

Stressing the Importance of Stress Beliefs

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Abstract

Most individuals experience acute stress. This can lead to both positive and negative health consequences often in the same domain. For example, stress can be a risk factor or a protective factor against cardiovascular disease. These differences may arise from different evaluations, or appraisals, of stressful situations. These appraisals lead to different behavioural, emotional, and physiological responses to stress. One factor that could influence appraisals may be stress beliefs. However, little research has explored this link. This thesis addressed this gap via systematic reviews, qualitative studies, experimental research, and by developing a new stress belief scale.

A systematic review of predictors of appraisals highlighted a need for research on stress beliefs and appraisals. A stress induction study ($N = 117$) found no association between stress beliefs and appraisals. A systematic review and a qualitative study ($N = 35$) of stress beliefs were then conducted. Results suggested that current stress belief measures do not assess all stress beliefs. As such, this thesis focuses on the development of a new stress belief measure; the Subjective Thoughts REgarding Stress Scale (STRESS). A Delphi study with experts in stress research ($N = 14$) confirmed the completeness of the qualitative study results. A pilot study of the original 78 items of the STRESS in an international lay sample ($N = 107$) confirmed all items were commonly held beliefs. Exploratory factor analysis ($N = 419$) and confirmatory factor analysis ($N = 300$) resulted in a final 19-item scale. The scale contains three subscales: beliefs about the i) Consequences of stress, ii) Coping Efficacy, and iii) Interpersonal Relations in stress. A final stress induction study ($N = 137$) demonstrated the predictive validity of the STRESS, with the STRESS successfully predicting the stressor appraisals made of the stress induction.

This thesis has reconceptualised the notion of stress beliefs, resulting in a new multi-dimensional measure of stress beliefs. The new measure successfully predicts the appraisals

made of a standardised stress induction. This will allow future research to use this scale to further explore the role of stress beliefs in the subjective stress response. In turn, it is now possible for future research to explore the link between stress beliefs and differences in stress-related health outcomes.

Statement of Originality

This work has not previously been submitted for a degree or diploma in any university.
To the best of my knowledge and belief, the thesis contains no material previously published
or written by another person except where due reference is made in the thesis itself.

Christopher Jon Kilby

1st November 2019

Statement of Contribution

Chris Kilby is the lead author for all works reported in this thesis. Chris Kilby was the primary researcher in all aspects of the research conducted, including the conceptualisation and design of the studies, participant recruitment and data collection, data analysis, reporting of results, and preparation and submission of works for publication. The following works have been submitted or published in peer-reviewed journals; all co-authors were members of Chris Kilby's supervisory panel:

Chapter 2 – Predictors of Interindividual Differences in Appraisals

Kilby, C. J., Sherman, K. A., & Wuthrich, V. M. (2018). Towards understanding interindividual differences in stressor appraisals: A systematic review. *Personality and Individual Differences*. <https://doi.org/10.1016/j.paid.2018.07.001>

Chapter 4 – Scoping Review of Stress Beliefs

Kilby, C.J., Sherman, K.A., & Wuthrich, V.A. (under review). A scoping review of stress beliefs: Literature integration, measurement issues, and theoretical concerns. *Annals of Behavioral Medicine*.

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“Everybody knows what stress is and nobody knows what it is. The word stress, like success, failure, or happiness, means different things to different people and, except for a few specialized scientists, no one has really tried to define it although it has become part of our daily vocabulary. Is it effort, fatigue, pain, fear, the need for concentration, the humiliation of censure, loss of blood, or even an unexpected success that requires complete reformulation of one’s life? The answer is yes and no. That is what makes the definition of stress so difficult. Every one of these conditions can produce stress, and yet none of them can be singled out as being ‘it’ since the word applies equally to all others as well” – Hans Selye, 1973

Chapter 1 – Introduction to Thesis

Stress is a phenomenon experienced by all individuals in some capacity. The range and commonality of stress experiences are reflected in the variety of measures from trait approaches capturing perceived stress over the prior month (Cohen, Kamarck, & Mermelstein, 1983), to state measures capturing momentary stress (Mitchell, 2007). Further reflecting the diversity of stress measures are those capturing the number of and magnitude of lifetime stressful events (Ferguson, Matthews, & Cox, 1999; Shrout, 1981; Tennant & Andrews, 1976), to stress within a particular development stage, such as childhood (Finkelhor, Shattuck, Turner, & Hamby, 2015), and more. Experiences of stress can be minor, with minimal impact on an individual, or they can be debilitating. The experience of stress can also be invigorating leading to improvements in a whole host of domains (for a review see: Bourne Jr & Yaroush, 2003; Lupien, McEwen, Gunnar, & Heim, 2009; Schneiderman, Ironson, & Siegel, 2005). Consequences of stress can be transient or long-lasting (Lepore, Miles, Levy, & Levy, Jodi, 1997). Interestingly, the exact way that experiencing a stressor will affect one individual may not necessarily be the same way that the same stressor affects another individual (Bourne Jr & Yaroush, 2003; Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). To this point, there is merit in being able to identify factors that determine these individual differences in the experience of stress.

Dominant theories of stress outline that the way we interpret stressful situations may be a key point at which individual differences in the stress response arise (Folkman, 2014; Ursin, 2009). These theories outline that our unique way of *interpreting* stressful situations could mean that two people are making decisions about how to behaviourally respond to the same situation using different information. Logically, it is understandable that the two individuals may not respond the same way to the same stressful situation. Stress theories further suggest that the appropriateness and effectiveness of this responding to address the

stressful situation can lead to emotional responses (e.g., anxiety, frustration, excitement). The combined effect of the cognitive, behavioural, and emotional responses to stress can bolster or diminish emotional and physical wellbeing (Penley, Tomaka, & Wiebe, 2002; Ursin & Eriksen, 2007).

There is a wealth of empirical research demonstrating that the way stressful situations are perceived influences the way we behaviourally respond, and that these responses have consequences for emotional and physiological wellbeing (Fardell et al., 2016; Hewett, Liefoghe, Visockaite, & Roongrerngsuke, 2018; Kennedy, Kilvert, & Hasson, 2016; McCarthy, Lambert, Lineback, Fitchett, & Baddouh, 2016; Raskauskas & Huynh, 2015). However, there is a lack of research exploring how these individual differences in the way that we process stress-related information arise. Being able to identify critical factors that predispose individuals to perceive stressful situations in a certain way may prove beneficial for promoting positive consequences and diminishing negative consequences associated with stress. This thesis considers one potential candidate, namely stress beliefs. By definition, a stress belief is a lay belief about stress, that is, an individual's lay understandings about stress in the most general sense (Kilby & Sherman, 2018). As a first step to understanding the potential importance of stress beliefs in the stress response, this thesis aimed to evaluate the relationship between stress beliefs and the way information from stressful situations is processed. If this link could be demonstrated, then future research could explore the safety of, and methodologies required for, such an intervention.

This introductory chapter first provides a working definition of stress, then briefly discusses the physiological stress response and the concept of allostasis to provide the background context as the future implications and importance of this work are relevant to the physiological stress response. Moreover, an understanding of the physiological stress response is needed to further understand how current stress theories relate stress to

physiological health. This chapter then outlines the relationship between stress and mental health, along with several theories of stress. These theories will be synthesised together to highlight their commonalities and build a complete picture of the stress response. Following this, stress beliefs are introduced as a possible factor underlying individual differences in how stressful situations are appraised (a common aspect of the stress response across stress theories). Several belief theories are then discussed and synthesised to highlight the commonly theorised role of beliefs in influencing the appraisal of information from a stress stimulus. This introductory chapter concludes by extrapolating this knowledge of beliefs, applying it to stress to demonstrate the possible role of stress beliefs in indirectly influencing individual differences in physiological and mental health via appraisals.

1.1 Defining Stress

Stress was first used in the field of Engineering to describe the way that a material responds when placed under physical pressure, a neutral term in that a material being under stress was not considered to be in a positive or negative state. The term stress is now found across most fields of science, particularly human and biological sciences. Stress, in the context of the human experience, could be one of the most challenging concepts to define. So challenging, that its existence was once questioned as merely being a generic term manufactured post-World War II to explain otherwise unexplainable suffering (Pollock, 1988). There is a myriad of definitions for stress that each have their unique implications for measurement and theory. Outlined below are some of the more common definitions.

One perspective defines stress as a purely physiological response, such as “the physiological pattern of adaptation [to stressors]” (pp. 662, Burchfield, 1979). These definitions suggest the need for objective measurement of some physiological by-product associated with stress to determine the magnitude of stress felt by the individual. Others describe stress as being a product of how an individual thinks about a stressful situation; “a

situation that is appraised by the individual as personally significant and as having demands that exceed the person's resources for coping" (pp. 901-902, Folkman, 2014). Definitions of this variety are often accompanied by self-report measures of varying lengths to capture the different thought processes that an individual may be engaging in during a stressful situation.

One of the earliest definitions of stress did not distinguish between psychological or physiological responses but instead defined stress only as a "non-specific response of the body to any demand made upon it" (pp. 692, Selye, 1974). Here, the demand is considered the source of the stress, and the non-specific response is the way that the individual handles the stress. The response to stress is described as non-specific as there is no singular way that an individual responds to stressful situations, instead the response is informed by how the individual subjectively experiences the stressful situation (Selye, 1974; Ursin & Eriksen, 2004). However, this definition only captures the response and the stressor, and consequently does not clearly define stress. More recent work has extended on this theory by describing stress as an alarm that arises when there is a discrepancy between reality and what is expected (i.e., the demand), with the alarm eliciting or motivating the enactment of the non-specific response (Eriksen, Murison, Pensgaard, & Ursin, 2005). To this extent, stress is simply an increase in motivation to act. The increase in motivation may be a pleasurable or unpleasurable experience and may produce pleasurable or unpleasurable outcomes. This extended definition of stress is compatible with current major theories of stress that further define the process by which an individual experiences and responds to stress (e.g., the Biopsychosocial Model of Stress, Blascovich, 2008; the Transactional Model of Stress, Lazarus & Folkman, 1984; or the Cognitive Activation Theory of Stress, Ursin & Eriksen, 2004). As such, adopting this extended definition of stress provides the ability to not only define stress but to do so in a way that does not limit the applicability of current theories.

With this definition in hand, it is possible to explore the way that stress may affect an individual's health.

1.2 Stress and Health

1.2.1 Stress and Physical Health

Since the conception of stress research in animals by Hans Selye, there has been a fascination with how stress relates to health (Selye, 1936). Research has primarily focussed on how experiencing stress can harm an individual's physical health. The exact nature of this harm appears to differ across developmental stages (Lupien et al., 2009). This thesis only discusses stress and health in adulthood as the empirical components of this thesis focus on stress in adulthood exclusively.

In adulthood, stress can have detrimental effects on both physical and psychological wellbeing. Large meta-analyses have reported that higher subjectively perceived stress levels increase the risk of Type 2 diabetes, decreased time for HIV to develop into AIDS (Schneiderman et al., 2005), and slower wound healing (Walburn, Vedhara, Hankins, Rixon, & Weinman, 2009). Moreover, increased perceived stress levels are associated with initial onset or mortality due to cardiovascular heart disease (Kivimäki & Kawachi, 2015; Richardson et al., 2012). It is thought that stress increases the risk for cardiovascular heart disease by higher levels of perceived stress that cause thickening and damaging of the arterial walls, plaque formations in the circulatory system, and decreased immune cell profiles (Segerstrom & Miller, 2004). However, other evidence suggests that the effect of stress on physical health is not exclusively negative. Heightened levels of stress have been associated with increased metabolic functioning, lower risk of heart disease, upregulation of the immune system, and an upregulation of body systems that strengthen and repair muscular tissue damage (for reviews, see Lupien, Maheu, Tu, Fiocco, & Schramek, 2007; Schneiderman et al., 2005).

Allostasis can be used to understand how stress could be associated with both diminished and improved physical health (Calabrese & Baldwin, 2002; Wingfield, 2005). This theory focusses on understanding how an organism responds to environmental pressures (i.e., stressors), such as breeding, feeding, and shelter. As the pressures increase in their intensity or their duration, more energy is needed to overcome or coexist with the stressor. The demand for energy is known as 'allostatic load'. Overload occurs when the allostatic load goes beyond the organism's available energy reserves. In these circumstances, the organism undergoes a 'life change', involving alteration of the organism in some way to now persevere and survive with the presence of the pressure, or ultimately, death. These alterations can be both positive and negative (Wingfield, 2005).

The organism's response to increased allostatic load and overload is caused by a shifting of the body's resources (e.g., hormones) that upregulate and downregulate to meet the situational demands. If this dysregulation is maintained for an extended period, the body will adopt this dysregulation as the new 'normal'. In other words, the body's systems for managing and maintaining healthy levels of bodily resources such as oxygen, nutrients, and hormones (i.e., homeostasis) will change the level at which these resources are maintained to match the chronic dysregulation caused by the allostatic load. The only way to reverse this, according to Allostasis Theory, is to remove the organism from the environmental pressure, thus triggering a different allostatic load that would reset the body's normal levels. An extreme example of allostatic load and overload can be found in a species of snails where all newborns are females. In the absence of males, the hormones associated with reproduction increase as a result of a rising allostatic load, which in turn increases the desire to mate. Under allostatic overload, these hormones trigger the growth of male genitalia, now allowing the snail to mate with other females (Wingfield, 2005).

The dysregulation associated with allostatic load in humans is characterised primarily by increased levels of adrenaline and cortisol produced through the hypothalamus-pituitary-adrenal axis (Gaab, Rohleder, Nater, & Ehlert, 2005). Simultaneously, experiencing stress causes increased activity in the sympathetic nervous system, notably resulting in the release of adrenaline from the adrenal glands. It is important to note that adrenaline and cortisol have competing effects on the body and that the process of releasing these hormones manages the competing demands. Adrenaline is released almost immediately in stressful situations as electrical currents activate the sympathetic nervous system. However, cortisol is activated through typical hormonal pathways which are considerably slower than the electrical currents of the sympathetic nervous system. As such, an individual experiences adrenaline for some time before cortisol is released (for a review, see Bourne Jr & Yaroush, 2003).

Under stress, the body first releases adrenaline resulting in the fight or flight response (Jansen, Nguyen, Karpitskiy, Mettenleiter, & Loewy, 1995). Adrenaline increases heart rate, blood pressure, breathing, and sweating while decreasing metabolic functioning and sexual functioning. The increase in breathing, heart rate, and blood pressure work to push blood flow to the body's extremities, thus providing muscles with additional blood-based nutrients to facilitate the fight or flight state. However, this redistribution of blood means that there is a decrease in nutrients made available to parts of the body that are not in the extremities, thus resulting in the decrease of metabolic and sexual functioning (Bourne Jr & Yaroush, 2003; Lupien et al., 2007, 2009; Schneiderman et al., 2005). Cortisol and noradrenaline are released after adrenaline to promote recovery following stress (Bourne Jr & Yaroush, 2003; Lupien et al., 2007; Schneiderman et al., 2005). These hormones promote an increase in metabolism, immune functioning, blood flow, and cognitive functioning, such as vigilance and emotion-based memory functioning (Lupien et al., 2005, 2007). However, while exposure to both of these hormones is beneficial in the short term for either fight and flight (adrenaline) or

recovery (cortisol and noradrenaline), they are both highly catabolic and neurotoxic (Bourne Jr & Yaroush, 2003). As such, prolonged exposure to adrenaline, cortisol, and/or noradrenaline (often resulting from chronic stress) can lead to lasting cardiovascular and organ damage (Schneiderman et al., 2005; Segerstrom & Miller, 2004), decreased immune functioning, and increased wound healing time (Walburn et al., 2009). Further, cortisol can cross the blood-brain barrier and can directly affect dopaminergic and serotonergic regions of the brain (Bourne Jr & Yaroush, 2003; Lupien et al., 2007).

1.2.2 Individual Differences in Stress and Physical Health

The acute stress response is an adaptive response to redistribute the body resources via a dysregulation of hormones that increases the likelihood of the organism to overcoming the source of their stress (Bourne Jr & Yaroush, 2003; Lupien et al., 2007, 2009; Schneiderman et al., 2005; Segerstrom & Miller, 2004). However, chronic stress, leading to a chronic dysregulation of hormones, can lead to negative consequences for the body (Lupien et al., 2009; Segerstrom & Miller, 2004). While there is no specific length of time that an individual must experience the sensation of stress before it is deemed chronic, there is a consensus that chronic stress represents an ongoing sensation of stress that can span several days, weeks, months, or years; conversely, acute stress is much more short-lived (Hammen, Kim, Eberhart, & Brennan, 2009). Episodic acute stress (i.e., repeated exposure to acute stress) does not constitute chronic stress; rather, chronic stress is the ongoing and nonstop experience of stress (Lepore et al., 1997). There is evidence that emotion-based reappraisals both from a coping perspective (Collins, Baum, & Singer, 1983) and from an emotion regulation perspective (Ragen, Roach, & Chollak, 2016), can moderate the severity of chronic stress, suggesting a possible cognitive component to the experience of chronic stress. Additionally, the Biopsychosocial Model of Stress (described in detail later) highlights that, under certain cognitive appraisals of stress, individuals will display different cardiovascular

profiles (Blascovich, 2008), with negative threatening appraisals leading to vasoconstriction (a risk factor for cardiovascular disease; Blascovich, 2008). This suggests that if an individual were to consistently appraise a chronic source of stress as a threat, then they may be increasing their likelihood of harmed health, such as cardiovascular disease incidence (Segerstrom & Miller, 2004). This, then, would further suggest that cognition may play a role in determining the health consequences associated with stress. This more psychological side of the stress response is not only associated with physical health but has also been associated with mental health.

1.2.3 Stress and Mental Health

Experiencing stress has been associated with decreases in mood (Bolger, DeLongis, Kessler, & Schilling, 1989), onset and maintenance of depression and anxiety (Schneiderman et al., 2005), as well as decreases in memory functioning (Lupien et al., 2005), concentration and willpower (Bourne Jr & Yaroush, 2003; Lupien et al., 2007). Some of these effects are due to psychological consequences of stress. For example, depression and anxiety are associated with decreased mood, feelings of helplessness or feelings of hopelessness (Henkel, Bussfeld, Möller, & Hegerl, 2002). Other aspects have neurophysiological groundings. For example, changes in elevations of cortisol and adrenaline can increase and decrease memory functioning and concentration levels (Lupien et al., 2005). Nevertheless, stress is also known to promote positive affect both during a stressful situation, and the day following a stressful situation that elicited negative affect (Bolger et al., 1989) and, in some circumstances, can promote life-satisfaction (Flinchbaugh, Luth, & Li, 2015). Further, not all individuals will experience anxiety or depression under stress (Folkman, Lazarus, Gruen, & DeLongis, 1986). In contrast, stress can lead to improvements in concentration, memory, and willpower for others (Lupien et al., 2007), implying that stress does not have a unidirectional effect on

health. An examination of common theoretical models of stress may provide some direction for how these differences in mental health might emerge.

1.3 Psychological Models of Stress

Numerous theories and models outline different processes involved in experiencing and responding to stress, many of these are complementary. This section considers three theories of stress; The Transactional Model of Stress (Lazarus & Folkman, 1984) and the Biopsychosocial Model of Challenge and Threat (Blascovich, 2008) will be discussed together, and then a discussion of the Cognitive Activation Theory of Stress (Ursin & Eriksen, 2004) will follow. Together, these three theories provide a detailed account of the cognitive processes involved in stress, as well as how they are related to the behavioural and physiological responses made under stress, and ultimately, mental and physical wellbeing. This synthesis is important given that stress is a motivation to respond that can encompass a cognitive response, a physiological response, and a behavioural response.

1.3.1 Transactional Model of Stress

The Transactional Model of Stress outlines how an individual responds to the presence of a stressor and allows for an account of how individual differences in stress responses may arise (Lazarus & Folkman, 1984). The model proposes that there are two key aspects to the stress response: cognitive appraisals and coping. These two aspects are interconnected, and their relationship with the environment and individual can create a host of emotional, behavioural, and physiological responses (Folkman, Lazarus, Gruen, et al., 1986).

Cognitive appraisals are a highly subjective aspect of the stress response and can significantly vary from person to person, even within the same stressful situation. To this extent, there is a range of measures that have been developed to capture these individual

differences in appraisals of stressful situations (Figuerola-Fankhanel, 2014; Herbert & Cohen, 1996; Schneider, 2008). Cognitive appraisals can be divided up into primary appraisals (representing how an individual perceives a stressful situation), and secondary appraisals (representing what resources the individual perceives themselves as having to address the stressful situation) appraisals (Folkman & Lazarus, 1980). Primary appraisals can represent perceptions of challenges or threats, where challenges represent possible tangible or intangible gains (e.g., increased income or increased self-confidence) and threats represent potential loss (Schneider, 2008). Challenge and threat appraisals can be measured either as separate constructs (e.g., Skinner & Brewer, 2002) or as a single continuum ranging from challenging to threatening (Peacock & Wong, 1990). Secondary appraisals are often described in the context of whether a particular resource is seen as being available or not, or if the individual perceives themselves as being able to cope with the stressful situation (Peacock & Wong, 1990). Secondary appraisals can be measured with single items that contain statements such as “do you have the ability to cope with this task?” or may assess the perceived level of individual resources available to the individual (Schneider, 2008).

Another approach to cognitive appraisals is to describe primary appraisals as a quantification of the amount of ‘demands’ perceived in a stressful situation and secondary appraisals capture the amount of ‘resources’ the individual has to cope with the situation (Schneider, 2008). In this definition, a threat appraisal occurs when the demands exceed the resources, whereas a challenge appraisal occurs when the resources are equal to or exceed demands. This approach assumes that demands and resources are of equal value. When measured, a ratio is calculated of resources to demands. If the resulting value is equal to 1 or higher, then a challenge appraisal is assumed. If the value is less than 1, then a threat appraisal is assumed (Schneider, 2008).

