, *118*, 17-24.

Leary, M.R., Tate, E.B., Adams, C.E., Allen, A.B., & Hancock, J. (2007). Self-compassion and reactions to unpleasant self-relevant events: The implications of treating oneself kindly. *Personality Processes and Individual Differences*, *92*(5), 887-904.

Lee, J., Ahn, Y., Jeong, K., Chae, J., & Choi, K. (2014). Resilience buffers the impact of traumatic events on the development of PTSD symptoms in firefighters. *Journal of Affective Disorders, 162*, 128-133.

Leontjevas, R., Beek, W.O., Lataster, J., & Jacobs, N. (2014). Resilience to affective disorders: A comparative validation of two resilience scales. *Journal of Affective Disorders, 168*, 262-268.

Li, M., & Nishikawa, T. (2012). The relationship between active coping and trait resilience across U.S. and Taiwanese college student samples. *Journal of College Counseling, 15*, 157-171.

Llabre, M.M., Spitzer, S.B., Saab, P.G., Ironson, G.H., & Schneiderman, N. (1991). The reliability and specificity of delta versus residualized change as measures of cardiovascular reactivity to behavioral challenges. *Psychophysiology, 28*(6), 701- 711.

Lü, W., Wang, Z., & You, X. (2016). Physiological responses to repeated stress in individuals with high and low trait resilience. *Biological Psychology, 120*, 46-52.

Luo, X., Qiao, L., & Che, X. (2018). Self-compassion modulates heart rate variability and negative affect to experimentally induced stress. *Mindfulness, 9*, 1522-1528.

Luthar, S.S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development, 71*(3), 543-562.

Mindware Technologies (2017, September 26). *All about HRV Part 5: Data Editing.* Mindware Technologies LTD. Support Portal. https://support.mindwaretech.com/2017/09/all-about-hrv-part-5-data-editing.

Mindware Technologies (n.d.). Electrode placement: Recommended practices. Retrieved from https://support.mindwaretech.com/wpcontent/uploads/2016/04/Electrode_Placement_11x85.pdf.

Neff, K.D. (2003). The development and validation of a scale to measure self-compassion. *Self and Identity, 2*(3), 223-250.

Neff, K.D. (2015). The self-compassion scale is a valid and theoretically coherent measure of self-compassion. *Mindfulness, 7*(1), 264-274.

Nery-Hurwit, M., Yun, J., & Ebbeck, V. (2018). Examining the roles of self-compassion and resilience on health-related quality of life for individuals with multiple sclerosis. *Disability and Health Journal, 11*, 256-261.

Obradović, J. (2012). How can the study of physiological reactivity contribute to our understanding of adversity and resilience processes in development? *Development and Psychopathology, 24*, 371-387.

O'Donohue, J.S., Mesagno, C., & O'Brien, B. (2019). How can stress resilience be monitored? A systematic review of measurement in humans. *Current Psycholo*gy, 1-25.

Ong, A.D., Bergeman, C.S., Bisconti, T.L., & Wallace, K.A. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Personality Processes and Individual Differences, 91*(4), 730-749.

Ottaviani, C., Thayer, J.F., Verkuil, B., Lonigro, A., Meda, B., Couyoumdjian, A., & Brosschot, J.F. (2016). Physiological concomitants of perseverative cognition: A systematic review and meta-analysis. *Psychological Bulletin, 142*(3), 231-259.

Petros, N., Opacka-Juffry, J., & Huber, J.H. (2013). Psychometric and neurobiological assessment of resilience in a non-clinical sample of adults. *Psychoneuroendocrinology, 38*, 2099-2108.

Petrocchi, N., Otaviani, C., & Couyoumdijian, A. (2017). Compassion at the mirror: Exposure to a mirror increases the efficacy of a self-compassion manipulation in enhancing soothing positive affect and heart rate variability. *The Journal of Positive Psychology, 12*(6), 525-536.

Pietrzak, R.H., Johnson, D.G., Goldstein, M.B., Malley, J.C., & Southwick, S.M. (2009). Psychological resilience and postdeployment social support protect against traumatic stress and depressive symptoms in soldiers returning from operations Enduring Freedom and Iraqi Freedom. *Depression and Anxiety,* 1-7.

Poloni, N., Zizolfi, D., Lelmini, M., Pagani, R., Caselli, I., Diurni, M., Milano, A., & Callegari, C. (2018). A naturalistic study on the relationship among resilient factors, psychiatric symptoms, and psychosocial functioning in a sample of residential patients with psychosis. *Psychology Research and Behavior Management, 11*, 123-131.

Rainey, E.E., Petrey, L.B., Reynolds, M., Agtrap, S., & Warren, A.M. (2014). Psychological factors predicting outcome after traumatic injury: The role of resilience. *The American Journal of Surgery, 208*(4), 517-523.

Schaubroeck, J.M., Tiolli, L.T., Peng, A.C., & Spain, E.S. (2011). Resilience to traumatic exposure among soldiers deployed in combat. *Journal of Occupational Health Psychology, 16*(1), 18-37.