The Biopsychosocial Model of Challenge and Threat provides an additional way of describing cognitive appraisals through objective physiological responses associated with challenge and threat appraisals (Blascovich, 2008; Seery, 2013; Tomaka, Blascovich, Kibler, & Ernst, 1997). Across three studies, the link between appraisals and physiology was examined experimentally (Tomaka et al., 1997). In the first study, applying the demands and resources view, appraisals were manipulated with instruction sets directing participants to effortfully appraise a situation in either a challenging or threatening way. Those primed for challenge appraisals demonstrated higher cardiac activation than those who made threat appraisals (Tomaka et al., 1997). Being primed for challenge appraisals was also associated with vasodilation (a relaxing of the blood vessels). However, those primed for threat appraisals demonstrated vasoconstriction (a tightening of the blood vessels). In subsequent studies (Tomaka et al., 1997), the authors manipulated cardiovascular activity and found that cardiovascular activity did not affect the appraisals made of a stressful situation, suggesting that although appraisals can influence physiology, the reverse may not also be true. These findings provide evidence linking appraisals to different physiological responses. Later work demonstrated that these aspects of physiology predicted athlete performance during a college baseball season several weeks after the physiological measurements were taken (Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004).

Irrespective of the measurement approach used, primary and secondary appraisals are nonetheless thought to influence how we cope with stressful situations (Folkman, Lazarus, Dunkel-Schetter, et al., 1986; Schneider, 2008). Coping is typically described in terms of problem-focused or emotion-focused strategies that, respectively, either address the stressor directly or address emotional discomfort caused by the stressor (Folkman & Lazarus, 1980). The Transactional Model of Stress does not label a particular appraisal or coping strategy as positive or negative, but rather that the outcomes of coping can be positive or negative

(Folkman, Lazarus, Dunkel-Schetter, et al., 1986). Where positive outcomes occur, the coping strategies adopted are considered 'adaptive', while adverse outcomes are associated with 'maladaptive' coping (Tan, Teo, Anderson, & Jensen, 2011). This is an important distinction as maladaptive coping can also include health endangering behaviours, such as the excessive use of alcohol or smoking, as an emotion-based coping strategy to achieve short-term respite from negative sensations of stress (Field & Powell, 2007; Shadel & Mermelstein, 1993).

There is a bidirectional relationship between coping and appraisals. Although appraisals influence the adoption of particular coping strategies, the effectiveness of coping can change the appraisals an individual may hold towards a stressful situation (Blascovich, 2008; Folkman & Lazarus, 1980; Folkman, Lazarus, Dunkel-Schetter, et al., 1986). This process is known as reappraisal and is a feedback loop used by the individual to evaluate both the effectiveness of coping with addressing the stressor and with determining when the stressor has subsided (Lazarus & Folkman, 1984). The effectiveness of coping also produces an emotional response which may be positive or negative and, in extreme circumstances, can result in psychological distress that may reach levels of clinical relevance (e.g., depression or anxiety; Folkman, Lazarus, Gruen, & DeLongis, 1986). This places appraisals in a unique position in the model as being a purely subjective experience. Whereas coping and reappraisal share a transactional relationship in that the effectiveness of a coping strategy, the emotional response that follows, and the reappraisals that are made, are the product of whether the coping strategies selected are adaptive for that particular stressful situation (Folkman, 2014; Holahan & Moos, 1987; Lazarus & Folkman, 1984). This reinforces the point that two different people may make different appraisals of the same stressful situation. Although the Transactional Model of Stress highlights that these differences arise from personality traits (Lazarus & Folkman, 1984), there is no clear explanation as to which traits

are important, the direction of their effect, and whether any of these traits could be targeted in an intervention to improve the way an individual appraises stress generally.

At this point, it is necessary to distinguish effortful from autonomous reappraisals. The Transactional Model of Stress describes appraisals, the selection of coping strategies, and reappraisals as a mostly automatic process by which an individual is continually evaluating the effectiveness of their coping strategy (Folkman, Lazarus, Dunkel-Schetter, et al., 1986; Lazarus & Folkman, 1984). If the strategy is not working, then the appraisal of the situation or the resources may change to help identify new coping strategies. An inability to shift one's appraisals in these circumstances is considered a sign of a dysfunctional response to stress. Reappraisal in this sense is very different from the effortful reappraisals found in reappraisal therapy. Reappraisal therapy capitalises on the link between appraisals and coping and, through a range of psychotherapeutic techniques (including Cognitive Behavioural Therapy), clients are taught how to effortfully identify their appraisals and willingly change them to promote more adaptive coping responses (Jamieson, Mendes, & Nock, 2013). This is a reactive process and requires a high level of insight from the individual as they first need to acknowledge that an appraisal is negative or unhelpful, and then to willingly and consciously reframe the situation. Therefore, although the automatic reappraisals as conceptualised by the Transactional Model of Stress focus on the effectiveness of the coping strategies, the effortful reappraisals of reappraisal therapy focus on the appropriateness of the appraisals.

The Transactional Model of Stress provides a model that allows an in-depth exploration of stress and coping. However, one of the first studies using the model to determine if there were physiological and psychological health correlates to the stress response found that appraisals and coping were only related to psychological symptomology (Folkman, Lazarus, Gruen, et al., 1986). Specifically, they found that only primary appraisals and coping were related to psychological symptomology, whereas secondary appraisals were

unrelated. The lack of connection with physiological health may be due to an absence of understanding of the complicated relationship between appraisals, coping, and physiological responding. The Cognitive Activation Theory of Stress provides one alternative explanation for how the stress response may relate to physiological health.

1.3.2 Cognitive Activation Theory of Stress

The Cognitive Activation Theory of Stress aims to provide a broader perspective on stress, incorporating not only the cognitive aspects of stress but also the physiological and behavioural aspects (Ursin & Eriksen, 2004). The model outlines stress as a homeostatic alarm that is triggered when there is a discrepancy between what is expected in an environment and the reality of that environment. This definition provides for a broader range of possible stress stimuli than the Transactional Model of Stress and includes such situations as those involving new stimuli, where expected stimuli are missing when there is a homeostatic imbalance, or when the individual is threatened or challenged in some way. The model argues that the alarm, in and of itself, is of no threat to health. However, prolonged activation can have downward consequences for health.

The theory outlines an overarching model of the stress response having four main components: The stress stimuli (or the stressor), the stress experience (or the emotional load), the stress response, and a feedback mechanism from the stress response. The model, at face value, appears to be very similar to Lazarus and Folkman's (1984) Transactional Model of Stress. In both models, a present stressor is evaluated (termed appraisals in the Transactional Model of Stress, and termed stress experience in the Cognitive Activation Theory of Stress). These evaluations may be positive or negative and may differ from person to person for the same stressor. They influence the responses individuals make toward the stressor (called coping in The Transactional Model of Stress and called stress responses in the Cognitive Activation Theory of Stress). Feedback from the responses are used to evaluate the

effectiveness of the response to address the stressor (termed reappraisal in the Transactional Model of Stress, and termed feedback in the Cognitive Activation Theory of Stress).

However, there are some subtle differences worth highlighting. In the Cognitive Activation Theory of Stress, a stress stimulus can be a new stimulus, a missing stimulus, a stimulus that threatens or challenges the individual in some way, or a stimulus that affects homeostatic balance. This is a broader range of stressors than identified by the Transactional Model of Stress. For the Cognitive Activation Theory of Stress, there are two processes in the stress experience, an expectation of the stimulus and an expectation of the outcomes (Ursin & Eriksen, 2010). These expectancies are described in terms of acquisition strength, perceived probability, and affective value. Acquisition strength refers to an individual's past experiences with a similar stimulus and follows general learning principles regarding the intensity of the previously experienced stimuli, the number of previous experiences, and the timing between exposure to these previous experiences. Specifically, these previous encounters would have the most substantial influence on expectancies if there were numerous intense exposures in close succession. Predicted probability implies that an individual subjectively calculates the probability of stimulus and response expectancies coming to fruition. Finally, affective value represents whether the expectation is attractive, aversive, or neutral (Ursin & Eriksen, 2007). These three domains are thought to inform the expectations an individual develops regarding both the stimulus and the response.

The stress response, according to the Cognitive Activation Theory of Stress, is described in terms of two aspects (Reme, Eriksen, & Ursin, 2008; Ursin, 2009). First, a non-specific response of activation or arousal in response to the stress. This is characterised by increased wakefulness, cognitive arousal, and dysregulation of the body's hormone system involving increases in cortisol, adrenaline, and testosterone, amongst others. Second, a specific response is elicited to address the cause of the stress that is more akin to the notion of coping.

It is vitally crucial to highlight that the Cognitive Activation Theory of Stress deems coping as an evaluative stage, whereas the responses made are considered a separate entity, as it is argued that treating coping as an evaluation rather than an action is pertinent in coping being predictive of physiological and health outcomes associated with stress (Ursin, 2009). The notion of the feedback mechanism are very similar across both the Cognitive Activation Theory of Stress (Ursin & Eriksen, 2010) and the Transactional Model of Stress (Lazarus & Folkman, 1984).

Under the Cognitive Activation Theory of Stress, single acute stress responses are adaptive and bear no threat to health. However, repeated acute exposures to stress that are deemed beyond the individual's ability to cope may, over time, lead to changes in homeostatic levels (Ursin & Eriksen, 2004). The theory of allostasis describes these changes in response to repeated acute exposures to stress in considerable detail in both animal and human models (McEwen, 2013). However, exposure to repeated acute stress is not considered harmful if the stress is deemed manageable. Chronic exposure to stress is thought to lead to a range of physiological changes that can instigate poor health, in alignment with previously discussed research linking chronic stress to poor physical health.

Bringing the Transactional Model of Stress and the Cognitive Activation Theory of Stress together allows for a synthesised model of stress. Such a synthesis accounts for both the psychological and physiological outcomes that may arise because of stress, be they positive or negative outcomes. Together, these theories propose that stressful situations, in one way or another, are evaluated in terms of the stimulus, the outcome, and our resources to deal with the stressful situation. These evaluations lead to physiological responses within the body as well as behavioural responses to address either the stressful situation itself or the emotions that arise because of the stressful situation. These responses are then reviewed, and the evaluations are modified to refine further the responses made. Figure 1 outlines both models

graphically, with similar concepts within each model colour coded. Prolonged or repeatedly experienced negative evaluations are deemed risks for physical health, whereas maladaptive behavioural responses are deemed risks for psychological health. Given that an individual's evaluations are highly subjective and, across both models, are either directly or indirectly related to health outcomes, it is logical to argue that appraisals may be a viable target for stress interventions.

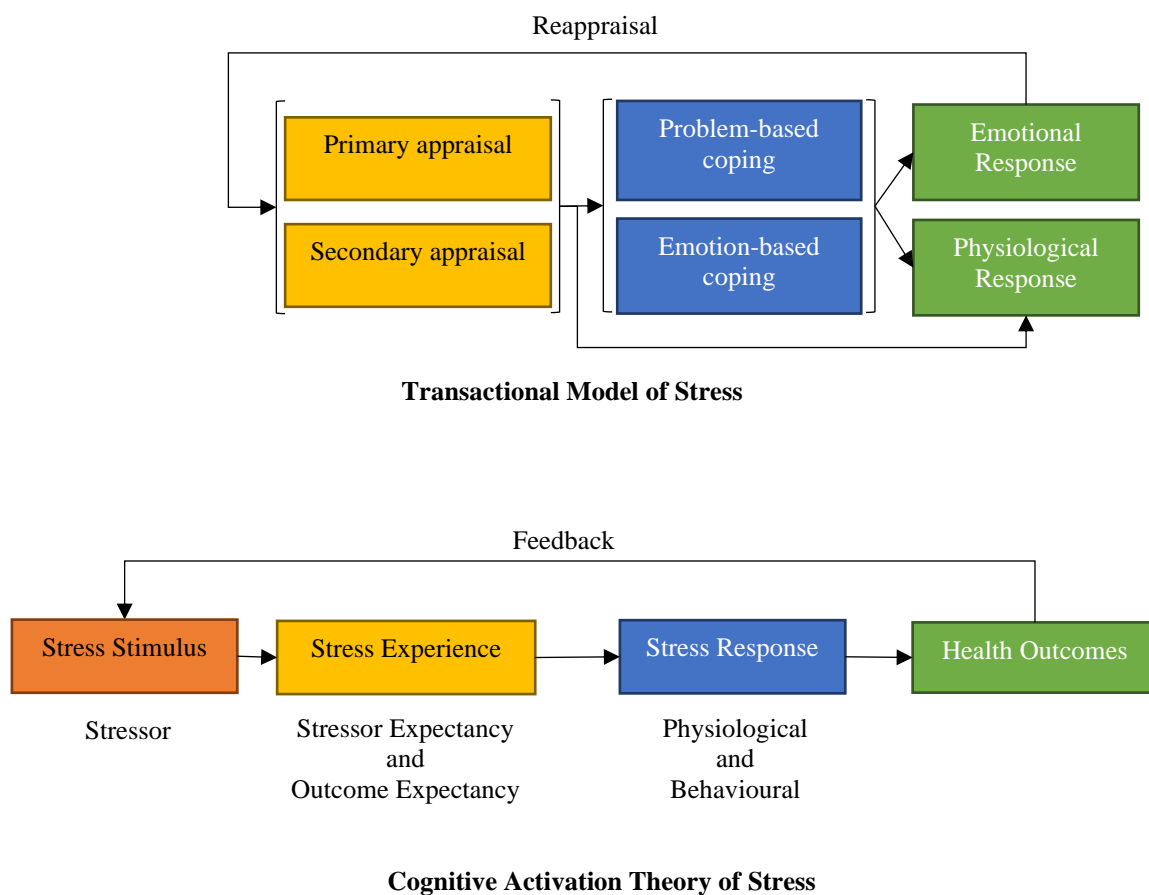


Figure 1. The Transactional Model of Stress and the Cognitive Activation Theory of Stress graphically summarised. Colours represent similar components.

1.4 A Possible Predictor of Interindividual Differences in Stressor Appraisals

The Transactional Model of Stress, the Biopsychosocial Model of Stress, and the Cognitive Activation Theory of Stress all place appraisals as a critical determinant of physiological, behavioural, and emotional responses to stress (Blascovich, 2008; Lazarus & Folkman, 1984; Ursin & Eriksen, 2004). As previously discussed, these responses have consequences for psychological and physiological health. It is through this appraisal process that interindividual differences in responses to stressful situations arise. Although there has been an active research focus on how differences in appraisals lead to differences in physiological, behavioural, and emotional responses to stress, there is a lack of research exploring what predisposes interindividual differences in appraisals. One psychological construct known to influence general cognitive appraisals of stimuli and situations outside of the stress literature are beliefs, or the lay explanations people use to explain or rationalise the world around them (Kilby & Sherman, 2018). These beliefs do not need to mirror with existing scientific theory but can be (and often are) contrary to scientific knowledge (Furnham, 1988; Zlius, Müller, & Schooler, 2017). It is also possible to hold contradictory beliefs simultaneously; here, it is thought that one belief may be harnessed in certain situations while the contradictory belief is held in other situations (Furnham, 1988). The beliefs are informed by upbringing and socialisation, our past experiences, and through observing others. In this way, beliefs stand as kernels of subjective knowledge that are used to explain the happenings of the world around us (Kilby & Sherman, 2018; Prior, 2003; Zlius et al., 2017). Many psychological models have been proposed linking beliefs to cognitive appraisals derived from multiple disciplines including developmental psychology, cognitive psychology, emotional psychology, and health psychology, including; Schema Theory (Pace, 1988), Internal Representations (Jack, Caldara, & Schyns, 2009; Kiyonaga & Egner, 2014), Explanatory Models and Belief Systems (Blumhagen, 1981), the Schema, Propositional,

Associative, and Analogical Representation Systems (Khetrapal & Khetrapal, 2007), the Consensual and Process Models of Emotion Regulation (Gross, 2015), and the Common-Sense Model of Self-Regulation of Health and Illness (Leventhal, Phillips, & Burns, 2016).

1.5 Defining Beliefs

Three similar theories developed in different psychological fields, Schema Theory, Internal Representations, and Explanatory Models of Illness have attempted to describe the nature of beliefs. Schema Theory proposes that we have abstract cognitive connections of related ideas (known as a schema) that grow through our development, genetics, and past experiences, that produce assumptions about how the world around us is organised (Axelrod, 1973; Piaget, 1926). Although the notion is labelled schema from a developmental psychology perspective, it is also known as an Internal Representation in cognitive psychology (Kiyonaga & Egner, 2014). A schema is made up of a collection of nodes that represent individual but related pieces of information. The activation of a particular node of a schema will increase the likelihood of activating other nodes of the schema, bringing those pieces of information into the individual's working memory. The connection between nodes of a particular schema can be thought of like beliefs, and as such, a schema may be thought of as a collection of related beliefs (James, Southam, & Blackburn, 2004). For example, thinking of a fire engine may also bring to mind the colour red, the sound of the siren, or maybe even a time and place where one saw a fire engine. These schemas and the connections within them can be thought of as beliefs "fire engines are red" or "fire engines have sirens" (Pace, 1988). In the real world, these schemas help to quickly evaluate and interpret stimuli from the outside world (Pace, 1988).

An elaborated model of Schema Theory proposed by Axelrod (1973) outlines how schemata process information from the environment and the way contradictory information might be handled. Under this elaboration, information from the environment, be it something

seen, heard, physically or emotionally felt, and so forth, will activate related nodes (and in turn, the beliefs) within the individual's schemata and, if this activation is sufficiently strong, then an existing schema will be used to interpret the information (Axelrod, 1973). In the case that an existing schema is not activated, one of four things may happen. The information may be discredited and ignored, a new schema may be created, an existing schema may be updated or extended to incorporate the new information, or if there is a schema that is somewhat but not fully activated then the individual may be motivated to respecify the information (selecting to focus on some elements and ignore others) in such a way that it now activates that existing schema. This model argues that the latter is the most common approach to handling new information suggesting that there is a strong bias towards interpreting information in the context of our existing schemata rather than creating new or modifying existing schemas.

Explanatory Models of Illness grew out of medical and anthropological sciences to describe how an individual or group of individuals conceptualise and respond to cues of illness (Blumhagen, 1981). Like Schema Theory, the underlying principle is that existing models of knowledge (or beliefs) are applied to information from the environment to make sense of them. Explanatory Models of Illness are used to highlight that these beliefs are not just about the symptoms and consequences of an illness but also about the way that one should respond to that illness. For example, Blumhagen (1980) demonstrated that, in a sample of people diagnosed with hypertension, those that believed hypertension meant increased stress (i.e., 'hyper' = increased and 'tension' = stress) used their diagnosis to justify actions attributable to having increased stress, regardless of whether their stress levels had been elevated.

A stress belief would thus be a schema, internal representation, or explanatory model related to aspects of stress. This might include not only the consequences of stress such as

“stress makes me feel anxious” or “I am more productive when I am stressed”, but it might include other ideas. These may include those about what it means to be stressed like “Stress is a feeling” or “Stress is the way I act when under pressure” or maybe something more abstract such as “Stress is pressure”. They may also include the responses that should be made under stress “When stressed, I try to meditate” or “When stressed, I need to have a cigarette”. Coupled with the idea that there is a general bias toward interpreting information in light of existing schemata, then experiencing stress would bring with it other thoughts and feelings attributable to that individual’s schemata around stress. This, alone, would mean that two people in the same stressful situation may experience different emotions and thoughts towards the stressful situation, and may arrive at different decisions about how to respond to that situation.

1.6 The Relationship between Beliefs and Emotions

The influence of beliefs on information processing can lead to interindividual differences in the experience of emotion toward a stimulus (Gross, 2008). The general premise being that the use of beliefs to interpret information will lead individuals to arrive at different conclusions about that information (Gross, 1998, 2008). These conclusions either are thought to be emotionally charged and automatically eliciting an emotional response, or are subject to an emotional appraisal to evaluate the emotional impact of the stimulus (Gross, 2008; Power & Dalgleish, 2016). This paves the way for emotion-based disorders due to issues in both the emotional appraisal and the influence of beliefs on the processing of information from a stimulus. The Schema, Propositional, Associative, and Analogical Representation Systems (SPAARS) model (Power & Dalgleish, 1999, 2016) and the Process Models of Emotion and Emotion Regulation (Gross, 1998, 2008) provide further detail. This notion is essential to understand given that appraisals in stress can lead to depression and

anxiety. As such, these theories may provide insight into the possible role of stress beliefs as an early antecedent of individual differences in appraisals.

The SPAARS model proposes that emotions arise via a similar system to how beliefs can influence our behaviour (Khetrapal & Khetrapal, 2007). The model argues that some event or stimulus in the environment is processed by sensory systems (e.g., visual, auditory, tactile) that transduce the information from the environment into a format analysable by cognitive mechanisms. This first stage is labelled the analogical system. Three separate systems then process this information in parallel: the associative system, the propositional system, and the schematic system. The associative system represents the cognitive network of related ideas and concepts, similar to the idea of nodal networks in schema theory. It is thought that this system allows for previous experience to be accessed to interpret information from the environment. The propositional system applies semantic information to the situation. The schematic system takes information from the environment, associative system, and propositional system to appraise the information and apply meaning. This appraisal then produces emotional responses. The schematic system is also the point at which new information is integrated into the associative and propositional systems. It is worth noting that, via operant learning, the associative, propositional, and schematic systems can become redundant and previously experienced situations can directly elicit emotional responses (Power & Dalgleish, 1999). This model, generally, mirrors the idea of a lay belief or pre-existing understanding influencing how something in the environment is appraised, and in turn, this appraisal eliciting some response. In this context, the lay belief can be thought of as the associative and propositional systems that encapsulate both language and memory associated with a particular situation, with the schematic system representing appraisals, and the arising emotions from these appraisals as the response.

The SPAARS model is similar to and is extended on by, the Process Models of Emotion Regulation (Gross, 1998, 2015). Like SPAARS, this model highlights that we create an evaluation as to whether a situation is deemed positive or negative. An action (either mental or physical) is then chosen, based upon this evaluation, to obtain some goal or end state (Gross, 2015). It is theorised that there are multiple iterations of this model existing in parallel that influence each other and that, in the context of emotion, one such model would be fixated on the end state of emotion. In the context of stress, then, there may be one such model specific to the experience of stress and overcoming the difficulties presented by the stressful situation, with a second model processing emotional information relevant from the experience of and response to stress. Another additional feature of this model over SPAARS is a response modulation feedback in which an individual evaluates the effectiveness of their action or behaviour to address the difficulties presented by the situation (Gross, 1998).

The Common-Sense Model of Self-Regulation of Health and Illness further expands on the ideas of our beliefs influencing behaviour and emotion to include behaviours related to cues related to health. The model argues that when presented with some cue related to health (e.g., noticing a lump under the skin or feeling the pain of a headache) we use our pre-existing understanding about that symptomology and about illness, in general, to determine how we should respond to that illness. This pre-existing understanding is known as a representation and is akin to lay beliefs about illness. The Common-Sense Model includes five specific representations: Identity (how an individual describes an illness), Cause (factors, such as stress, that are believed to trigger the onset of some illness), Consequences (the expected effects of having a particular illness), Timeline (expectations regarding whether the illness is likely to be chronic or acute), and Treatment (perceived ways of addressing the illness either via personal or professional means). These representations are highly subjective such that the representations of one person about an illness are rarely the same as another's.

This, in turn, leads to individual differences in response to health or illness cues. We then engage in an evaluation, known as an ‘appraisal’, of the effectiveness of our behaviour to address the illness. These appraisals are similar to the notion of reappraisals from the Transactional Model of Stress and influence the representations made of an illness (Leventhal et al., 2016). In addition to this, the emotional response elicited by the health or illness cue can moderate the behaviour engaged in. For example, there is a phenomenon in the Common-Sense Model literature known as the stress-illness rule. This rule states that under situations perceived to be highly stressful, an individual is more likely to attribute cues to ill health toward the emotional response to stress rather than to disease (Cameron & Leventhal, 2012). However, it is also important to note that there is a bi-directional relationship between representations and emotions such that the elicited emotions could influence the representations that are brought to mind in a particular situation, but the representations can also influence the emotional response to the cues to health (Leventhal et al., 2016).

The Common-Sense Model initially grew out of the Transactional Model of Stress in the sense that illnesses could be treated as a type of stressful situation. However, with further developments in this model, it has evolved beyond the Transactional Model of Stress to incorporate the representations people hold about an illness (Cameron & Leventhal, 2012). It may be possible, then, to now treat stress as similar to an illness in the Common-Sense Model. If this were done, then the model would suggest that once an element in a given situation was perceived as stressful, our representations about stress (along with the emotional responses made to the presence of the stressful situation) would influence the behaviours we engaged in to address the stressful situation. An evaluation would then be made to ascertain whether the chosen behaviour addressed the stressful situation. The one addition the Common-Sense Model (Leventhal et al., 2016) adds over and above that of the

Transactional Model of Stress (Lazarus & Folkman, 1984) is the role of representations in shaping how we determine behavioural responses.

1.7 Synthesising the Models Together

Collectively, these theories all propose that we evaluate situations in order to make sense of them. This evaluation has been labelled schema, internal representation, explanatory model, belief system, meaning-making, and representation across all these theories. In all cases, this evaluation influences the emotional and behavioural responses made toward the situation. The individual differences in these emotional and behavioural responses, in all cases, can lead to ill health or can promote health. Figure 2 provides a visual depiction of each model. Components in this figure are colour coded to group similar concepts. These models all place a strong emphasis on the evaluation phase as being the critical point of subjectivity in our behavioural and emotional responses to stimuli. This is not dissimilar to the models of stress. The one advantage of considering these information processing theories is that they highlight the importance of beliefs in the evaluation of stimuli. As such, it may be that our beliefs about stress could influence the way we evaluate/appraise stressful situations.

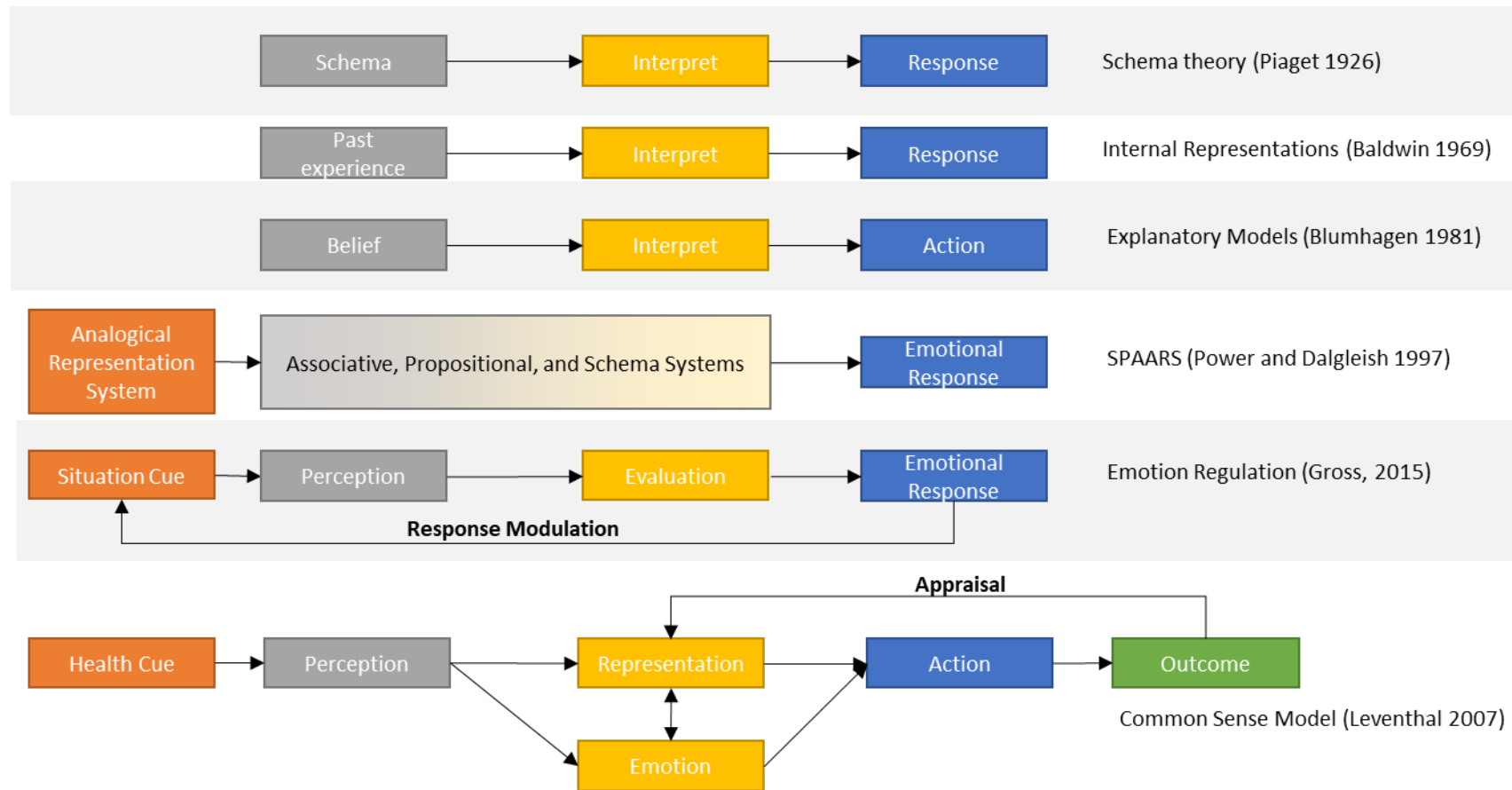


Figure 2. Graphical summary of information processing models. Colours are representing overlapping concepts.

1.8 Present Work

Despite the hypothetical connection between stress beliefs, coping, and stress-related health outcomes, stress beliefs have not been formally integrated with existing stress theories. Instead, it has been proposed that stress beliefs exist separate from existing theories (Jamieson, Crum, Goyer, Marotta, & Akinola, 2018). Contrary to this perspective, this thesis argues the point that stress beliefs complement existing stress theories. Information processing models collectively highlight the importance of beliefs in influencing how we evaluate a situation. As such, stress beliefs should be vital in determining the appraisals that we make of stressful situations. If so, then stress beliefs should predispose interindividual differences in appraisals. Figure 3 highlights the similarities between these models. Existing work in stress has already demonstrated that these interindividual differences in appraisals are critical in predicting differences in behavioural, emotional, and physiological responses to stress (Folkman & Lazarus, 1980; Folkman, Lazarus, Dunkel-Schetter, et al., 1986; Folkman, Lazarus, Gruen, et al., 1986; Lazarus & Folkman, 1984). This would suggest that, rather than being separate to these existing theories, stress beliefs are an integral and vital component of existing stress theories. This thesis examines the relationship between stress beliefs and primary appraisals. This thesis will begin by systematically reviewing the research conducted on stress beliefs to date before systematically reviewing other factors that influence appraisals to confirm that there is further scope to explore the relationship between stress beliefs and appraisals. This thesis will then endeavour to examine the relationship between stress beliefs and appraisals experimentally.

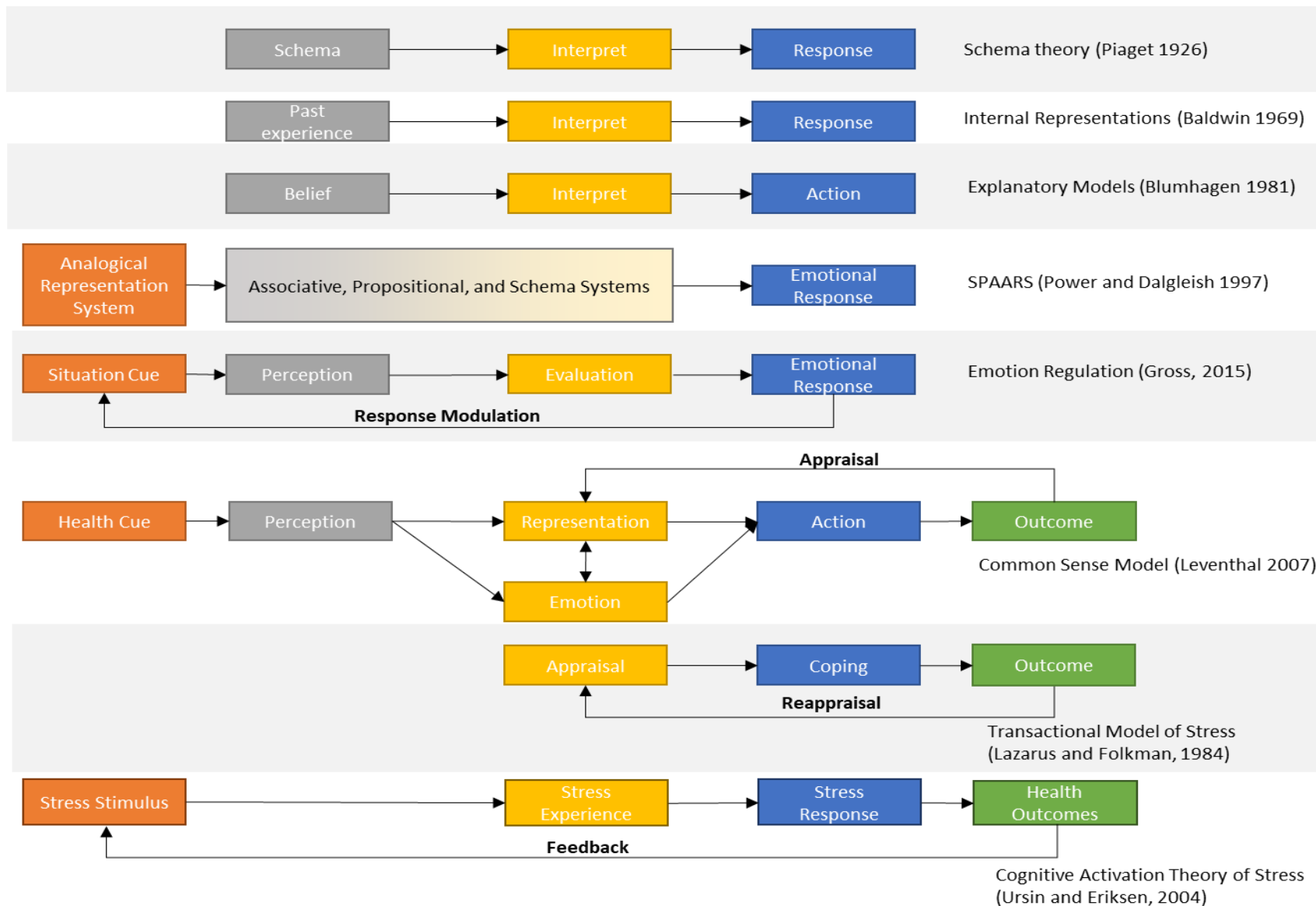


Figure 3. Overview of all relevant belief-interpretation models and stress models. Colours highlight similar concepts across models.

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Chapter 2 – Predictors of Interindividual Differences in Stress Appraisals

Given that there may be other factors driving perceptions of stressful situations, it is essential to be able to determine what these factors are to ensure that no other study has examined a construct similar to stress beliefs under a different name as a predictor of appraisals. This also allows for reviewing of different approaches to measuring stressor appraisals. As such, this chapter contains a systematic review published in *Personality and Individual Differences* that identifies predictors of stressor appraisals and discusses measurement concerns related to stressor appraisals in this field. Stressor appraisals, here, is a broad term used to loosely group research exploring the extent to which stressful situations are perceived to be challenging or threatening. The focus is on stressor appraisals as defined by the Transactional Model of Stress, as, despite sharing a high level of overlap with the expectancies defined in the Cognitive Activation Theory of Stress, there is more research utilising appraisals. American English and the *Personality and Individual Differences* referencing template were used for this article to meet journal requirements.

Towards Understanding Interindividual Differences in Stressor Appraisals:
A Systematic Review

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Abstract

Objective: This paper aims to systematically review and synthesize existing empirical evidence examining the factors related to interindividual differences in stressor appraisals (i.e., perceived challenge and threat).

Method: Studies were identified in PsycINFO, Scopus, Psychological and Behavioral Sciences Collection, and Medline databases (1980-March 2017). Only empirical studies assessing constructs theorized to influence stressor appraisals were included.

Results: Of the 1956 identified articles, 11 studies reported in 12 articles assessing six constructs met inclusion criteria: Emotional intelligence, big five personality traits, anxiety, stress mindset, just world beliefs, and perfectionism. Stronger challenge appraisals were associated with higher emotional intelligence, lower neuroticism, higher extraversion, and more positive beliefs about the consequences of feeling stressed. Weaker threat appraisals were associated with lower neuroticism, and higher emotional intelligence, agreeableness, extraversion, and openness, stronger beliefs that the world is a just and fair place, and lower perfectionistic concerns and greater perfectionistic striving. Anxiety was unrelated to appraisals.

Conclusion: This review identified factors associated with interindividual differences in stressor appraisals, with some factors related to challenge appraisal but not threat appraisal, and vice versa. This suggests a potentially complex interplay between personality and appraisals.

Keywords: Stress; Stressor Appraisal; Primary Appraisal; Challenge Appraisal; Threat Appraisal; Transactional Model of Stress; Emotional Intelligence; Personality

1. Introduction

When an individual is presented with any single stressful event they engage in a stress response, which according to the Transactional Model of Stress (for a detailed explanation of the model, see: Lazarus & Folkman, 1984), involves them subjectively evaluating that single stressful event for its potential gains (challenge) and losses (threat) in a process known as primary appraisal. The individual will also evaluate their perceived available resources to cope with the stressful event in a process known as secondary appraisals (Folkman, Lazarus, Gruen, & DeLongis, 1986; Hanton, Wagstaff, & Fletcher, 2012; Lazarus & Folkman, 1984). In some cases, researchers refer to the appraisal of the stressful event as ‘stressor appraisals’, a collective term referring to any measurement of the extent to which the stressful situation is perceived to be challenging and/or threatening. This includes direct measurements of primary appraisals (e.g., Skinner & Brewer, 2002), as well as combined measurements of primary and secondary appraisals that are still interpreted as the extent to which the stressful event is being appraised as challenging and/or threatening (e.g., Tomaka, Blascovich, Kibler, & Ernst, 1997).

Interindividual differences in the appraisals made of any particular stressful event will lead to the adoption of different coping strategies informed by the individual’s appraisals (Searle & Auton, 2015). This means that two individuals experiencing the same stressful event may appraise, and thus cope with, the stressful event differently (Conner & Barrett, 2005). It is thought that these interindividual differences in the stress response lead to different consequences for general health and functioning, for example, some individuals will report improvements and others will report declines in domains such as attention (Moore, Vine, Wilson, & Freeman, 2015; Vine et al., 2015), memory (Pedraza et al., 2016), and physiological wellbeing (Jamieson, Mendes, & Nock, 2013). With evidence that the application of different coping strategies by different people can impact on general health and functioning (Folkman et al., 1986; Gloria & Steinhardt, 2016; Jamieson et al., 2013; Moore et

al., 2015; Pedraza et al., 2016), there is a need to understand how these interindividual differences in stressor appraisals emerge.

Despite research on the Transactional Model of Stress dating back to 1980 (Folkman & Lazarus, 1980), there is yet to be a systematic review of the range of factors that may predict stressor appraisals. Prior systematic reviews (e.g., Andersson & Willebrand, 2003; Bradley, Sparks, & Weber, 2016; Dewe, Cox, & Ferguson, 1993; Gooding, Holly, Organista, Burack, & Biesecker, Barbara, 2006) have focused on the way that stressor appraisals influence interindividual differences in coping processes in health decision making (Gooding, Holly et al., 2006), coping at work (Bradley et al., 2016; Dewe et al., 1993), and disability (Andersson & Willebrand, 2003). Yet, none of these reviews have focused on factors that influence interindividual differences in stressor appraisals of a single stressful event *per se*. Such an evaluation will allow for the proposal of a predispositional stressor appraisal mechanism that may help aid researchers further explore inter-individual differences in the stress response, and aid clinicians in identifying and targeting interindividual differences that predispose problematic stressor appraisals, and in turn, ineffective coping.

The primary aim of this systematic review is to synthesize the empirical literature that investigates factors related to interindividual differences in stressor appraisal. This review considers only the stressor appraisals made of a stressful event prior to an individual engaging with that event. Consequently, predictors of only secondary appraisals and predictors of appraisals made after the coping process with the stressful event is initiated are beyond the scope of this review. Examining only stressor appraisals made in anticipation of a stressful event will help to partial out any effects due to the interaction of coping and later appraisals. Furthermore, it is important to note that stressor appraisals have been measured in two key ways in current research. One view describes challenge and threat appraisals as bipolar opposites of a single continuum (referred to as the ‘single continuum’ approach to

appraisals throughout this review), whereby a stressful event is deemed to be either challenging or threatening, but never simultaneously both (e.g., Jones, Meijen, McCarthy, & Sheffield, 2009). A common way of measuring appraisals via this single continuum approach is as a function of both primary and secondary appraisals. Such a ratio is thought to capture the dynamic relationship between primary and secondary appraisals in which higher ratio values are indicative of threat appraisals, and lower ratio values are indicative of challenge appraisals (Tomaka et al., 1997). Another competing view portrays challenge and threat appraisals each having their own continuum which are related to each other (referred to as the 'dual continua' approach to appraisals throughout this review; e.g., Meijen, Jones, Sheffield, & McCarthy, 2014; Skinner & Brewer, 2002). Given that there is no evidence for the superiority of one definition over the other, this review will consider research from both single and dual continua research and will compare the findings between them where possible.

2. Methodology

2.1 Literature search strategy

Online literature searches were conducted on the PsycINFO, Scopus, Psychology and Behavioral Sciences Collection, and Medline databases (1980 to March 2017). This review searched for empirical articles published from 1980 onwards as articles prior to 1980 would predate the first Transactional Model of Stress paper (Folkman & Lazarus, 1980). Search terms comprised of commonly used keywords and terminologies in related papers, specifically: Transactional Model of Stress, Cognitive-Phenomenological Model of Stress, stress appraisal, primary appraisal, challenge appraisal, threat appraisal, and cognitive appraisal. To arrive at the final database, duplicates were first removed ($n = 414$). The remaining studies were then examined against inclusion and exclusion criteria (see Table 1). Articles were rejected if, based on their abstract and title, they were not deemed to meet the inclusion criteria, or they met the exclusion criteria. Full papers were scrutinized where a

decision could not be determined from the abstract or title alone. The reference lists of included articles were hand-searched to identify further articles that may be included in the review ($n = 16$). A flow diagram is presented in Figure 1.

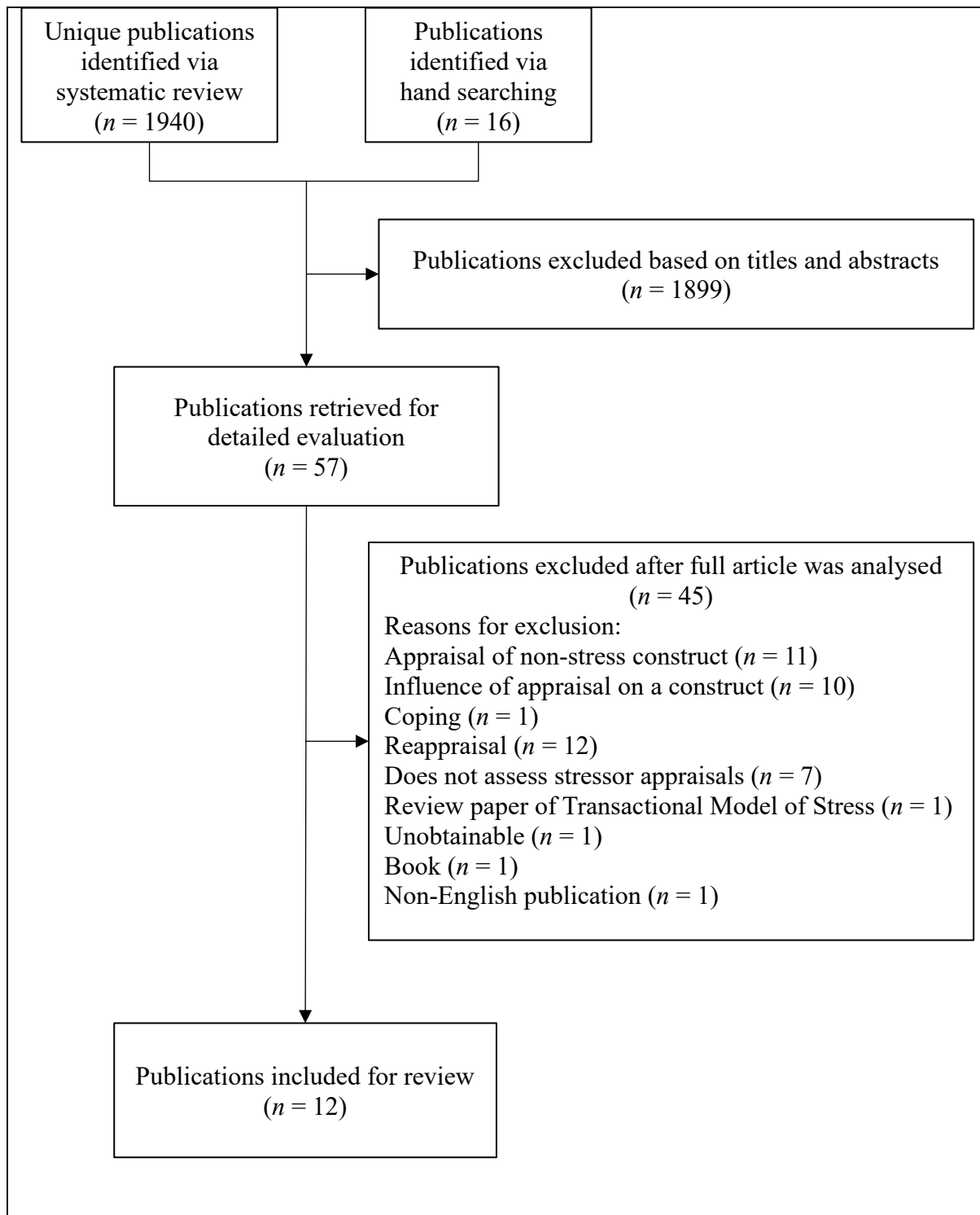


Figure 1. Flowchart showing the selection process of relevant publications.