Schlomer, G.L., Bauman, S., & Card, N.A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology, 57*(1), 1-10.

Schwerdtfeger, A., & Dick, K. (2018). Episodes of momentary resilience in daily life are associated with HRV reductions to stressful operations in firefighters: An ambulatory assessment approach using Bayesian multilevel modeling. *The Journal of Positive Psychology, 14*(5), 593-602.

Shaffer, F., & Ginsberg, J.P. (2017). An overview of heart rate variability metrics and norms. *Frontiers in Public Health, 5*, 1-17.

Shebuski, K., Bowie, J.A., & Ashby, J.S. (2020). Self-compassion, trait resilience, and trauma exposure in undergraduate college students, *Journal of College Counseling, 23*(1), 2-14.

Shebuski, K., Davari, J., Cobourne, L., McLaulin, S., & Ashby, J.S. (2019). Examining physiological correlates of trait resilience: A stress response study. Poster presented at: 127th Annual Meeting of the American Psychological Association: Chicago, IL.

Smith, B.W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The Brief Resilience Scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine, 15*, 194-200.

Souza, G.G., Magalhães, L.N., Cruz, T.A., Ferraz, A.C., De-Souza, M., Duarte, A.F., Fischer, N.L., Souza, W.F…& Volchan, E. (2013). Resting vagal control and resilience as predictors of cardiovascular allostatic in peacekeepers. *Stress: International Journal on the Biology of Stress, 16*(4), 377-383.

Sünbül, Z.A., & Güneri, O.Y. (2019). The relationship between mindfulness and resilience: The mediating role of self-compassion and emotion regulation in a sample of underprivileged Turkish adolescents. *Personality and Individual Differences, 139*, 337-342.

Tabachnick, B.G., & Fidell, L.S. (2019). *Using Multivariate Statistics.* Pearson Education Inc.

Tang, W. (2019). Resilience and self-compassion related with achievement emotions, test anxiety, intolerance of uncertainty, and academic achievement, *Psychological Studies, 64*(1), 92-102.

Task force of the European Society of Cardiology the North American Society of Pacing Electrophysiology. (1996). Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. *Cardiology, 93*, 1043-1065.

Thayer, J.F., Yamamoto, S.S., & Brosschot, J.F. (2010). The relationship of autonomic imbalance, heart rate variability, and cardiovascular disease risk factors. *International Journal of Cardiology, 141*, 122-131.

Thompson, N.J., Fiorillo, D., Rothbaum, B.O., Ressler, K.J., & Michopoulos, V. (2018). Coping strategies as mediators in relation to resilience and posttraumatic stress disorder. *Journal of Affective Disorders, 225*, 153-159.

Tugade, M., & Fredrickson, B.L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology, 86*(2), 320-333.

Van Hedger, K., Necka, E.A., Barakzai, A.K., & Normal, G.J. (2017). The influence of social stress on time perception and psychophysiological reactivity. *Psychophysiology, 54*, 706-712.

Wagnild, G. M., & Young, H. M. (1993). Development and psychometric evaluation of the Resilience Scale. *Journal of Nursing Measurement*, 1(2), 165–178.

Walker, F.R., Pfingst, K., Carnevali, L., Sgoifo, A., & Nalivaiko, E. (2017). In the search for integrative biomarker of resilience to psychological stress. *Neuroscience and Biobehavioral Reviews, 74*, 310-320.

Wampold, B.E., & Freund, R.D. (1987). Use of multiple regression in counseling psychology research: A flexible data-analytic strategy. *Journal of Counseling Psychology, 34*(4), 372-382.

Wang, A., & Xu, J. (2016). A cross-sectional study on risk factors of posttraumatic stress disorder in Shidu parents of the Sichuan earthquake. *Journal of Child and Family Studies, 25*, 2915-2923.

Waugh, C.E., Wager, T.D., Fredrickson, B.L., Noll, D.C., & Taylor, S.F. (2008). The neural correlates of trait resilience when anticipating and recovering from threat. *Social and Cognitive Affective Neuroscience, 3*(4), 322-332.

Waugh, C.E., Thompson, R.J., & Gotlib, I.H. (2011). Flexible emotional responsiveness in trait resilience. *Emotion, 11*(5), 1059-1067.

Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical Gerontology, 21*, 152-169.

Windle, G., Bennett, K.M., & Noyes, J. (2011). A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes*, *9*(8), 1-18.

Wolpe, J., & Lang, P.J. (1964). A fear schedule for use in behavior therapy. *Behaviour Research and Therapy, 2*, 27.

Ying, L., Wu, X., Lin, C., & Jiang, L. (2014). Traumatic severity and trait resilience as predictors of posttraumatic stress disorder and depressive symptoms among adolescent survivors of the Wenchuan earthquake. *Plos One*, *9*(2), 1-7.

Zerach, G., Solomon, Z., Horesh, D., & Ein-Dor, T. (2013). Family cohesion and posttraumatic intrusion and avoidance among war veterans: A 20-year longitudinal study. *Social Psychiatry and Psychiatric Epidemiology, 48*, 205-214.