2.2 Quality Ratings

Studies were evaluated for their quality after they were deemed to have met the inclusion criteria. Given that included literature were exclusively empirical in nature, the quality of studies was evaluated against STROBE (von Elm et al., 2008) and CASP (Singh, 2013) checklist criteria relevant for experimental research, these factors included: Adequate statistical power, randomized groups, stressor appraisals clearly defined, participant inclusion/exclusion criteria specified, use of a validated appraisal measure, multiple time points, and the use of a methodology guided by previous research (e.g., the use of an established stress induction and the use of validated scales). The number of criteria that were met were summed such that higher scores represented higher quality papers. The number of articles not meeting each criterion was tallied to highlight study quality areas most in need of improvement.

3. Results

3.1 Literature search results

The titles and abstracts of the 1956 unique articles obtained from the literature search were compared against the inclusion and exclusion criteria. This resulted in the exclusion of 1899 articles. The remaining 57 articles were retrieved, and the full paper was scrutinized against both inclusion and exclusion criteria. This resulted in the removal of a further 45 papers (see Figure 1). In particular, 11 articles addressed an appraisal of a construct other than a stressful event (e.g., subjective perceptions of pain levels); 10 articles addressed the influence of appraisal on another construct (e.g., the influence of appraisal on coping); one article focused only on coping (i.e., did not use stressor appraisal as an outcome); 12 articles focused on appraisals made after the participant had initiated coping with a stressful event; seven papers did not assess stressor appraisal; one paper was a review of the Transactional Model of Stress; one paper was unobtainable; one paper was a book chapter; and one paper was not written in English. Twelve papers evaluating the influence of six different constructs

on stressor appraisal met inclusion criteria. Two papers (Lyons & Schneider, 2005; Schneider, Lyons, & Khazon, 2013) report on different outcomes of the same dataset, and will therefore both be treated as one study reported across two papers hereafter. As such, these two papers will be counted as one study in all following statistics.

Table 1. Inclusion and exclusion criteria

Criterion	Included	Excluded
Types of participants	Participants over the age of 18.	Participants under the age of 18 or suffering from a mental illness.
Type of appraisal	Stressor appraisals (challenge, threat, or both).	Secondary appraisal, reappraisal, or any other type of appraisal.
Type of study	Studies assessing the association of stressor appraisals with any psychological construct that is theorized to influence or predict stressor appraisals.	Studies assessing any psychological construct that is theorized to be influenced by stressor appraisals.
Type of outcome	Challenge appraisal, threat appraisal, or both.	Outcomes other than challenge and/or threat appraisal
Type of methodology	Longitudinal or cross-sectional studies that may suggest (though not necessarily imply) causality.	Correlational studies without reason to suggest possible causation. Literature reviews.
Type of material	Peer-reviewed journal articles.	Book chapters. Grey literature (e.g., dissertations, websites).

3.2 Characteristics of the selected studies

Specific study characteristics can be found in Table 2. Sample sizes ranged from 24 to 371 participants (total sample size = 1454; mean sample size = 132). All studies sampled from an undergraduate university sample. One study supplemented their undergraduate sample with a small ($n=25$) community sample (Kilby & Sherman, 2016). All studies, except two, reported mean participant age from 19.6 to 23 years (mean = 21). The majority of studies were conducted in the United States ($n=7$, 64%), with The Netherlands ($n=1$, 9%), Belgium ($n=1$, 9%), Germany ($n=1$, 9%), and Australia ($n=1$, 9%) each having conducted only one study. All studies, except one, reported the gender distributions of their sample (Males: $M=35$, $SD=15.5$, range=8-54; Females: $M=73.3$, $SD=39.5$, range=14-115). The majority (90%) of these studies had more female than male participants. Eight studies (73%) adopted a single continuum approach to stressor appraisals, six of which measured this as a ratio of primary to secondary appraisals (Lyons & Schneider, 2005; Mikolajczak & Luminet, 2008; Penley & Tomaka, 2002; Schneider, 2004; Schneider et al., 2013; Schneider, Rench, Lyons, & Riffle, 2012; Tomaka & Blascovich, 1994), the other two measured only threat appraisals (Shewchuk, Elliott, MacNair-Semands, & Harkins, 1999; Zureck, Altstötter-Gleich, Gerstenberg, & Schmitt, 2015). Three studies (27%) adopted a dual continua approach to stressor appraisals (Gallagher, 1990; Kilby & Sherman, 2016; Van der Zee, Van Oudenhoven, & De Grijis, 2004).

3.3 Quality of included studies

Table 3 provides the quality assessment of all studies. Quality scores ranged from 3 out of 6 (Van der Zee, 2004) to 5 out of 6 (Kilby & Sherman, 2016; Mikolajczak & Luminet, 2008; Schneider et al., 2012; Shewchuk et al., 1999; Zureck et al., 2015). All studies provided a definition for stressor appraisals and utilized a methodology guided by previous research.

However, only two studies used more than a single time point (Shewchuk et al., 1999; Zureck et al., 2015), representing the area in need of the most improvement in this body of research.

3.4 Variations in Methodology

Ten of the 11 (91%) studies based their rationale for why their predictors of interest might influence stressor appraisals on the premise that their predictors of interest were trait variables that existed outside of the presence of a stressful event, and that stressor appraisal is a state variable that only occurs following the awareness of an upcoming stressful event (Gallagher, 1990; Kilby & Sherman, 2016; Lyons & Schneider, 2005; Mikolajczak & Luminet, 2008; Penley & Tomaka, 2002; Schneider, 2004; Schneider et al., 2013, 2012; Tomaka & Blascovich, 1994; Van der Zee et al., 2004; Zureck et al., 2015). Here, the trait variable was measured prior to participants being provided with the instructions for a stress induction, whereas stressor appraisals were measured after participants had been informed about the forthcoming stress inductions. One study adopted a longitudinal design in which predictors of interest were measured at study outset and stressor appraisals were measured at a subsequent follow-up (Shewchuk et al., 1999).

3.5 Stress Induction Tasks

An important element of stressor appraisals is that they cannot occur without a stressful event to appraise (Folkman & Lazarus, 1980). Therefore, studies examining stressor appraisals often opt to induce stressful events to be appraised by their participants experimentally. This is advantageous as it allows for the predictors of interest to be measured before the nature of the stress induction is divulged to the participant. There was considerable variability in the types of tasks used to induce the stressful event to be appraised. Five studies used a mathematics task as the stressful event to be appraised (45%; Kilby & Sherman, 2016; Moïra Mikolajczak & Luminet, 2008; Schneider, 2004; Schneider et al., 2012; Tomaka &

Blascovich, 1994), one used an oral task (9%; Penley & Tomaka, 2002), two used a combination of mathematics and oral tasks (19%; Lyons & Schneider, 2005; Schneider et al., 2013; Zureck et al., 2015), and three used vignettes to describe a stressful event to be appraised (27%; Gallagher, 1990; Shewchuk et al., 1999; Van der Zee et al., 2004).

3.6 Potential predictors of stressor appraisals

Across the 11 studies, there were six different factors considered as potential predictors of stressor appraisals. Two studies (18%) assessed the influence of *emotional intelligence* on stressor appraisal with one measuring ability-based emotional intelligence (Lyons & Schneider, 2005; Schneider et al., 2013) and one measuring trait emotional intelligence (Mikolajczak & Luminet, 2008). *Broad Personality Traits*, specifically the *Big Five* (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) and *Broad Multicultural Personality Traits* (cultural empathy, open-mindedness, emotional stability, social initiative, and flexibility) were assessed in six studies (55%; Gallagher, 1990; Penley & Tomaka, 2002; Schneider, 2004; Schneider et al., 2012; Shewchuk et al., 1999; Van der Zee et al., 2004). Other single studies reported on trait anxiety (9%; Van der Zee et al., 2004), trait stress mindset (9%; Kilby & Sherman, 2016), trait justice beliefs (9%; Tomaka & Blascovich, 1994), and trait perfectionism (9%; Zureck et al., 2015). Seven studies included a correlational measure of effect size between each predictor of interest and stressor appraisal (64%; correlations were converted into R^2 for the purpose of this review), one of these papers also reported the overall R^2 for all of their predictors collectively on stressor appraisals (Schneider et al., 2012). Two studies included partial eta-squared effect sizes (18%). The other two papers did not report effect sizes. All papers reporting effect sizes reported weak-to-moderate effects.

Table 2. Characteristics of included studies

Authors and country	Type of appraisal	Type of predictors	Type of stressful event	Methodology	Sample size (mean age)	Gender	Effect size
(Zureck, Altstotter-Gleich, Gerstenberg, & Schmitt, 2015) GER	Threat.	Perfectionism (APS-R).	Mathematics. Oral.	Cross-sectional.	168(22)	M = 54 F = 114	R^2 : 0.00 to 0.08*
(Schneider, Lyons, & Khazon, 2013) US ^a	Single. [†]	Emotional intelligence (MSCEIT).	Mathematics. Oral.	Both tasks completed – cross-sectional.	126(20)	M = 51 F = 75	<i>n.r.</i>
(Lyons & Schneider, 2005) US ^a	Single. [†]	Emotional intelligence (MSCEIT).	Mathematics. Oral.	Both tasks completed – cross-sectional.	126(20)	M = 51 F = 75	R^2 : 0.00 to 0.15*
(Mikolajczak & Luminet, 2008) BE – Study 2	Single. [†]	Emotional intelligence (TEIQue-SF).	Mathematics.	Cross-sectional.	32(19.6)	M = 8 F = 24	<i>n.r.</i>
(Kilby & Sherman, 2016) AUS	Dual.	Stress mindset (SMM).	Mathematics.	Cross-sectional.	124(21)	M = 33 F = 91	η^2_p : 0.01 to 0.07

Table 2 (cont.). *Characteristics of included studies*

Authors and country	Type of appraisal	Type of predictors	Type of stressful event	Methodology	Sample size (mean age)	Gender	Effect size
(Tomaka & Blascovich, 1994) US	Single. [†]	Justice beliefs (BJW)	Mathematics.	Cross-sectional	24(<i>n.r.</i>)	M=10 F=14	<i>n.r.</i>
(Schneider, 2004) US	Single. [†]	Personality (NEO PI-R).	Mathematics.	Cross-sectional.	59(21)	M = 33 F = 26	R^2 : 0.01 to 0.18*
(Schneider, Rench, & Lyons, 2012) US	Single. [†]	Personality (NEO PI-R).	Mathematics.	Cross-sectional.	152(20.3)	M = 42 F = 110	R^2 : 0.02 to 0.06* ^{††}
(Penley & Tomaka, 2002) US	Single. [†]	Personality (NEO PI-S).	Oral.	Cross-sectional	97(21)	M=33 F=64	R^2 : 0.01 to 0.12*
(Gallagher, 1990) US	Dual.	Extraversion and neuroticism (EPI).	Vignette.	Cross-sectional.	371(<i>n.r.</i>)	<i>n.r.</i>	R^2 : 0.01 to 0.20*

Table 2 (cont.). *Characteristics of included studies*

Authors and country	Type of appraisal	Type of predictors	Type of stressful event	Methodology	Sample size (mean age)	Gender	Effect size
(Van der Zee, Van Oudenhoven, & de Grijjs, 2004) NE	Dual.	Cultural perceptions (MPQ). Neuroticism, and extraversion (EPI).	Vignette.	Cross-sectional.	160(21)	M = 45 F = 115	η^2_p : 0.00 to 0.06
(Shewchuk, Elliot, MacNair-Semands, & Harkins, 1999) US	Threat.	Anxiety (STAI). Personality (NEO PI-S).	Vignette.	Three time points (baseline, two weeks, and four weeks)	141(23)	M=41 F=100	R^2 : 0.00 to 0.11*

Note. *n.r.* = not reported. In “type of appraisal”: Single = challenge and threat measured on a single continuum from highly challenging to highly threatening, Dual = challenge and threat measured on separate continua; the challenge continuum ranges from highly challenging to not very challenge, the threat continuum ranges from highly threatening to not very threatening. US = United States of America. BE = Belgium. NE = Netherlands. AUS = Australia. GE = Germany. * = R^2 range calculated as the square of the smallest and largest Pearson’s r between individual predictors of interest and stressor appraisals where Pearson’s r was the only reported measure of effect size between each individual predictor of interest and stressor appraisals. [†] Denotes a study in which threat appraisals were calculated as the ratio of primary and secondary appraisals. ^{††} Schneider et al. (2012) report that personality collectively explained 8.4% of the variance in stressor appraisals. ^a Examines the same dataset.

Table 3. The methodological quality of included studies based on select STROBE criteria and additional advantageous features

Authors	Appraisals defined	Methodology guided by previous research	Inclusion criteria	Validated appraisal measure	Adequate statistical power	Multiple time points	Quality score (/6)
(Lyons & Schneider, 2005; Schneider, Lyons, & Khazon, 2013)	✓	✓	✓	✗	✓	✗	4
(Gallagher, 1990)	✓	✓	✓	✗	✓	✗	4
(Schneider, 2004)	✓	✓	✓	✗	✓	✗	4
(Mikolajczak & Luminet, 2008)	✓	✓	✓	✓	✓	✗	5
(Schneider, Rench, & Lyons, 2012)	✓	✓	✓	✓	✓	✗	5
(Van der Zee, Van Oudenhoven, & de Grijs, 2004)	✓	✓	✗	✗	✓	✗	3
(Kilby & Sherman, 2016)	✓	✓	✓	✓	✓	✗	5
(Zureck, Altstotter-Gleich, Gerstenberg, & Schmitt, 2015)	✓	✓	✗	✓	✓	✓	5
(Penley & Tomaka, 2002)	✓	✓	✗	✓	✓	✗	4
(Tomaka & Blascovich, 1994)	✓	✓	✗	✓	✓	✗	4
(Shewchuk, Elliot, MacNair-Semands, & Harkins, 1999)	✓	✓	✗	✓	✗	✓	4
Need of improvement (/12)	0	0	5	4	1	9	

Note. Need of improvement represents the number of studies that did not meet a particular criterion.

3.6.1 Emotional intelligence. Two studies across three papers (Lyons & Schneider, 2005; Mikolajczak & Luminet, 2008; Schneider et al., 2013) found a link between emotional intelligence and stressor appraisals. Emotional intelligence is a set of skills targeted at processing emotion-relevant information (Mayer, Salovey, Caruso, & Sitarenios, 2003) and thought to act as an adaptive mechanism to aid individuals in acting on a broad range of situations, including stressful events, within their environments (Svyantek & Rahim, 2002). This construct can be conceptualized in two ways. Emotional intelligence can refer to an individual's overall perceived ability to correctly process emotion-relevant information (known as trait emotional intelligence; Cooper & Petrides, 2010). Alternatively, emotional intelligence could reflect individual skills in: i) perceiving emotions accurately (based on normed data); ii) emotion-facilitated thought; iii) understanding emotions; and, iv) the ability to manage your emotions, known as emotional management (known as ability-based emotional intelligence; Mayer et al., 2003). Both conceptualizations were present across the three studies that assessed emotional intelligence on stressor appraisal (Lyons & Schneider, 2005; Mikolajczak & Luminet, 2008; Schneider et al., 2013). Both studies used a single continuum approach to stressor appraisals. Both provided evidence that individuals with superior emotional intelligence were more likely to make a challenge appraisal, as opposed to threat appraisals, of an oral and mathematics task. The study using ability-based emotional intelligence demonstrated that only the emotional management factor positively predicted challenge appraisals (Lyons & Schneider, 2005; Schneider et al., 2013), with Lyons and Schneider (2005) reporting an effect size ($R^2 = 0.15$) for emotional management. However, this effect was only found in men in the other paper (Schneider et al., 2013). No other emotional intelligence ability was related to stressor appraisal.

3.6.2 Broad Personality Traits. There were six studies that explored the relationship between stressor appraisals and the Big Five broad personality traits (openness,

conscientiousness, extraversion, agreeableness, neuroticism). Four of the six studies demonstrated a negative relationship between neuroticism and stressor appraisal. Individuals who were more neurotic were more likely to perceive an upcoming stressful event as more threatening and less challenging with either a mathematic stress induction (Schneider, 2004; Schneider et al., 2012) or through the use of vignettes describing stressful events (Gallagher, 1990; Shewchuk et al., 1999) with reported R^2 values between 0.06 and 0.20 across the four studies. Additionally, there were individual studies reporting that greater agreeableness ($R^2 = 0.03$; Shewchuk et al., 1999) and conscientiousness ($R^2 = 0.26$; Penley & Tomaka, 2002) were negatively associated with threat appraisals, and greater extraversion (Gallagher, 1990) was positively associated with challenge, but not threat, appraisals ($R^2 = 0.05$). However, these findings were not replicated in any of the other studies assessing broad personality traits.

One study (Van der Zee et al., 2004) evaluating broad multicultural personality traits (cultural empathy, open-mindedness, emotional stability, social initiative, and flexibility) found that participants who were higher in adaptation ($\eta^2_p = .10$) and openmindedness ($\eta^2_p = .02$) made lower threat appraisals, especially under high stress ($\eta^2_p = .03$ for both adaptation and openmindedness). Further, Van der Zee found that those higher in openness made stronger challenge appraisals under high stress, but weaker challenge appraisals under low stress ($\eta^2_p = .03$).

3.6.3 Anxiety. Van Der Zee et al. (2004) failed to find a relationship between anxiety and stressor appraisals while using a dual approach to stressor appraisals in vignettes describing intercultural stressful events framed in either a high or low stress context.

3.6.4 Stress Mindset. Kilby and Sherman (2016) found a positive relationship between challenge appraisal and positive beliefs about the consequences of stress ($\eta^2_p = .07$). Stress mindset was unrelated to threat appraisals.

3.6.5 Justice Beliefs. Tomaka and Blascovich (1994) utilizing a mathematics stress induction and measured stressor appraisals with a single continuum scale, found that those who held a stronger belief that the world is just and fair perceived the stress induction as less threatening.

3.6.6 Perfectionism. Zureck et al (2015), utilizing path analysis, found evidence that increased levels of perfectionistic striving were significantly associated with lower levels of threat appraisal ($R^2 = 0.03$), however, higher levels of perfectionistic concern were significantly associated with higher levels of threat appraisal ($R^2 = 0.08$). There was no evidence of an interaction between these two perfectionism variables and threat appraisal, nor between high and low stress groups.

3.7 Single vs Dual Continuum Approach. Studies varied regarding whether they used a single or dual continua approach. Some studies conceptualized stressor appraisals as a single continuum in which an individual's stressor appraisal could range from 'highly threatening' through to 'highly challenging'. Under this approach, a stressful event can never be both challenging and threatening. Other studies adopted a dual continua approach in which challenge and threat appraisals were conceptualized as two separate continua, with one ranging from 'low challenge' to 'high challenge', and the other ranging from 'low threat' to 'high threat'. This perspective treats challenge and threat appraisals as separate entities and implies that, while a stressful event may be perceived as exclusively challenging or threatening, it may also be perceived to be both challenging and threatening simultaneously.

Eight studies (73%) used the single continuum perspective of stressor appraisals and addressed emotional intelligence, openness, conscientiousness, extraversion, agreeableness, neuroticism, perfectionism, and justice beliefs. In all but two cases (Shewchuk et al., 1999; Zureck et al., 2015), appraisals were measured as the ratio of primary to secondary appraisals

in which higher values represented a stronger threat appraisal and lower values represented a stronger challenge appraisal. Here, an individual is more likely to appraise a stressful event as challenging rather than threatening if they are high in emotional intelligence (Mikolajczak & Luminet, 2008), specifically, if the individual's emotional intelligence involves high emotional management (Lyons & Schneider, 2005; Schneider et al., 2013), and has lower neuroticism (Schneider, 2004; Schneider et al., 2012; Shewchuk et al., 1999), higher openness (Schneider et al., 2012), higher conscientiousness (Penley & Tomaka, 2002), higher perfectionistic striving and lower perfectionistic concern (Zureck et al., 2015), and stronger beliefs that the world is just and fair (Tomaka & Blascovich, 1994). Regarding emotional intelligence, it is important to note that one study could only reproduce the influence of emotional management on stressor appraisal in men, but not women (Schneider et al., 2013).

Three studies (27%) used the dual continua perspective of stressor appraisals and covered personality, anxiety, stress mindset, and perfectionism. Specifically, this area has revealed that individuals are more likely to make a greater challenging appraisal of a stressful event if they are lower in neuroticism and higher in extraversion (Gallagher, 1990), and if they believe that feeling stressed elicits positive consequences (Kilby & Sherman, 2016). In relation to threat appraisals, individuals are more likely to make lower threat appraisals if they are low on neuroticism (Gallagher, 1990), high in openness (Van der Zee et al., 2004). There is no evidence that anxiety is related to challenge or threat appraisals (Van der Zee et al., 2004).

3.8 Mathematic and Oral Stress Inductions vs Vignettes

Two studies used vignettes to provide their samples with stressful events to appraise (Gallagher, 1990; Shewchuk et al., 1999). In both circumstances the researchers were exploring the relationship between broad personality traits and stressor appraisal. Both found

higher neuroticism was negatively associated with challenge appraisal. This replicated similar findings in two of the four other studies exploring broad personality traits and stressor appraisals using more involved mathematic and oral stress inductions which also found this negative relationship between neuroticism and stressor appraisals.

Discussion

4.1 Main Findings

It has been documented that two individuals can appraise the same stressful event completely differently from each other (Conner & Barrett, 2005). These differences in stressor appraisals are associated with different coping styles (Searle & Auton, 2015) which in turn lead to different mental health outcomes (Folkman et al., 1986; Gloria & Steinhardt, 2016). It may be that each individual brings with them a number of predisposing factors which, to some degree, influence how they will appraise a stressful event. If so, then these predictors may also play a key role in determining differing mental health outcomes associated with stress. We have provided a systematic review of empirical studies that have sought to identify factors that predispose individuals towards perceiving stressful events as more or less challenging and/or threatening. Eleven studies across 12 papers met inclusion criteria for the review. The findings from these studies demonstrate a wide variety of methods used to examine stressor appraisals. These variations include differences in whether stressor appraisals were defined as being on a single or dual continuum, the diverse types of stress induction tasks used, differences in the predictors examined and the methods to determine the contribution of those predictors in explaining stressor appraisal variance.

The findings indicated that there was the most robust evidence for emotional intelligence and neuroticism being important predictors of stressor appraisals. Only emotional intelligence was consistently replicated across multiple studies. Here, greater emotional

intelligence was associated with greater challenge appraisals (Mikolajczak & Luminet, 2008). Further investigations into emotional intelligence revealed over two studies that it was the emotional management component of emotional intelligence driving these results (Lyons & Schneider, 2005; Mikolajczak & Luminet, 2008; Schneider et al., 2013). Emotional management refers to an individual's ability to control their own emotions (Mayer et al., 2003) and has been previously associated with better self-reported ability to manage stress (Sotile & Sotile, 2003). Having greater mastery in emotional management helps one to change the way they appraise a stressful event in a more positive light (Wang & Saudino, 2011). This has been associated with a greater uptake of more adaptive coping strategies during stressful events (Thomas, Cassady, & Heller, 2017). Thus, the replicated findings that emotional management is related to greater challenge appraisals are consistent with the understanding of both emotional management and how it relates to the stress response generally.

Neuroticism received partial support with four of six studies examining neuroticism finding that higher levels of neuroticism were associated with weaker challenge appraisals and stronger threat appraisals (Gallagher, 1990; Schneider, 2004; Schneider et al., 2012; Shewchuk et al., 1999). Neuroticism is characterized as being overreactive towards signals of threat and a tendency to construe events in a negative light (Suls & Martin, 2005). This suggests that neuroticism may bias an individual to not only focus on threatening elements in a stressful situation, but to then further interpret those threatening elements as worse than they actually may be. This notion is further reinforced with evidence that higher neuroticism is associated with a greater level of perceived stress (Ebstrup, Eplov, Pisinger, & Jørgensen, 2011) and lower use of coping strategies that try to overcome the stressful event and greater use of coping strategies that try to overcome the emotions felt due to the stressful event (Connor-Smith & Flachsbart, 2007). As such, neuroticism may influence stressor appraisals

by predisposing an individual to focus on threatening (vs. challenging) information. However, two studies failed to demonstrate a relationship between stressor appraisals and neuroticism (Penley & Tomaka, 2002; Van der Zee et al., 2004). This is likely due to methodological nuances in each study (i.e., the use of only an oral stressor in Penley and Tomaka [2002], and the use of a cross-cultural stressor and the simultaneous testing of both the Big Five personality traits and multicultural personality traits in Van der Zee et al [2004].)

Furthermore, across these six studies, there were individual studies supporting the role of agreeableness (Shewchuk et al., 1999), conscientiousness (Penley & Tomaka, 2002), and extraversion (Gallagher, 1990) in stressor appraisals. However, none of these effects were replicated across the other studies. These less replicated results may reflect an alternative theory in which openness, conscientiousness, extraversion, agreeableness, and neuroticism directly influence coping strategies (rather than indirectly influencing coping strategies through stressor appraisals). Here, it is thought that these factors play a key role during early development by providing a framework by which coping strategies can be adopted (Connor-Smith & Flachsbart, 2007; Derryberry, Reed, Pilkenton, & Taylor, 2003). For example, neuroticism may predispose an individual to focus on threatening information in an environment, and to construe information in a negative way that promotes the desire to engage in coping strategies aimed at avoiding either the stressful event itself or the emotional experience that encompasses any stress response (Connor-Smith & Flachsbart, 2007).

The lack of association between trait anxiety and stressor appraisals in Van der Zee et al. (2004) is not consistent with prior research suggesting that trait anxiety, like neuroticism, biases an individual to focus on threatening information in the environment (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Mogg, Bradley, & Hallowell, 1994). This unexpected finding could be due to a statistical artifact in that anxiety was entered into the same statistical analysis as adaptation. Given that adaptation

encompasses an individual's stability of emotions, and is negatively associated with threat appraisals, and given that anxiety is associated with biased attention towards threatening stimuli, it may be that the effect of anxiety was confounded by the effect of adaptation.

Emerging research into the dual continua approach to stressor appraisals (Gallagher, 1990; Kilby & Sherman, 2016; Van der Zee et al., 2004) is suggesting that the way these constructs relate to challenge and threat appraisals separately may be more nuanced than is captured with the single continuum approach seen in the majority of studies (e.g., Schneider et al., 2012). This highlights the potentially complex relationship between challenge and threat appraisals that can only be documented by treating each appraisal as a separate entity. Unfortunately, due to the lack of studies adopting a dual continua approach to stressor appraisals, it is not possible to comment on the replicability of current findings. This is an area that future research should address.

4.2 A predispositional mechanism of stressor appraisals

This review has highlighted robust findings that higher neuroticism and lower emotional intelligence are associated with stronger threat appraisals and weaker challenge appraisals (Gallagher, 1990; Lyons & Schneider, 2005; Mikolajczak & Luminet, 2008; Schneider, 2004; Schneider et al., 2013, 2012; Shewchuk et al., 1999), irrespective of the type of stress induction or the way in which stressor appraisals are defined and measured. Neuroticism and emotional intelligence are inherently emotion-based constructs (Mayer et al., 2003; McCrae & Costa, 1987). However, according to the Hierarchical Model of Personality, neuroticism is a higher-order personality construct representing the commonalities across a number of lower-order factors, specifically, a general tendency towards anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability (McCrae & Costa, 1987; Paunonen, 1998). Emotional intelligence has been

described as one such lower-order factor that is primarily driven by neuroticism, but this is also influenced by extroversion and conscientiousness to a lesser extent (Vernon, Villani, Schermer, & Petrides, 2008). This supports the individual findings of Gallagher (1990) and Penley and Tomaka (2002) who respectively found an association of extroversion and conscientiousness with stressor appraisals. It is thought that the strong negative emotionality associated with individuals high in neuroticism results in lower emotional intelligence, preventing accurate perceptions and regulation of both their own, and other people's emotions (Newby et al., 2017). This lower level of emotional intelligence may further compound the effect of neuroticism on feelings such as anxiety and hostility during stressful events by preventing the individual from having insight into their own emotions, and thus, not being able to regulate their emotions even from the outset of a stressful event (Newby et al., 2017; Vernon et al., 2008). In turn, this inability to shift one's focus from these more negative feelings may promote threat appraisals and hinder challenge appraisals. This review has highlighted that such difficulties are associated with a greater likelihood of perceiving stressful events as threatening, rather than challenging (Lyons & Schneider, 2005; Mikolajczak & Luminet, 2008; Schneider et al., 2013). It is important to note that emotional management was identified as the only facet of emotional intelligence that predicted stressor appraisals. Given the overlap between neuroticism, emotional management, and common coping strategies (such as emotion-based coping strategies, and reappraisals), future research would benefit from further exploring the role of emotional intelligence with neuroticism, appraisals, and coping. Moreover, both neuroticism and emotional intelligence (and all other factors identified in this study) explained a small amount of variance in stressor appraisals, implying that there may be other factors in understanding interindividual differences in stressor appraisals.

4.3 Challenges for future research.

This systematic review has identified several constructs that have some preliminary evidence regarding their influence on stressor appraisals, and importantly draws attention to the need for further investigations in this area to replicate these findings. With such a large proportion of the sampled populations being female, it is not possible to comment on any gender differences. This is an important gap in the literature to address as gender differences have been identified in emotional intelligence (Petrides & Furnham, 2000) and neuroticism (Chapman, Duberstein, Sörensen, & Lyness, 2007; Lynn & Martin, 1997; Weisberg, Deyoung, & Hirsh, 2011). This shortcoming could be addressed in future work by purposeful sampling by gender. The effect sizes across the included studies were all weak-to-moderate, suggesting that none of the factors assessed influence stressor appraisals in isolation. Rather, it may be that these factors interact to better explain stressor appraisals. Further, evaluating the combined effects of these predictors in a single model, similar to the mechanism proposed in this study, will allow researchers to observe the unique contributions of each predictor to stressor appraisals. Such research would confirm the validity of the proposed mechanism. Future research should also evaluate the integrity of the proposed mechanism in real-life settings. All studies identified in this systematic review utilized lab-based stress inductions. Although this is beneficial in terms of experimental control, such findings may not generalize to real-world stressful events. Future research can overcome this by evaluating both the predictor of interest and the stressor appraisals made of an upcoming stressful event. Given that all studies examined university students, university exams may stand as a viable real-world stressor to examine.

An additional challenge for future research is to address design limitations common across studies in this field by including multiple assessment time points allowing for longitudinal analyses to explore the effect of these factors on future stressor appraisals. This will allow for the causal relationships to be clarified. Future research is also challenged to

explore the effects of using different kinds of stress inductions in this field of research. These differences in stress induction methods may result in different perceived levels of psychological stress (that is, the perceived subjective severity of a stressful event; Cohen, Kamarck, & Mermelstein, 1983) and stressor appraisals, especially between vignettes and stress inductions that place participants in actual stressful events (such as completing an oral task). In order for firm conclusions to be made, more studies are needed to compare and contrast the differences in levels of perceived stress and stressor appraisals that result from using different stress induction tasks.

4.4 Concluding Remarks

This systematic review highlights the repeated findings between stressor appraisals and both neuroticism and emotional intelligence. Research is yet to assess the association between neuroticism and stress mindset, but given the strong association with neuroticism, stressor appraisals, and its associated predictors, neuroticism may also influence stress mindset. Taken together, this begins to build a predispositional mechanism of stressor appraisals integrating personality theory into the subjective stress response by highlighting possible ways in which personality constructs may lead to biased stressor appraisals. The findings of this review may be useful in guiding the development of targeted interventions to aid individuals who are struggling to cope with stressful events by identifying target variables, namely emotional intelligence (though also possibly just world beliefs, perfectionism, and stress mindset).

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Chapter 3 – The Relationship between Stress Beliefs and Stressor Appraisals

This brief report contains the null findings from an experimental design in which the relationship between stress beliefs (measured with the Stress Mindset Measure) and stressor appraisals (in which challenge and threat are measured separately) of the Trier Social Stress Test. The major strength of this study is that stress beliefs are measured before the participants were made aware of the stress induction. A brief report format was chosen for publication as many journals reserve this format for null findings. The Stress Mindset Measure was chosen over the Beliefs About Stress Scale for stress beliefs as, at the time of the study, the Beliefs About Stress Scale did not exist. The ethics approval letter for this study can be found in Appendix A.1. The measures used in this study can be found in Appendices B.1 to B.10.

The Relationship Between Stress Mindset and Evaluations of Stressful Events

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Abstract

Rationale Stress mindsets (beliefs about consequences of feeling stressed) are associated with health/behavioural stress-related outcomes. Belief-behaviour theories suggest that stress mindset may influence these outcomes by biasing how the information in a stressful event is appraised. We aimed to assess whether stress mindset biased participants' appraisals of the Trier Social Stress Test.

Method Consenting participants ($N = 117$) completed measures of demographics, physical wellbeing, emotional regulation, affect, public speaking and mathematics anxiety, resilience, depression, anxiety, perceived stress (over the last week and momentary [pre-instruction]), and stress mindset. Participants were then instructed about the stress induction, reported momentary stress (post-instruction) and stressor appraisals, then completed the Trier Social Stress Test. Momentary stress was re-measured mid- and post-induction.

Results Linear regressions between i) stress mindset and appraisals, ii) stress mindset and post-instruction momentary stress, and iii) appraisals and post-instruction momentary stress, controlling for covariates, suggested higher momentary stress was associated with lower challenge and higher threat appraisals, and stress mindset was not associated with appraisals or momentary stress.

Implications These findings do not support the theorised relationship between stress mindset and appraisals of stressful events. This may reflect an exception to previous belief-behaviour theories or shortcomings in the current measures of stress mindset and appraisals.

Keywords: Stress; stress mindset; beliefs; stressor appraisal; primary appraisal; challenge appraisal; threat appraisal; Trier Social Stress Test

Stress mindset, the extent to which stress-related consequences are perceived as enhancing or debilitating, is thought to influence health and behaviour (Crum, Salovey, & Achor, 2013). Stress-is-enhancing mindsets (e.g. “experiencing stress facilitates my learning and growth”) promote: i) lower perceived stress, ii) greater overall wellbeing, and iii) more frequent adaptive coping strategies than holding a stress-is-debilitating mindset (e.g. “experiencing stress depletes my health and vitality”; Crum et al., 2013). However, research has not empirically demonstrated how stress mindset influences these outcomes.

Mindsets are summaries of belief structures (Gupta & Govindarajan, 2002) that influence behaviour by biasing information selection, encoding, interpretation, and recollection for a given situation (Rucker & He, 2015). Several belief-behaviour theories reinforce this idea, including lay theories (Furnham, 1988, 1997), schema theory (James, Southam, & Blackburn, 2004), and attentional bias (Segerstrom, 2001). For stress mindset, this implies that stress-is-enhancing mindsets should lead to more positive appraisals of a stressful event (i.e., processing information from a stressful event in a more positive light) than a stress-is-debilitating mindset.

Two studies have explored this relationship (Crum, Akinola, Martin, & Fath, 2017; Kilby & Sherman, 2016). Both measured stress mindset, introduced a stressful event, measured appraisals of the stressful event as stressor appraisals (from the Transactional Model of Stress; Lazarus & Folkman, 1984), and then participants engaged with the stressful event. Only Kilby and Sherman (2016) found any support for the proposed relationship where stress-is-enhancing mindsets were associated with stronger positive appraisals (challenge appraisals) but were unrelated to negative appraisals (threat appraisals). There were several differences in methodology between the studies. Kilby and Sherman (2016) used an online induction preventing reliable standardisation, yet Crum et al. (2017) used the Trier Social Stress Test, a reliable, standardised induction (Kirschbaum, Pirke, & Hellhammer, 1993).

Further, Crum et al. (2017) treated stressor appraisals as a single construct ranging from challenging to threatening, but Kilby and Sherman (2016) treated challenge and threat as more complex, distinct constructs. The lack of expected findings may be due to the use of an inadequate stress induction or an overly simplistic primary appraisal measure. The present study aimed to assess whether the hypothesised relationship between stress mindset and appraisals of stressful events is evident by pairing a rigorous stress induction (Crum et al., 2017) with a complex measure of stressor appraisals (Kilby & Sherman, 2016).

Method

Participants

First-year psychology students over 18 years of age ($N = 117$) from Macquarie University, Sydney, self-enrolled into this in-person study for course credit. Participants self-reported being free of psychological, stress-related, or heart-related conditions. Institutional ethics approval was gained (approval number: 5201600554).

Procedure

Following consent, participants completed online measures of demographics, perceived overall health (one item from the Medical Outcomes Survey; Ware & Sherbourne, 1992), emotion regulation (Emotion Regulation Questionnaire; Gross & John, 2003), positive and negative affect (PANAS; Watson, Clark, & Tellegen, 1988), public speaking anxiety (Personal Report of Public Speaking Anxiety Scale; McCroskey, 1970), mathematics anxiety (Abbreviated Math Anxiety Scale; Hopko, Mahadevan, Bare, & Hunt, 2003), stress resilience (reappraisal/suppression; Brief Resilience Scale; Smith et al., 2008), depression, anxiety, and stress over the last week (DASS-21; Henry & Crawford, 2005; Lovibond & Lovibond, 1995), momentary perceived stress (pre-instruction; Distress Thermometer, reworded to read 'stress' rather than 'distress'; Mitchell, Baker-Glenn, Granger, & Symonds, 2010) and stress mindset (Stress Mindset Measure; Crum, Salovey, & Achor, 2013).

All participants then underwent the single-person Trier Social Stress Test (TSST; Krpan, Stuss, & Anderson, 2011) entailing completion of a 5-minute speech and 5-minute mathematics task by each participant in the presence of a reviewer (i.e., author CJK) and recording camera under the assumption that three experts would review the recording and analyzed for body language. Momentary stress (post-instruction) and primary appraisals were measured after receiving the induction instructions, but before completing the induction (Cognitive Appraisals Measure; Skinner & Brewer, 2002). Momentary stress was reassessed after the speech task (mid-induction) and following induction completion (post-induction). All measures demonstrated satisfactory internal reliability (α 's>0.68).

Statistical Analysis

Analyses were completed in R (ver: 3.3.3; R Development Core Team, 2008). Friedman's nonparametric test assessed changes in momentary stress over the induction. Challenge and threat appraisals were individually regressed onto stress mindset. Post-instruction momentary stress (reflecting the highest momentary stress increase from pre-instruction) was regressed onto challenge and threat appraisals (assessing whether appraisals related to momentary stress), and stress mindset (as a secondary hypothesis test).

Results

Sample characteristics are described in Table 1. Momentary stress increased from pre-instruction (median=2, IQR=1-4) to post-instruction (median=6, IQR=5-6, $p<.001$), remained stable mid-induction (median=6, IQR=3-6, $p=.742$), then declined post-induction (median=4, IQR=2-7, $p<.001$; Friedman Chi-square=130.53, $p<.001$) demonstrating induced acute stress. Linear regression analyses revealed significant relationships between threat/challenge appraisals and momentary stress. Stress mindset was unrelated to challenge/threat appraisals or momentary stress (Table 2).

Table 1. Sample characteristics

	M	SD	Range
Covariates			
Age	20.16	4.21	18-48
Gender n(%)			
Male	32(27.35%)		
Female	85(72.65%)		
Ethnicity n(%)			
Other	42(35.90%)		
Caucasian	49(41.88%)		
Asian	26(22.22%)		
Place of Birth n(%)			
Other	26(22.22%)		
Australia	91(77.78%)		
Education n(%)			
≤12 years	103(88.03%)		
>12 years	14(11.97%)		
Work n(%)			
Full-time	4(3.42%)		
Part-time	27(23.08%)		
Casual	53(45.30%)		
Self-employed	3(2.56%)		
Unemployed	30(25.64%)		
Physical Health n(%)			
Excellent	10(8.55%)		
Very good	60(51.28%)		
Good	39(33.33%)		
Fair/poor	8(6.84%)		
Reappraisal	4.90	0.94	1-7
Suppression	3.45	1.33	1-7
Positive Affect	31.62	7.14	10-50
Negative Affect	19.67	6.46	10-50
Speech Anxiety	108.35	22.87	34-170
Mathematics Anxiety	21.89	7.26	9-45
Stress (DASS)	5.44	3.63	0-21
Anxiety (DASS)	3.09	2.86	0-21
Depression (DASS)	3.45	3.41	0-21
Resilience	3.44	0.74	1-5
Predictors			
Stress Mindset	1.58	0.60	0-4
Challenge Appraisal	3.59	0.95	1-6
Threat Appraisal	3.80	1.05	1-6

Table 2. Results of regression analyses of stress mindset with perceived stress and appraisals

		95% CI					
	β	<i>SE</i>	Lower	Upper	<i>t</i>	<i>p</i>	η^2_{partial}
Perceived stress^{a,b}							
Challenge appraisal	-0.84	0.20	-1.24	-0.44	-4.12	<.001	0.14
Threat appraisal	0.83	0.21	0.42	1.24	4.01	<.001	0.13
Stress mindset	-0.05	0.27	-0.58	0.48	-0.19	.846	0.00
Challenge appraisal^{a,c}							
Stress mindset	0.05	0.79	-0.20	0.29	0.39	.698	0.00
Threat appraisal^{a, d}							
Stress mindset	0.05	0.13	-0.20	0.31	0.41	.684	0.00

Note. ^a Controlling for positive and negative affect, speech and mathematics anxiety, depression, anxiety, stress, and resilience. ^b Additionally controlling for age and education. ^c Additionally controlling for reappraisal and ethnicity. ^d Additionally controlling for age, physical health, education, and ethnicity.

Discussion

Prior research failed to demonstrate a link between stress mindset and both challenge and threat appraisals of stressful events (Crum et al., 2017; Kilby & Sherman, 2016). This study revisited this question to address prior limitations. Although challenge and threat appraisals were related to perceived stress levels as predicted, the expected relationship between stress mindset and appraisals of stressful situations was not demonstrated.

These results suggest that stress mindset may not influence perceptions of stressful events as belief-behaviour theories would suggest (Furnham, 1997; Gupta & Govindarajan, 2002; James et al., 2004; Segerstrom, 2001). One alternative explanation may be that stress mindset only influences other aspects of the stress response, such as coping strategy selection, as demonstrated by Crum et al. (2013). Appraisals are a well-known predictor of coping strategy selection (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986), thus if stress mindset directly influences coping, then there should be weak associations evident between stress mindset and appraisals. However, the current study found no statistical evidence for any association between these two variables. Alternatively, these findings

suggest that stress mindset may only impact select aspects of stress-related information processing. Previous research has shown that stress mindset is associated with retrospective perceived stress (Crum et al., 2013), yet our study failed to demonstrate a relationship with momentary perceived stress. This may indicate that stress mindset only impacts recall rather than encoding or interpretation of stress-related information.

Finally, these results may reflect measurement limitations. The Stress Mindset Measure (Crum et al., 2013) captures beliefs about stress consequences but excludes other beliefs (e.g., control over stress; Anderson, 1977). Potentially, a more comprehensive measure assessing beliefs about the antecedents to stress and how one behaves under stress is needed to detect interindividual differences in stress responses, other than consequences alone. Additionally, Crum et al. (2013) and Kilby and Sherman (2016) both measured stressor appraisals as the perceived level of challenge and threat in a stressful situation. However, there is an alternative approach to measuring stressor appraisals as a ratio of perceived demands of a situation to the perceived resources an individual has to cope with the situation (e.g., Penley & Tomaka, 2002). The expected relationship between stress mindset and stressor appraisals may be identifiable with the use of this third approach.

Conclusion and Future direction

Beliefs about stress should influence how we perceive stressful events. We adopted a common stress induction paradigm and addressed limitations in previous works but found no evidence of the expected relationship. This may highlight issues with the applicability of existing measures or methods to exploring the proposed belief-behaviour link in stress. The employment of broader measures of both beliefs about stress and appraisals of stress may overcome the unexpected findings of the present paper.

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Chapter 4 – Scoping Review of Stress Beliefs

Following the null findings reported in Chapter 3, it could be concluded that either the numerous theories and decades of research linking beliefs to information processing might be wrong, or that how we measure stress beliefs may not be optimal. The latter is most likely to be the case. One possible explanation is that the Stress Mindset Measure may not assess an appropriately broad enough range of stress beliefs. The Stress Mindset Measure initially comprised of only 10 items which, following item reduction, were reduced to 8 items. The items were generated based upon the research team's expert opinion and were not informed by the stress belief literature. The absence of considering stress belief research in the development of the Stress Mindset Measure may be due to the absence of a scoping review documenting the known stress beliefs to date. As such, it is crucial to take stock of the stress belief literature to date. This chapter contains a review of all published empirical studies concerning stress beliefs. The scoping review in this chapter is currently under review at the *Annals of Behavioral Medicine*. It also documents how these beliefs were measured, and utilises the Common-Sense Model of Self-Regulation of Health and Illness to identify gaps in the stress beliefs literature. This paper uses the American Medical Association referencing style as required by the *Annals of Behavioral Medicine*. This chapter is written in American English in alignment with journal requirements.

**A Scoping Review of Stress Beliefs:
Literature Integration, Measurement Issues, and Theoretical Concerns**

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ABSTRACT

Background: Individual stress beliefs are associated with stress-related behavioral responses and health consequences. The Common-Sense Model of Self-Regulation may help in understanding the role of stress beliefs in these behavioral responses and consequences.

Purpose: To synthesize empirical studies exploring the relationship between stress beliefs and stress-related behavioral responses and health consequences using the Common-Sense Model as a guiding framework.

Method: Peer-reviewed journal articles on stress beliefs in PsycArticles, PsycINFO, PubMed, Scopus, and Sociological Abstracts were included if they were in English, reported on adult humans. Nineteen of the 1972 unique articles reporting on 24 studies met inclusion criteria. Study quality was assessed with existing reporting criteria.

Results: Four of the five Common-Sense Model representations were included across the review studies, namely Identity, Cause, Consequences, and Control. Consequences and Control-related stress beliefs are associated with stress-based health and behavioral outcomes. One study explored Identity-related stress beliefs with health outcomes, reporting no relationship. No study assessed the relationship between Cause-related stress beliefs and behaviors or health outcomes. No study has explored any aspect of Timeline-related stress beliefs. Study quality ranged from very low to very high.

Conclusions: There is limited evidence exploring stress-related beliefs and behaviors and health outcomes. According to the Common-Sense Model, the Timeline representations remains to be investigated in the stress context, and Identity and Cause are under-researched. This review highlights future directions for stress beliefs research.

Keywords: stress, belief, scoping review, individual differences, Common-Sense Model

Stress can be described as a phenomenon containing several elements, including a stressor or stressful situation that triggers the sensation of stress, a ‘stress response’ comprising of a cognitive evaluation or appraisal that evaluates the stressor, a physiological, emotional, and behavioral response, and a set of physiological and psychological health outcomes associated with this stress response[1]. According to the Transactional Model of Stress, when a situation is deemed stressful or a stressor is identified, individuals interpret the available information from the stressor and determine their ability to cope with the situation through a cognitive appraisal process[2]. These appraisals influence behavioral[3], emotional[2], and physiological[4] responses to the stressful situation. Inter-individual differences in the stress response toward the same stressor can result in some individuals experiencing improvements, whilst others experience declines, in domains such as attention[5,6], memory[7], and physical health[8,9]. One emerging theoretical perspective that may help explain these inter-individual differences in appraisals and responses to stressful situations is stress beliefs[10,11].

By definition, stress beliefs are a form of lay belief or lay theory about stress held by an individual[12,13]. These beliefs may align with scientific theory and evidence, but can also be informed by past experience with situations both experientially and vicariously[14]. Lay beliefs are foundational components of many theories of health behavior, including the Common-Sense Model of Health and Illness (CSM)[15]. The CSM outlines that, when presented with a cue to health or illness (e.g., gaining weight, coughing, noticing a new dark patch of skin) lay beliefs about health and illness (referred to as representations) bias how an individual interprets these cues[16]. Meta-analytic research has found that illness-specific representations (e.g., representations about breast cancer) not only bias the interpretations of these cues but also influence the way individuals respond to the illness[17,18]. The theory outlines five broad representations by which an individual’s beliefs can be categorized,

including: Identity (the cues by which one identifies the aspect of health or illness in question); Cause (the causes of the aspect of health or illness in question); Timeline (whether the aspect of health or illness is chronic or acute, and whether it comes and goes or is stable); Consequences (the positive and negative consequences associated with the aspect of health or illness in question); and, Controllability (whether something can be done in response to this aspect of health or illness and whether those actions will be effective). The theory implies that if two individuals hold different representations about the same aspect of health or illness, they may interpret relevant cues to that aspect of health or illness in different ways. This is said to lead to different behavioral responses to that cue[16]. The CSM includes stress as both a possible Cause representation (e.g., stress causes heart disease) and Consequence (e.g., headaches make me feel stressed)[16]. Furthermore, research has highlighted the stress-illness rule in the CSM in which, under high levels of stress, individuals are more likely to attribute symptoms of illnesses that they believe are associated with stress to their perceived experience of stress rather than to the illness itself[19].

Applied to the context of stress, the CSM implies that representations about stress (hereafter, “stress beliefs”) should change how an individual interprets various aspects of stressful situations and that this difference in interpretation may lead to different behavioral and physiological responses that could have consequences for health. In the context of the Transactional Model of Stress, this would suggest that stress beliefs should be a preceding factor that influences appraisals. Research into the influence of stress beliefs on health have reported that, for those who were experiencing high levels of stress, holding the belief that stress negatively affects your health was associated with an increased risk of 8-year mortality[20] and 18-year risk of coronary incidents[21] compared to those individuals with similar levels of stress who did not hold this belief. These effects were maintained after controlling for a range of health status and health behavior variables. However, both studies

opted for single-item measures of stress beliefs that exclusively assessed consequence representations only (according to the CSM), and therefore, leaves open whether similar effects might be found with the other four stress-related representations.

Despite emerging research into stress beliefs, to date, there has been no systematic or integrative review of these findings. Given that stress is involved in both health and illness, the CSM is an appropriate theoretical framework from which to understand inter-individual differences in stress beliefs and associated behavioral responses and health consequences, and to guide such an integrative review of this research. The aim of this scoping review is to systematically integrate the stress belief empirical research using the CSM representation categories as a guiding framework. This review will identify the extent to which stress belief research reflects the breadth of CSM representation categories and determine the extent to which stress beliefs are associated with behavioral responses and health outcomes. Empirical findings will also be assessed and interpreted within evidence-based reporting criteria for quantitative and qualitative research to evaluate the quality of research in this field and to inform future directions[22–24].

Methods

This scoping review followed PRISMA scoping review guidelines. Studies were eligible for this review if they were: focused on adult humans free of any psychological morbidity (e.g., post-traumatic stress disorder); written in English; empirical and peer-reviewed qualitative or quantitative work; and addressing a belief about stress in healthy adult humans. Only papers discussing beliefs about stress, in general, were included, ensuring that the reviewed beliefs were exclusively about stress in general, rather than a stress-related aspect of some other situation or phenomenon. For example, beliefs about war stress in Soviet soldiers[25] may reveal beliefs that are more related to the situation of

war than to the phenomenon of stress, and therefore, would not be included in this review. Studies were also excluded if they were published reviews, as well as grey literature or dissertations to ensure only high-quality peer-reviewed original research were included in this review. The second author (KAS) reassessed the eligibility of 30% of articles as a measure of inter-reviewer reliability; no discrepancies emerged. This review was not pre-registered. A meta-analysis was not undertaken due to the different measurement and theoretical approaches to the operationalization of stress beliefs. In many instances, the different approaches to measuring stress beliefs were featured in only one paper.

Six different online journal article databases were searched to identify relevant studies in October 2018, including PsycInfo, PsycArticles, PubMed, Medline, Sociological Abstracts, and Scopus. The general structure of the search phrase was BELIEF TERM + STRESS TERM. Given that beliefs, thoughts, expectations, attitudes, and mindset are semantically similar, all four were treated as ‘belief’ terms. The reference lists of included articles were also hand searched for additional references. Papers from disciplines outside of the human sciences (e.g., engineering) were excluded from search results as the subject matter in these areas are not humans but rather may be mechanical, mathematical, or other non-human based subject matters. Given that this review is focusing on human stress, it was inappropriate to include papers from these fields outside of the human sciences. As such, the final search term consisted of: (belief* OR believ* OR thought* OR think* OR expect* OR attitud* OR mindset*) AND (*stress*).

As part of this scoping review, study quality was assessed. For quantitative studies, the quality criteria were based upon select STROBE[22] and CASP[23] guidelines focusing on the rationale, design, and measurement of beliefs. Higher quality studies: i) reported rationales that included a mechanism explaining how stress beliefs might influence some stress-related outcome; ii) used one of the two validated measures of stress

beliefs; either the Stress Mindset Measure[11] or the Beliefs About Stress Scale[10]; iii) measured a variety of stress beliefs; iv) tested the proposed mechanism; v) evaluated the impact of stress beliefs on some stress-related outcome; and, vi) utilized a longitudinal design as this provides stronger evidence for predictive relationships between variables than cross-sectional or correlational studies. For qualitative studies, high quality was based on accepted guidelines from previous work[24] defined as having: i) clearly outlined and justified aims and research approach; ii) a detailed account of the interview process; iii) sufficient data to address the research question; iv) a method of analysis outlined; v) a detailed account of the theoretical framework; vi) consideration of socio-cultural norms; and, vii) a verification of analytical results such as asking the original participants or a separate sample of participants to confirm the accuracy of the analytical results. For both study types, studies received a 1 for meeting a criterion and a 0 for not meeting that criterion. Quantitative studies were scored out of 6, and the qualitative study was scored out of 8.

In this review, beliefs identified across the included studies and the evidence supporting or challenging the theoretical link between stress beliefs and health outcomes were integrated into the five broad representations outlined by the Common-Sense Model. This approach allowed for the critical examination and identification of gaps in the stress belief literature to date. Finally, to document existing stress belief measures, summary information corresponding to standard reporting practices is presented.

Results

Initially, 3429 articles were identified. After duplicates had been removed ($N=1443$ removed), article titles and abstracts were screened for inclusion and exclusion criteria, resulting in the removal of an additional 1871 articles. The 101 remaining articles were

retrieved, and the whole paper was screened for inclusion and exclusion criteria, in which a further 82 papers were excluded, producing the final set of 19 articles (see Figure 1). The 19 included articles reported on 24 different studies. Some articles reported multiple studies, and two articles reported on the same sample[26,27], with Crum et al. (2018) reporting on a subset of participants who consented to be genotyped of Crum et al. (2017). These 24 studies represented a total sample size of 40926 participants (range $N=42$ to 28,753; Male = 61%). Across all studies, there was a mean age of 33 years, with a range between 19 years and 75 years. Studies were based in either Germany ($n=3$), America ($n=9$), the United Kingdom ($n=5$), Australia ($n=2$), Israel ($n=4$) or Japan ($n=1$). There was a range of methodologies employed across the 24 studies, with some utilizing multiple methodologies. Nine studies used longitudinal designs with self-report questionnaires[10,11,20,21,28–31]. Fourteen studies employed cross-sectional designs with self-report questionnaires[11,12,37,38,26,27,31–36]. One study used cross-sectional designs with one-on-one interviews using thematic analysis[39].

A summary of the details and findings of included papers is provided in Table 1 and summaries of how beliefs were measured in each study can be found in Table 2. All studies reported some rationale for why stress beliefs may influence health and behavior. Specifically, 20 (83%) presented a theoretical link by which stress beliefs may influence these outcomes. The other four studies (17%) presented prior research linking stress to the outcome of interest but did not discuss this in the context of a specific theory[21,30,34,38,39].

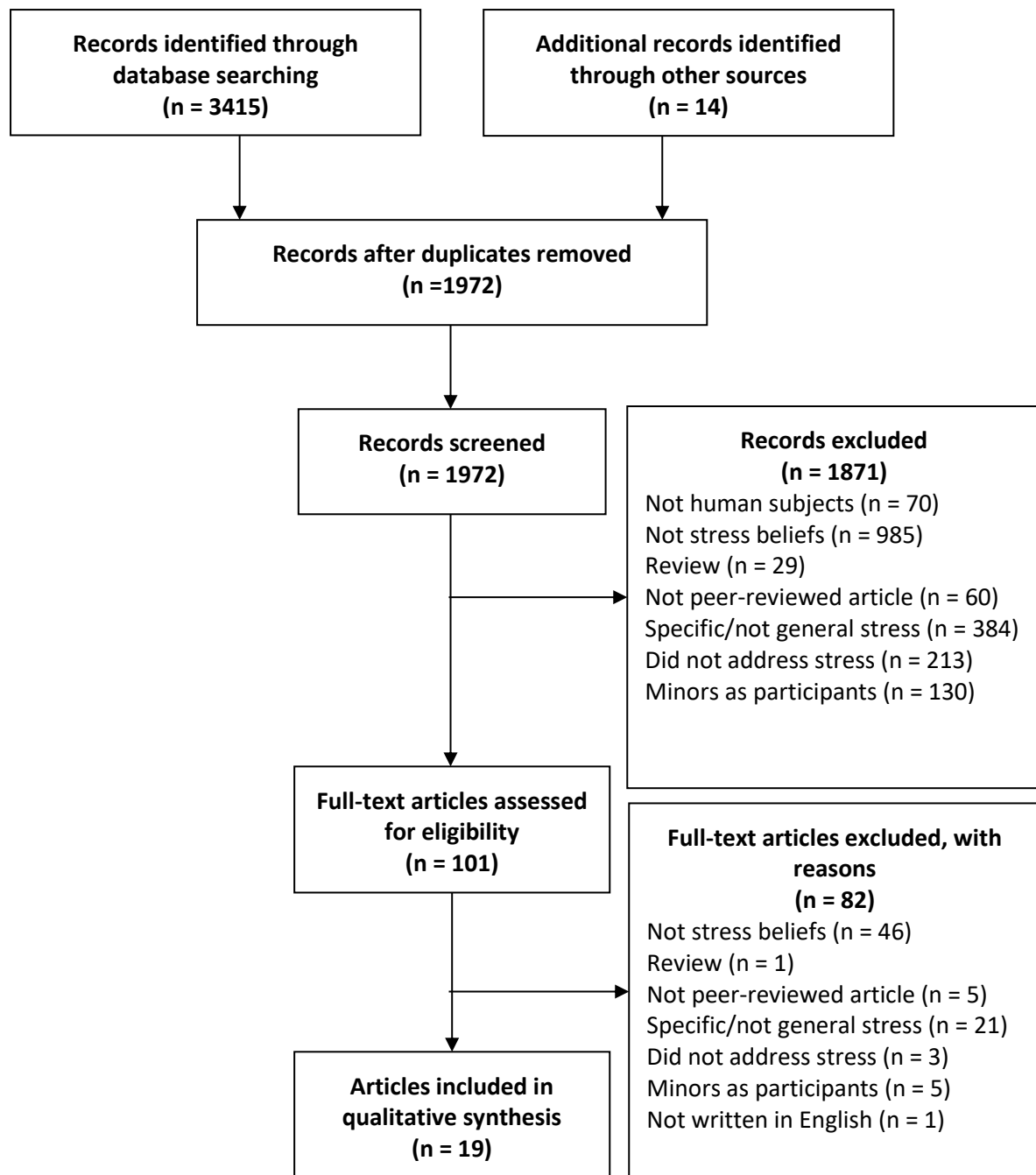


Figure 1. PRISMA diagram

Table 1. Summary of papers included for review

Citation	Sample	Belief	Method	Results	Effect size
				Identity	
Thomae. (1981). GER	174 older aged participants†	Unchangeability of life stress	Self-report questionnaires	Stress belief unrelated with objective or perceived stress	<i>n.r.</i>
Kinman, & Jones. (2005). UK	45 employees†	What is stress	Interviews	A stimulus, stimulus-response, or a response	K=.76
				Cause	
Furnham. (1997). UK	134 employees†	Causes of occupational stress	Self-report	Found five categories of beliefs about the cause of workplace stress: conflict and satisfaction, career development, demographic subgroups, danger and intimidation, and authority	Variance explained: Conflict: 21.2% Career development: 8.6% Minorities: 7.3% Danger/intimidation: 5.7% Authority: 5.1%
Kinman, and Jones. (2005). UK	45 employees from a range of occupations†	Causes of occupational stress What is a stressful job	Interviews	Pressure, new technology, and media hype Being placed under physical danger, being responsible for others, working with others who are stressed, job security, and mundane work.	<i>n.r.</i>
				Consequence	
Daniels, Hartley, & Travers. (2006). UK	42 UK university staff members†† 101 teachers at a UK secondary school††	Impact of stress on work Impact of stress on positive and negative affect	Self-reported questionnaires	Believing stress impacted work increased number of reported stressful situations. Believing stress elicited negative affect or impacted work increased negative affect under stress Believing stress elicited positive affect unrelated to levels of positive affect under stress.	<i>n.r.</i> <i>n.r.</i>
Furnham. (1997). UK	134 employees†	Manifestations of workplace stress	Self-report	Found five categories of beliefs about the manifestations of workplace stress: Intolerance and lack of patience, anxiety and fear of interaction, denial, depression and intolerance, and loss of energy	Variance explained: Intolerance: 29.5% Anxiety: 9.9% Denial: 8.1% Depression: 6.6% Loss of energy: 6.2%

Table 1(cont.). Summary of papers included for review

Citation	Sample	Belief	Method	Results	Effect size
Furnham. (1997). UK	134 employees†	Consequences of stress	Self-report	There were four categories of beliefs relating to consequences of stress: Physical and external consequences, powerlessness and lack of control, self-destruction, and loss of self-esteem	Variance explained: Physical/external: 26.0% Lack of control: 10.2% Self-destruction: 7.0% Loss of self-esteem: 6.4%
Keller et al. (2012). USA	28,753 participants of the National Health Interview Survey††	Belief that stress negatively impacts health	Self-report and national death records	Strong belief that stress negatively affected health and having high levels of stress increased mortality risk by 43%, compared to those not holding belief. Effects maintained after controlling for covariates.	OR=1.43
Kinman, & Jones. (2005). UK.	45 employees from a range of occupations†	Effects of occupational stress Valence of consequences Negative mood	Interviews	Mental health, behavior, physical health, cognitive functioning. Initially reported stress eliciting negative consequences, but some later reported positive consequences as well.	<i>n.r.</i> Negative mood: $r=.229$
Febles, and Ogden. (2005). UK	548 patients at a London-based GP†	Specific somatic symptoms Non-specific somatic symptoms Social symptoms	Self-reported questionnaires	Regardless of the belief, viewing any health symptom as a symptom of stress was associated with an increased intention to seek medical help	Specific somatic: $r=.189$ Non-specific: $r=.228$ Social symptoms $r=.241$
Nabi et al. (2013). UK	7268 participants in the British Whitehall II cohort study††	Belief that stress negatively impacts health	Self-report	Believing stress negatively affected health a lot increased coronary incidence rate by 1.49 time compared to those not holding the belief. Effects maintained after controlling for covariates.	OR=1.49
Parker, Finkel, & Indice. (1993). USA	346 undergraduates†	Relationship between stress and 26 health problems	Self-reported questionnaires	Participants associated stress more strongly with common health problems than infrequent or severe health problems. The type of problem associated with stress was moderated by ethnicity.	<i>n.r.</i>

Table 1(cont.). Summary of papers included for review

Citation	Sample	Belief	Method	Results	Effect size
Ben-Avi, Toker, & Heller. (2018). Israel	Study 1: 348 USA community members (MTurk)†	Valence of consequences	Self-reported questionnaires	Positive beliefs were associated with lower perceived burnout, which was associated with greater perceived promotability in others. Results maintained after controlling for covariates.	<i>n.r.</i>
	Study 2: 207 MBA students†	Valence of consequences	Self-reported questionnaires following stress mindset manipulation	Positive beliefs were associated with higher levels of perceived presenteeism in others, which was associated with greater perceived promotability. Results maintained after controlling for age, age and mood, or managerial style (covariates differed depending on the analysis).	Presenteeism: $\eta^2=.03$ Somatic symptoms: $\eta^2=.03$
	Study 3: 135 Israeli community members†	Valence of consequences	Self-reported questionnaires following stress mindset manipulation	Replicated Study 1 results via a stress mindset manipulation, controlling for mood and managerial style.	Positive vs negative: $\eta^2=.05$ Positive vs control: $d=0.25$ Negative vs control: $d=.03$
	Study 4: 292 USA community members (MTurk)†	Valence of consequences	Self-reported questionnaires following stress mindset manipulation	Stress-is-enhancing manipulation lead to more favorable perceptions of burnout and somatic symptoms compared to a stress-is-debilitating manipulation. However, presenteeism in others did not differ between the groups after accounting for covariates. Positive beliefs lead to lower perceived somatic symptoms, which lead to greater perceived intentions to help others. There was no mediating effect for presenteeism or burnout.	Burnout: $\eta^2=.04$ Somatic symptoms: $\eta^2=.02$ Presenteeism: $\eta^2=.01$
Crum, Akinola, Martin, & Fath. (2017) USA ^a	124 American first year psychology students†	Valence of consequences	Self-reported questionnaires and cognitive tasks	Following a challenging (but not threatening) stress induction, positive beliefs lead to increases in positive affect and increased DHEA5 levels, a greater attentional bias towards happy vs angry or neutral faces, and greater levels of cognitive flexibility. No effect for negative affect, cortisol, or attentional biases for negative stimuli.	Positive affect: $\eta^2=.04$ Negative affect: $\eta^2=.00$ Attentional bias: $\eta^2=.09$ Flexibility: $\eta^2=.04$ DHA5: $\eta^2=.11$ Cortisol: $\eta^2<.01$
Crum, Akinola, Turnwald, Kaptchuk, & Hall (2018). USA ^a	107 American first year psychology students†	Valence of consequences	Self-reported questionnaire, and biological measures	Carriers of a low activity variation of catechol-O-methyltransferase were more sensitive to stress-is-enhancing manipulations in terms of positive affect, attentional bias, and cognitive interference	Positive affect: $\eta^2=.05$ Negative affect: <i>n.r.</i> Attentional bias: $\eta^2=.06$ Interference: $\eta^2=.06$

Table 1(cont.). Summary of papers included for review

Citation	Sample	Belief	Method	Results	Effect size
Crum, Salovey, & Achor. (2013) USA	Study 1 and 2: 338 employees† † (same sample reported over two studies)	Valence of consequences	Self-reported questionnaires	Study 1: Stronger positive stress beliefs was associated with lower perceived stress, intolerance of uncertainty, avoidant-based coping, negative affect, and greater optimism, resilience, mindfulness, approach-based coping, wellbeing (mental and physical), and work performance.	Perceived stress: $r=-.34$ Optimism: $r=.23$ Resilience: $r=.31$ Uncertainty: $r=-.16$ Mindfulness: $r=.21$ Approach coping: $r=.27$ Avoidant coping: $r=-.17$ Negative affect: $r=-.25$ Mental health: $r=-.25$ Physical health: $r=-.15$ General wellbeing: $r=.20$ Work performance: $r=.15$
	Study 3: 63 students††	Valence of consequences	Self-reported questionnaires and cortisol	Study 2: Only those in the stress-is-enhancing manipulation reported increases in work performance and negative affect after controlling for coping style. Positive beliefs associated with greater desire for feedback, and medial (vs low or high) cortisol levels after controlling for covariates. Negative beliefs had an indirect effect on irritation/anger through emotional expression and support seeking (but not cognitive reinterpretations or problem solving). Negative beliefs did not relate to anxiety, depression, nor helplessness. Positive beliefs were not related with outcome.	Negative affect: $\eta^2=.02$ Work performance: $\eta^2=.04$ Feedback: $r^2=.09$ Cortisol: <i>n.r.</i>
Horiuchi, Tsuda, Aoki, Yoneda, & Sawaguchi, (2018). Japan	124 students†	Valence of consequences	Self-reported questionnaires	After controlling for covariates, stronger positive beliefs associated with greater challenge appraisal but was unrelated to threat appraisals.	<i>n.r.</i>
Kilby, & Sherman, (2016). AUS	124 students†	Valence of consequences	Self-reported questionnaires	Stress mindset were cross-sectionally negatively associated with perceived stress and physical wellbeing. Proactive coping mediated stress mindset with psychological wellbeing and perceived stress. Somatic symptoms mediated stress mindset with physical wellbeing and academic performance. Implicit beliefs were unrelated with outcomes.	Challenge: $\eta^2=.07$ Threat: $\eta^2=.01$
Keech, Hagger, O'Callaghan, & Hamilton, (2018). AUS	218 students††	Valence of consequences	Self-reported questionnaire and implicit associations test		Psy ^b wellbeing $R^2=.45$ Perceived stress $R^2=.64$ Physical wellbeing $R^2=.19$ Academic $R^2=.09$

Table 1(cont.). Summary of papers included for review

Citation	Sample	Belief	Method	Results	Effect size
Laferton, Stenzel, Fischer. (2018). GER	445 students ^{††}	Valence of consequences	Self-reported questionnaires	After controlling for covariates, positive and negative stress beliefs were not associated with perceived stress levels 6-8 weeks later	<i>n.r.</i>
Fischer, Nater, & Laferton. (2016). GER	363 students ^{††}	Valence of consequences	Self-reported questionnaires	Controlling for covariates, stronger negative stress beliefs were associated with more intense somatic symptoms 6-8 weeks later, mediated by elevated stress levels. No association between positive stress beliefs and somatic symptoms.	Negative beliefs: $\eta^2 = .02$ Positive beliefs: <i>n.r.</i>
Controllability					
Lafterton, Stenzel, & Fischer. (2018). GER	445 students ^{††}	Control over stress	Self-reported questionnaires	After controlling for covariates, beliefs about control over stress at baseline were not associated with perceived stress at follow-up	<i>n.r.</i>
Fischer, Nater, & Laferton. (2016). GER	363 students ^{††}	Control over stress	Self-reported questionnaires	Controlling for covariates, beliefs about one's control over stress at baseline were not associated with somatic symptoms at follow-up	<i>n.r.</i>
Furnham. (1997). UK	134 employees [†]	The alleviation of stress	Self-report	Four categories of beliefs relating to the alleviation of stress were identified: Inner control, self-help, seeking professional help, and shame	Variance explained - Inner control: 18.6% Self-help: 12.5% Seeking help: 9.1% Shame: 6.7%
Kawanishi. (1995). USA	193 Anglo-Saxons and 275 Japanese [†]	Controllability	Self-reported questionnaires	Japanese (vs Western) more likely to attribute stress and coping to one's actions or luck rather than external forces	<i>n.r.</i>
Kinman & Jones. (2005). UK	45 employees [†]	Stress management strategies	Interviews	76% of participants reported individual strategies (e.g., time management), 24% of participants reported organizational strategies (e.g., more control).	<i>n.r.</i>
Shadel & Mermelstein. (1993). USA	83 participants in a clinic-based smoking cessation program ^{††}	Effectiveness of smoking to cope with stress Self-efficacy to cope with stress	Self-reported questionnaires	Lower urge to smoke when stressed only if they believed that smoking was not an effective coping strategy, and that they could cope with stress. Other combinations of these beliefs promoted the urge to smoke.	Effectiveness of smoking to cope with stress: $R^2 = .16$ Self-efficacy to cope: $R^2 = .27$

Note. ^a These studies report on the same sample. ^b Psychological wellbeing. Crum et al. (2018) reports on a subset of the participants from Crum et al. (2107). [†] Cross-sectional. ^{††} Longitudinal.

Table 2. Description of measures used in studies.

Measure	Belief	Subscale	CSM ^a	Example Item	No. items	Range	Interpretation of higher score	Reliability
Validated Scales								
Stress Mindset Measure – General[11,26,27,36,37]	Valence of consequences	Nil	3	"The effects of stress are negative and should be avoided"	8	0 to 4	Stronger belief that stress has positive consequences	α = 0.86
Stress Mindset Measure – Specific[11]	Valence of consequences	Nil	3	"The effects of this stress are negative and should be avoided"	8	0 to 4	Stronger belief that current stress has positive consequences	α = 0.80
Stress Mindset Measure – Japanese[38]	Valence of consequences	Stress-is-enhancing	3	"The effects of this stress are negative and should be avoided"	4	0 to 4	Stronger subscale endorsement	α = 0.74
		Stress-is-debilitating	3		4			α = 0.79
Stress Mindset Measure - Stress Control[31]	Valence of consequences	Nil	3	"Stress can be used to enhance my performance and productivity"	15	1 to 6	Stronger belief that stress has positive consequences	α = 0.93
		Positive beliefs	3	"being stressed enables me to work in a more focused manner"	4	4 to 16	Stronger belief that stress is positive	α = 0.87 test-retest: .74
Beliefs About Stress Scale[10,30]	General beliefs about stress	Negative beliefs	3	"Being stressed makes me less resilient"	8	8 to 32	Stronger belief that stress is negative	α = 0.80 test-retest: .81
		Control beliefs	4	"Being stressed is something I am able to influence positively using my thoughts"	3	3 to 12	Stronger belief that stress is controllable	α = 0.73 test-retest: .61
Internality, Powerful Others, and Chance Scale[33]	Control over stress	Nil	4	"Successful coping depends mostly on the help from others"	6	1 to 5	Stronger endorsement of that item's content	Not applicable
Unvalidated Scales								
No name provided[32]	Unchangeability of life stress	Nil	1	"All of my plans are getting more and more restricted due to poor health"	10	Not reported	Stronger belief that stress is unchanging	Not reported
No name provided[28]	Stress and smoking	Smoking to cope with stress	4	Extent smoking is thought to help cope with stress	5	5 to 50	Stronger belief that smoking helps one to cope with stress	α = 0.89

Table 2 (cont.). Description of measures used in studies.

Measure	Belief	Subscale	CSM ^a	Example Item	No. items	Range	Interpretation	Reliability
No name provided[28]	Stress and smoking	Self-efficacy to cope with stress	4	Ability to cope with stress without smoking	3	3 to 30	Stronger belief that one can cope without cigarettes	$\alpha = 0.96$
No name provided[29]	Impact of stress on work performance	Nil	3	"How does dealing with this many issues in an hour affect your work performance?"	6	-6 to 6	Stronger belief that stress negatively affects work	$\alpha > .87$
No name provided[29]	Impact of stress on negative affect	Nil	3	Frequency of stressors eliciting negative affect.	3	-3 to 3	Stronger belief that stress increases negative affect	$\alpha > .76$
No name provided[29]	Impact of stress on positive affect	Nil	3	Frequency of stressors eliciting positive affect.	2	-2 to 2	Stronger belief that stress increases positive affect	$\alpha > .71$
No name provided[34]	Stress symptomology	Nil	3	Reflecting a symptom that may be associated with stress (e.g., chest pain)	25	1 to 3	Stronger endorsement of that item's symptom being characteristic of stress	Not reported
No name provided[35]	Stress and health problems	Nil	3	Agreement that stress causes specific health problems	26	1 to 5	Stronger endorsement of stress causing that health problem	Not reported
No name provided[13]	General beliefs about occupational stress	Causes of work stress	2	"The risk of redundancy is a very stressful factor"	27	1 to 7	Stronger endorsement of that item's content	Not reported
		Manifestations of work stress	3	"A stressed person will cry more"	19	1 to 7	Stronger endorsement of that item's content	Not reported
		Consequences of work stress	3	"A stressed person will miss work because of over-sleeping"	22	1 to 7	Stronger endorsement of that item's content	Not reported
		Alleviations of work stress	4	"Whether the person believes it is possible to eliminate the problem"	24	1 to 7	Stronger endorsement of that item's content	Not reported
National Health Interview Survey[20]	Stress negatively impacts health	Nil	3	"During the past 12 months, how much effect has stress had on your health - a lot, some, hardly any, or none?"	1	0 to 1	Categorical response option endorsement represents extent to which stress is believed to negatively impact health	Not applicable
British Whitehall II Cohort Study[21]	Stress negatively impacts health	Nil	3	"To what extent do you feel that the stress or pressure you have experienced in your life has affected your health?"	1	0 to 1	Categorical response option endorsement represents extent to which stress is believed to negatively impact health	Not applicable

Fifteen studies (63%) used validated scales to measure stress beliefs. Twelve studies used the Stress Mindset Measure[11,26,27,31,36–38]. Although there are four forms of the Stress Mindset Measure (General[11], Specific[11], Control[31], and Japanese[38]), the interpretation from the different forms are the same, and therefore, the research utilizing the Stress Mindset Measures is discussed collectively. Two studies used the Beliefs About Stress Scale, which measures beliefs about both the nature of stress and perceived control over stress[10,30]. One study used a validated scale of general locus of control, the Internality, Powerful Others, and Chance Scale[40], which does not explicitly assess stress beliefs. However, this scale was adapted for the context of stress in only one study[33]. Eight studies (33%) used scales that were developed for the purpose of their study and were not previously validated[13,20,21,28,29,32,34,35]. One (4%) study used a qualitative design and therefore did not employ the use of a scale, but rather used semi-structured interview questioning coupled with thematic analysis to identify participants stress beliefs[39].

Quality criteria scores for the quantitative articles ranged from 2 out of 6[13,21] to 6 out of 6[30,31] ($M = 3.8$, $SD = 1.4$). The most frequently met criteria were criterion i) the inclusion of a rationale for why stress beliefs relate to the target outcome (78%), criterion iii) the measurement of multiple stress beliefs (78%), and criterion v) the evaluation of the effect of the stress beliefs on the target outcome (83%). Only 39% of all articles empirically assessed their proposed rationale (criterion iv)[20,30–33,36,37], making criterion iv the least met and therefore, most in need of improvement in this field. The quality score for the one qualitative article in this review was 8 out of 8[39]. See Table 3 for a study-by-study breakdown of the quality assessment.

Table 3. Quality of included papers

Quantitative studies									
	Rationale for how beliefs affect outcome	Validated beliefs measure	Measured multiple beliefs	Evaluated the plausibility of their rationale	Evaluated impact of beliefs on outcome	Multiple time points	Quality score (/6)		
Thomae. (1981). Germany	✓	✗	✗	✓	✓	✗	3		
Shadel & Mermelstein. (1993). USA	✓	✗	✓	✗	✓	✓	4		
Daniels, Hartley, & Travers. (2006). UK	✓	✗	✓	✗	✓	✓	4		
Fischer, Nater, & Laferton. (2016). Germany	✓	✓	✓	✓	✓	✓	6		
Lafterton, Stenzel, & Fischer. (2018) Germany	✓	✓	✓	✗	✓	✓	5		
Kawanishi. (1995). USA	✓	✓	✗	✓	✗	✗	3		
Febles, & Ogden. (2005). UK	✗	✗	✓	✗	✓	✗	2		
Parker, Finkel, and Indice. (1993). USA	✓	✗	✓	✗	✗	✗	2		
Keller, et al. (2012). USA	✓	✗	✗	✓	✓	✓	4		
Nabi, et al. (2013). UK	✗	✗	✗	✗	✓	✓	2		
Furnham. (1997). UK	✓	✗	✓	✗	✗	✗	2		
Crum, Salovey, & Achor. (2013) USA	✓	✓	✓	✗	✓	✓	5		
Crum, Akinola, Martin, & Fath. (2017) USA	✓	✓	✓	✗	✓	✗	4		
Crum, Akinola, Turnwald, Kaptchuk, & Hall (2018)	✗	✓	✓	✗	✓	✗	3		
Kilby, & Sherman. (2016) Australia	✓	✓	✓	✓	✓	✗	5		
Keech, Hagger, O'Callaghan, & Hamilton, (2018). AUS	✓	✓	✓	✓	✓	✓	6		
Ben-Avi, Toker, & Heller. (2018). Israel	✓	✓	✓	✓	✓	✗	5		
Horiuchi, Tsuda, Aoki, Yoneda, & Sawaguchi. (2018). Japan	✗	✓	✓	✗	✓	✗	3		
Need of improvement (/18)	4	8	4	11	3	10			
Qualitative study									
Study	Aims outlined	Approach described	Clear account of process	Sufficient data	Method of analysis outlined	Theoretical framework	Socio-cultural factors	Verification of analysis	Score
Kinman, & Jones, (2005). UK	✓	✓	✓	✓	✓	✓	✓	✓	8

Note. Need of improvement represents the number of studies that did not meet a particular criterion.

Two studies explored Identity-related stress beliefs[32,39]. These beliefs focused on the way that individuals described their understanding of stress as a phenomenon. One qualitative paper highlighted that individuals believe stress could be identified as being an aspect of their workplace (e.g., being overworked), a response (e.g., feeling anxious), or a response specifically due to an aspect of the workplace (e.g., feeling anxious because of being overworked)[39]. Another study highlighted that people hold beliefs that the nature of stress changes as a function of age, such that some individuals believe that how they identify stress may be different in the future to how they identify stress now[32]. Only one of these studies examined the influence of these beliefs on stress-related consequences, but it was found that these beliefs were unrelated to the level of stress people reported experiencing at both an objective and subjective level[32]. Neither study explored the role of covariates.

Studies discussing Cause-related stress beliefs focused on sources of general occupational stress[13,39]. Neither study explored how these beliefs influence the stress response nor the role of covariates.

Consequence-related stress beliefs was the most researched representation. There is consistent evidence that consequence-related beliefs influence how information is interpreted from stressful situations[11,27,31,36,37]. Collectively, these studies suggest that the Consequence-related stress beliefs may be influencing how a broad range of information is interpreted. However, there is some variation in exactly what stress beliefs appear to be influencing from study to study. For example, Kilby and Sherman[36] found evidence that, after controlling for relevant covariates, Consequence-related stress beliefs bias how challenging a stressful situation is perceived to be, but this finding was not replicated by Crum et al. [27]. Several studies found a cross-sectional association between Consequence-related stress beliefs and trait perceived stress[11,31,36], in cases where covariates were

included, this effect existed over and above covariates[11,36]. One study implementing a longitudinal design failed to find this association in a 6-8 week follow-up after controlling for covariates[10].

In relation to the association between consequence-related beliefs with health and behavioral outcomes, stress beliefs appear to function as self-fulfilling prophecies. Specifically, study participants generally reported experiencing consequences of stress that are in alignment with their own beliefs about the consequences of stress[10,11,20,27,29–31,34,35,38]. One cross-sectional study found that Consequence-related stress beliefs were not directly related to psychological wellbeing, but instead were indirectly related through proactive coping and somatic complaints[31]. Moreover, it appears that the association between beliefs and behavioral and health outcomes only holds for negative Consequence-related stress beliefs, as all three studies that examined the relationship between positive Consequence-related stress beliefs and mental and physical health consequences failed to find evidence to support this relationship[10,29,30].

Two studies have looked at the effect of manipulating beliefs about general Consequence-related stress beliefs[11,27] and found that manipulations promoting positive beliefs via a priming video produce changes in both how information is interpreted (in the context of attentional biases towards happy faces)[27] as well as behavioral and health outcomes (regarding affect and work performance)[11]. Therefore, beliefs about the consequences of stress appear to be a targetable category of belief for interventions that could produce meaningful changes.

There were six studies exploring beliefs about the way individuals can control or respond to feelings of stress[10,13,28,30,33,39]. This category encapsulates beliefs about the level of control one has over stress[10,13,30,33,39] and whether one believes they either have the capacity to cope or if coping will be effective[13,28]. One study documented a cultural

divide in how individuals perceive their control over stress, with those of an Eastern background perceiving more control than those of a Western background[33]. One study demonstrated that beliefs about the level of control itself, after controlling for covariates, appear to be unrelated to perceived stress levels[10] or somatic complaints[30] at a 12-week follow-up. Another study found that believing that you can control your stress does appear to be associated with a lower dependence on at least one health-endangering coping strategy (i.e., smoking)[28].

Discussion

This scoping review systematically synthesized the research on different stress beliefs and their relationships with health and behavior. The CSM was used as a framework to guide this synthesis as it provides a well-established and commonly used taxonomy of five categories of beliefs about health and illness cues referred to as representations. This review found evidence of stress beliefs within four of the five categories (Identity, Cause, Consequence, and Control). However, there were no papers discussing Timeline-based stress beliefs, representing a category of beliefs yet to be explored.

One possible reason for the omission of Timeline-based stress beliefs could be due to the absence of a study that aims to identify the types of stress beliefs held by a general population. As such, most studies investigated stress beliefs that were not selected based upon prior empirical research or theoretical frameworks. This scoping review identified only one high quality qualitative study that specifically aimed to identify people's beliefs about stress within the workplace[39]. However, while beliefs about stress in the workplace may generalize to other stressful situations, the question remains whether there are other beliefs that are held generally about stress. Given that there could be any number of stress beliefs, and that beliefs do not need to agree with the scientific understanding of stress[14], further

qualitative work may supplement our understanding of what stress beliefs are commonly held by the general public.

Across the four stress-related CSM representation categories where research had been conducted, studies assessing the relationship of stress beliefs with behavioral responses and health outcomes generally reported that the way beliefs influence stress-related health and behavioral outcomes mimic the beliefs people hold about stress. For example, believing stress is a positive experience was associated with reports of more positive experiences of stress[27,36]. Similarly, believing stress was associated with poorer health or greater negative affect was associated with objectively poorer health[20,21], and greater experienced negative affect during times of stress[29]. Although correlational, this may suggest that expectations, in some way, could bias or predispose the individual to experiencing or interpreting their experience in a way that may be consistent with their beliefs. This notion is not only in alignment with the CSM[16] but also with a range of other theories such as the Self-fulfilling Prophecy[41], the Confirmation Bias[42], and Representativeness Heuristic[43]. All of these theories, in one way or another, argue that the way we process information from a situation is biased by our existing beliefs or understand of that situation. Although this evidence suggests associations between stress beliefs and health outcomes, it is unlikely that the beliefs directly influence the outcomes. The Transactional Model of Stress[2] would propose that the way in which a stressful situation is interpreted influences the way that we respond to that situation, and that maladaptive responses are associated with poorer health outcomes. This is also in alignment with the CSM which posits that our representations influence how we interpret cues relating to the aspect of health or illness in question, such as stress[16]. Thus, it may be that the associations between stress beliefs and health outcomes are mediated by how stressful situations are interpreted, and then how we respond to the situation based on that interpretation.

This review identified two psychometrically validated scales of stress beliefs, namely the Stress Mindset Measure[11] and the Beliefs About Stress Scale[10]. However, these measures do not assess all beliefs identified in this systematic review. For example, the Stress Mindset Measure focusses on beliefs about the consequences of stress but does not address Identity, Cause, Timeline, or Control. The Beliefs About Stress Scale improves upon the Stress Mindset Measure by also assessing beliefs about one's ability to control stress[10,30]. However, the Beliefs About Stress Scale does not measure beliefs relating to Identity, Cause, or Timeline. As such, there is a need to develop additional psychometrically valid measures to address all facets of stress-related beliefs.

Another need in this field is to explore factors that lead to the development of certain beliefs about stress. Although general frameworks regarding belief formation would argue that beliefs are a result of our context (e.g., socioeconomic status, social context, and culture), upbringing, and lived and vicarious experiences [14], no study has explored how these factors relate to stress belief formation. This is particularly important as there is a complex interplay between these factors and the experience of, and exposure to, stress (for a review, see [44]). Moreover, no study has considered whether such factors are better predictors than stress beliefs of individual differences in the responses made under stress. It could be argued that such factors may shape stress beliefs, and, in turn, those beliefs influence the responses made in response to the stressful situation. If so, then any association between these initial factors and the responses made under stress would become diminished if stress beliefs were changed. However, this is an empirical question that needs to be explored in future research.

If an intervention were to be built based upon stress beliefs, it must first be questioned whether there is a certain pattern of stress beliefs that maximally improve the stress response. The reviewed literature supports an exclusively positive pattern of stress belief as being associated with exclusively positive outcomes. However, such a pattern of

beliefs may not be optimal in the presence of a highly threatening stressor. Similarly, exclusively negative beliefs about stress may not be beneficial in all stressful situations. Rather, it may be that a balanced perspective is needed. This is yet another area for future research to explore.

Moreover, not all studies controlled for covariates in their analyses. This is a significant limitation in this field to address as there may be other factors underlying the stress response. In the case of stressor appraisals, one systematic review has highlighted that, amongst other variables, there is considerable evidence for the association between stressor appraisals with emotion regulation and neuroticism [45]. Future research exploring stress beliefs should consider including such variables, along with other variables of theoretical importance such as negative affective states, to assess whether stress beliefs hold a unique association with the stress response over and above these other documented factors.

Inherent in any scoping review is the possibility of reporting bias due to incomplete retrieval of research. While every precaution was taken to ensure all relevant studies were included, it is possible that studies used unique or uncommon phrasings to express the idea of stress beliefs, and thus may not have been retrieved in our systematic search. Nevertheless, the comprehensive set of keywords included in the search strategy should have identified most relevant studies. Further, this review adopted the CSM as a framework by which to evaluate the stress belief literature to date, as it is a commonly used model in research focusing on health beliefs and health outcomes. This highlighted areas yet to be explored in this literature. However, the use of alternative theories or models, such as the Health Belief Model, may have yielded different conclusions due to their use of different belief categories. Nevertheless, this is still the first study to utilize a framework to evaluate the stress belief literature. It is likely that, while alternative models may suggest the presence or absence of

different categories of beliefs, the finding that there is the potential for additional stress beliefs to exist is likely to be retained.

This synthesis has revealed that, while the quality of quantitative studies is moderately high (scoring an average of 3.8 out of 6), there were three criteria which the majority of studies failed to meet. The least met criterion was that studies did not test the hypothesized relationship between stress beliefs and their chosen outcome. Not only was this the least met quality criterion, it is also one of the most important for furthering the theoretical understanding of stress beliefs. Additionally, most studies failed to use established stress belief measures or a longitudinal design. Overcoming these limitations will further strengthen the quality of work in this field.

This is the first review to catalogue known stress beliefs using the CSM as a guiding framework. This review has proposed, based on both the CSM and the synthesized evidence of the review, that stress beliefs may influence how information from stressful situations is interpreted, which in turn influences the behavioral responses to stress and the health consequences related therein. This is an important theoretical development in the stress belief literature as it provides a model by which the influence of stress beliefs can be integrated into existing stress theory. Further, the influence of stress beliefs on behavioral responses and health consequences related to stress have not been examined for all identified stress beliefs, nor has the proposed pathway (stress beliefs influencing information processing which in turn influences behavior and health) been explored in depth by any one study. This review highlights the need for longitudinal research evaluating the relationship between all facets of stress beliefs with how information is interpreted from stressful situations, the behavioral responses to that stressful situation, and the health consequences that follow.

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Chapter 5 – Qualitatively Reported Beliefs About Stress

As noted in the systematic review of stress beliefs in Chapter 4, not all known stress beliefs were included in the Stress Mindset Measure, with the selected items focussing exclusively on consequence-related beliefs, ignoring other categories. Moreover, there was a lack of research exploring cause-, identity-, and timeline-related stress beliefs. Finally, the review highlighted a lack of qualitative research exploring beliefs about stress in the most general sense. As such, this chapter reports on a qualitative study prepared for the *Journal of Health Psychology* designed to identify commonly held beliefs about stress. The ethics approval letter for this study can be found in Appendices A.5 and A.6. The measures used in this study are all reported in-text.

How do you think about stress?

A qualitative analysis of beliefs about stress

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Abstract

This qualitative study aimed to identify common stress beliefs. Undergraduate Psychology students ($N = 35$) completed semi-structured interviews discussing the sensations, causes, purpose, valence, consequences, control, and timeline of stress. Interviews were analyzed via double-coded thematic analysis employing a latent, inductive, and realist framework. Five themes (Cognition, Emotion, Physical health, Interpersonal relations, and Behavior) and 17 subthemes. Themes and subthemes were validated in a Delphi study of experts in stress research ($N = 14$). Many of these identified beliefs have not been incorporated into current measures of stress beliefs, suggesting the need for new approaches to measuring this construct.

Keywords: stress, beliefs, qualitative, interviews, thematic analysis

Introduction

The experience of stress results in health benefits (e.g., increased immune cell count or increased metabolism) for some individuals, yet for others the stress experience leads to detriments in health in similar domains as those experiencing benefits (Lupien et al., 2007, 2009; Penley et al., 2002; Schneiderman et al., 2005). In response to this, research has demonstrated that a range of health and behavioural outcomes related to stress reflect the beliefs and expectations held about these outcomes. For example, believing stress has negative consequences for your health (compared to not holding this belief) has been associated with an increased 18-year risk of coronary incident and 8-year mortality rate for those experiencing high levels of stress over and above other health predictors (Keller et al., 2012; Nabi et al., 2013). One explanation for how stress beliefs may affect these outcomes is through lay beliefs, an individual's understanding of how the world works (Furnham, 1988).

Lay beliefs do not need to be factually accurate and are thought to function as a personal knowledge base by which an individual will interpret the world around them (Kilby and Sherman, 2018). It follows that lay beliefs held about stress (i.e., stress beliefs) should influence how individuals interpret stressful situations, thus providing a plausible explanation for why different people can make different interpretations of the same stressful situation. The Transactional Model of Stress, a long-standing theory of stress, outlines that interpretations of stressful situations (labelled 'appraisals') influence coping and health outcomes (Folkman and Lazarus, 1980; Lazarus and Folkman, 1984). It would be expected, then, that stress beliefs should demonstrate an indirect effect on health consequences and behavioural responses to stress through appraisals and evaluations of stress. If so, then the Transactional Model of Stress could be extended to include stress beliefs as a precursor to appraisals. However, research to date using existing measures of stress beliefs has not reliably demonstrated an association between stress beliefs and appraisals and evaluations of

stress, with one study finding only partial support for the association with appraisals (Kilby and Sherman, 2016), and two other studies failing to find any evidence of the association of stress beliefs with neither appraisals (Crum et al., 2017) nor subjective levels of perceived stress (Laferton et al., 2018). One reason for the lack of associations between stress beliefs and appraisal and perceived stress may be related to the scope of the existing measures of stress beliefs.

There are only two psychometrically validated measures of stress beliefs to date, the Stress Mindset Measure based on items generated from growth mindset research and assessing beliefs about the consequences of stress (Crum et al., 2013) and the Belief about Stress scale (Laferton et al., 2018), with items adapted from existing health belief scales assessing beliefs about the consequences of stress and perceived control over stress. Stress Mindset Measure items are based broadly upon growth mindset research (Crum et al., 2013), whereas items for the Beliefs About Stress Scale were adapted from a range of existing health belief scales (Laferton et al., 2018). A recent review of stress beliefs using the Common-Sense Model (CSM) of Self-Regulation of Health and Illness (Kilby et al., 2019) has highlighted the potential limitation that these existing measures do not reflect all identified stress beliefs, such as whether stress is an internal or external experience (Kinman and Jones, 2005) or due to chance (Kawanishi, 1995); whether stress changes over time (Thomae, 1981); and, regarding the causes of stress (Furnham, 1997; Kinman and Jones, 2005). Moreover, the CSM identifies categories of beliefs that are generally related to an aspect of health or illness. These span beliefs about how an individual identifies the aspect of health or illness, the cause and consequences of experiencing that aspect, as well as the timeline of symptoms (chronicity and whether symptoms ebb and flow), and whether the individual can do anything to control the situation (Leventhal et al., 2016). The review of stress beliefs identified that, while there were studies exploring beliefs about the consequence and control of stress, there

were far fewer studies exploring beliefs about the identity and cause of stress, and no study explored beliefs about the timeline of stress. This suggests that there may be yet-to-be identified beliefs about stress.

Moreover, for both existing measures, none of the items were generated from qualitative methodologies, potentially limiting the scope of stress beliefs assessed. Qualitative methodologies are well placed to identify the full range of stress beliefs as they allow participants to discuss stress in any way that they feel is most appropriate. Furthermore, there is a paucity of qualitative research in stress beliefs with only one known study, in this case assessing beliefs about stress within a single narrowly defined context, namely the workplace (Kinman and Jones, 2005). Qualitative methodologies are well placed to identify a broad range of stress beliefs without the prior assumptions imposed by existing measures.

This study aimed to qualitatively explore the beliefs people commonly hold about stress, in general, using semi-structured interviews inspired by the CSM (Leventhal et al., 2016) and the Antecedents, Behaviors, and Consequences (ABC) Model from Behavioral Analysis (Lehman and Geller, 2005). Although the CSM model includes stress as a possible belief about both the cause and consequence of illness, the model can also be applied to stress as an aspect of health. In which case the model would suggest the existence of beliefs about how individuals identify stress, the causes around stress, the timeline of stress, consequences of stress, and people's ability to control or respond to stress. The ABC Model (Lehman and Geller, 2005) further provides insight into the importance of evaluating the antecedents of the stress experience, the experience of stress itself, as well as the aftermath of the stress experience. Neither of the existing stress belief measures have taken this temporal approach to understanding stress as a process that unfolds over time, as the items focus on either the control or consequences associated with stress. This study employed a two-part approach. In Part 1, we conducted a standard semi-structured interview qualitative study. In Part 2, the

results of the qualitative study were subjected to expert verification via a two-step online Delphi panel with experts in stress research to achieve consensus across a diverse range of stress researchers on the appropriateness and completeness of the identified beliefs.

Method

Part One – Qualitative Study

Participants

Undergraduate psychology students ($N = 35$) attending Macquarie University in Sydney, Australia, were invited into the face-to-face 60-minute semi-structured interviews via an online research portal in exchange for course credit. Given the subjective nature of lay beliefs (Zlius et al., 2017), data saturation was not expected (Silverman, 2013). Instead, a sample size exceeding common recommendations for qualitative research was adopted (Braun and Clarke, 2006; Silverman, 2013). Ethical approval was granted by the Macquarie University Human Research Ethics Committee (reference number: 5201700422).

Procedure

Following online informed consent, two interviewers C.K. (Author 1) and a research intern (A.L.; RA3) conducted and audio-recorded all interviews (May to September 2017). Having two interviewers ensured increased response variance and reduced response biases associated with interviewer demographics. Key questions with proposed prompts and follow-up questions inspired by the CSM (Leventhal et al., 2016) and the ABC Model of Behavior (Lehman and Geller, 2005) prompted discussions (see Supplementary File for interview schedule). Tangential discussions were facilitated where relevant. Interviewers kept notes throughout the interview, providing a verbal summary of the interview content, allowing participants to clarify or add any points. Interview recordings were transcribed verbatim by

C.K (Author 1) and two research interns (K.K. and N.C.; RA1 and RA2). Pseudonyms masked all participants' identity.

Analytic Technique

Transcripts were analyzed using double-coded iterative line-by-line descriptive thematic analysis under a latent, inductive, and realist framework in NVivo (Braun and Clarke, 2006; Silverman, 2013), ensuring that coders read between the lines (latent) and identified themes were defined by these data (inductive), and that the content expressed by participants reflected the important aspects of the stress response for each participant (realist) (Braun and Clarke, 2006). Familiarisation and immersion were achieved through transcription. The first 10 interviews were examined for an initial set of codes. As new codes emerged, earlier transcripts were reassessed and recoded. Discrepancies between coders were resolved via discussion until consensus, as such inter-coder reliability statistics are not meaningful (Silverman, 2013). Following coding, transcript codes were examined for broader themes and subthemes (Braun and Clarke, 2006).

Part Two – Delphi panel

Participants

Email invitations were sent to researchers indexed in Scopus or Google Scholar with at least 10 publications or 50 citations in psychological stress. Researchers were ranked in terms of citation and publication count, and emails were sent in batches starting from the top-ranked researchers, until an acceptable sample size was achieved, as having too many participants in a Delphi study can undermine the ability to achieve meaningful consensus (Hsu, 2007). A total of 79 researchers were invited, of which 14 agreed to participate, a sample size within the recommended 10-20 range of participants for Delphi studies (Hsu, 2007). Participation was in exchange for AUD\$50 payable either to the participant or to a

preselected charity. Ethical approval was granted by the Macquarie University Human Research Ethics Committee (reference number: 5201828373210).

Procedure

In Step 1, Following online consent, Delphi participants read descriptions of each theme and subtheme, rating the importance as a stress belief on a 3-point scale (0 “not important”, 1 “somewhat important”, 2 “very important”), and provided optional open-response comments. Two months later, the participants were contacted to engage in Step 2 of the Delphi process in which any proposed changes based on Step 1 feedback, were sent back to the panel for their validation on the same 3-point scale. Open-response textboxes were also included.

Analytical Technique

At each step of the Delphi, consensus was defined as 80% agreement that a theme/subtheme was either ‘somewhat’ or ‘very’ important. If at least three-panel members rated any theme or subtheme as ‘not important’, then that theme or subtheme was included in Step 2 for the panel to vote on its removal. Further, all open responses were discussed between the authors, and any changes arising from these responses were also included in Step 2 for the panel vote. In Step 2, consensus was also defined as 80%. Any theme or subtheme not receiving 80% endorsement at Step 2 was removed.

Results

Part One – Qualitative Study

Of the 35 participants, 25 were female and the mean age was 22 years ($SD = 8$, range = 18-53). A total of 26 (73%) participants were Australian born, with the remaining born in China, India, Iran, Korea, Kuwait, South Africa, Sri Lanka, the UK, or Venezuela (one

participant each, 3%). Fourteen participants (40%) self-identified their ethnicity as Australian, 6 (17%) as Chinese, 4 (11%) as Indian, and 2 (5%) as Iranian. The remaining participants identified their ethnicity as either Greek, Italian, Korean, Latino, Maori, Pakistani, Samoan, Sri Lankan, or Turkish (1 participant each, 3%). For the majority of participants' ($N = 27$, 77%) their highest completed level of education was high school, with seven (20%) completing vocational training, and one (3%) completing a Bachelor's degree. Regarding employment, 15 participants (42%) were employed in casual positions, six (17%) held part-time jobs, three (9%) were self-employed, one (3%) held full-time employment, and 10 (20%) were students (otherwise not employed).

Theme: Cognition

All participants discussed some aspect regarding the relationship between stress and cognition. This theme encapsulates beliefs about how stress interacts with different thought processes. Some participants discussed the way that cognition can influence or cause sensations of stress:

If I am caught in really bad traffic, I get frustrated and I get stressed because I just start going over things that could happen in my head. (GR; Female, 19, Italian)

Others discussed how stress might affect their cognition:

Usually, I overthink things when I am stressed. So, if I am in a normal mood, I think things are fine. But if I'm stressed, I will think everything means something. (NS; Female, 18, Australian)

Subtheme: Working Memory. There were 22 participants (63%) who discussed how stress influences their ability to make decisions, tendencies to overthink, or an inability to think clearly.

I'll make less thoughtful decisions which will not be very good. (NF; Female, 18, Pakistani)

Mentally, not being able to have rational thoughts and have a structured logical way of thinking. (QN; Female, 30, Australian)

In contrast, some participants discussed how stress increased their focus.

There have been times where I have been stressed, but I have had to really concentrate on what I am doing to get it done. Like, say it was an assignment, I know I have to finish this. Even though it is under time pressure, I know that if I finish it, I'll be sweet, so I'll be totally zoned in on what I am doing ... [another example of] Fully zoned in would be at work. There was a lot of stuff going on and I was fully zoned in on what I had to do so I could get it done and move on. (KU; Male, 19, Latino)

Subtheme: Meaning. Beliefs around the subtheme of meaning were discussed by 23 participants (66%) referring to the meaning placed on their feeling of stress. This subtheme includes the way stress influences an individual's ability to perspective take or to re-evaluate a situation, the idea that stress is an alarm to something that needs your attention or that highlights something you care about:

When you're not stressed, you kind of just think 'I'm just going to do it, it doesn't matter'. But when you are stressed, it puts things into perspective a bit more than it would if you were relaxed. (AU; Female, 18, Chinese)

But [stress is] positive to the extent that if you stress about something, then you know that you care about it ... If I am stressing about a friend, it means that I really care about that friend.

(FY; Male, 20, Chinese)

Subtheme: Focusing on the Self. Four participants (9%) discussed beliefs about focusing on the self. Here, stress was thought to affect their ability to tend to others needs because they felt like they had to tend to their own needs; tend to their feeling of stress:

Stress makes it harder for me to help someone else up, because I feel like I need to get myself together first. Like, I am not in a position to help, although I could, I very much could. (AK;

Female, 22, Samoan)

I think [stress] makes me more selfish as a person. I think, let's say, family or my boyfriend or my friends; there have been times where they have needed emotional support, but if I am stressed, I feel like I am less able to provide that for them because I think I am just so focused on alleviating my stress. I just become more about me, I think, which is annoying. But at the time, I just feel like it is necessary, and I couldn't possibly devote time or energy to anything else, really. (HI; Female, 22, Maori)

Subtheme: Negative Thoughts. For 25 participants (71%), stress was associated with thought intrusion or rumination. Here, participants spoke about how thoughts about past stressful situations may unwillingly intrude into their stream of thoughts:

Even if you are thinking about something else, then you are like 'Oh no, I have to do that assignment tomorrow'. (IX; Female, 19, Australian)

Others discussed how they may struggle to stop thinking about a stressful situation after it has ceased, and that this can lead to experiencing the stress of the situation again:

It's just the fact that you just keep replaying the events over again, and feeling a little bit stressed about that event even though that event has gone, it's already gone. (JH; Male, 20, Indian)

Subtheme: Time. All participants raised the idea that stress and time are related with each other. There was talk of how stress changes one's perception of time, such as speeding up the sensation of time:

I kind of go into overdrive, so if I need to get something done and I am stressed, everything goes really fast. (QN; Female, 30, Australian)

Others discussed how a lack of time, being overwhelmed, or how the time until a looming deadline approaches can increase sensations of stress:

It [stress] has a slow kind of buildup, and the last few days [before a deadline] it like reaches its peak at a much faster rate. (EV; Female, 18, Indian)

Feelings of being overwhelmed come with stress. Feeling that you cannot do a task in time, that you need to get completed. (ML; Female, 18, Chinese)

Some spoke about how they believed stress was present all the time, in that, there was always a sensation of mild stress that was waiting to escalate.

I always have something on my mind that makes me a little bit stressed, it just varies as to how much it affects me. (GR; Female, 19, Italian)

Others described how, rather than always being present, stress could come and go throughout one's life:

I think there have been times in my life that have been characterized by a lot of stress and pressure ... and then there have been other periods where I have learnt that letting go of those insecurities, that if I am not in control, then it doesn't mean that it's chaos. There have

been periods of that where I have been able to let go and enjoy that I don't know what's going on. (DR; Female, 18, Greek)

Subtheme: Uncertainty. Twenty-two participants (63%) described situations that are perceived as being unstable or in states of change as being antecedents for stress. One participant described a key source of her stress being around “coping with change” that had arisen in “workload, postcode [location of residence], relationship status, health, and finances” (BP; Female, 37, Australian). Others described stress as arising from periods of uncertainty:

It [stress] is just like, worrying about the consequences. Like, worrying about the future; what's going to happen. Not being sure. (AU; Female, 18, Chinese)

Theme: Emotion

Almost all participants ($N=33$; 94%) described stress as being related to emotions in some way. In some cases, emotion was seen as an antecedent to stress “If you're overthinking things and you're a little bit anxious about what may or may not happen, that in itself becomes stressful” (RD; Female, 49, Australian), for others emotion was a part of the stress response “I get frustrated, and I get angry with small stuff because that's the natural behaviour of people when they are stressed” (LG; Female, 20, Korean), but for some it was a consequence of experiencing stress “It's definitely because of the stress that I feel so good after it [performing on stage]” (JH; Male, 20, Indian). There were two subthemes of emotion, the valence or the actual emotion felt, and how emotions may moderate the stress response.

Subtheme: Valence. There were 33 descriptions (94%) of stress being associated with negative emotions such as anxiety, anger, sadness, irritability, jealousy, panic, and discomfort:

Usually, when I'm stressed, I would be under pressure, panic, feeling uncomfortable, uneasy. It's a very discomfoting feeling. (GZ; Female, 18, Turkish)

My mood starts to change a little bit as well. I'll get a little bit angry and a little bit snappy with my family and my friends. (GR; Female, 19, Italian)

However, positive emotions such as calmness, excitement, and optimism were also associated with feelings of stress.

After performing, I'm on a high. I've got a lot of adrenaline going ... It's definitely because of the stress that I feel so good after performing. (JH; Male, 20, Indian)

Subtheme: Mood at the Time of Feeling Stressed. For two participants (5%), the way they experienced the sensation of stress depended on the mood they were in when the feeling of stress started:

When I'm just stressed, then I'm good; my work comes out ok. But if I'm stressed and not feeling so great, then obviously it's going to be a bit less. (AU; Female, 18, Chinese)

Theme: Interpersonal Factors

For 31 participants (89%), stress was a very interpersonal experience with stress affecting not only the desire to connect with other people but also the perceived impact of being around other people affected by stress. In some cases, other people were seen as a cause of stress "Sometimes other staff members will come into the workplace [stressed] and make it stressful ... If you are stressed, then everyone else is stressed" (RW; Female, 26, Australian) , but for other cases, other people were seen as one way to respond to stress "I would have to find someone to talk it through with, because that is what I do when I get stressed and panicky, I talk with someone. They talk me through it, and I just vent about it,

and then that is around about when most of the feeling [of being stressed] dissipates” (OO; Female, 18, Australian).

Subtheme: Support Networks. Fifteen people (43%) reported that other people could affect the way they experienced their stress. Some reported that stress promoted the desire to call on their support network:

[When stressed] I'll call up a friend or I'll call up relatives, even though they're overseas, and just like, check in ... They give me perspective, I would say, and the broader picture. By calling up a friend and hearing their stories and what's happening on their end helps me step back from my own pressures and anxiety and everything. (NF; Female, 18, Pakistani)

However, for others, it created a desire for solitude:

[when stressed] I become really agitated. I don't want to talk to any of my family. Whenever my family ask me questions, I try to avoid it because it might stir something up inside. (PE; Female, 18, Australian)

Subtheme: Other People's Stress. There were 29 reports (83%) of stress having contagious-like properties where participants found that they started to feel stressed when around other people who were stressed, even in situations that would typically not be conducive of stress:

[University exams] were stressful because everyone around me was panicking as well. It was that influence that just made me stressed out about it ... We [the participants friends] have a group chat and they would be sending questions and start panicking, and I'm just there like 'are you serious?', like I am out, and they are just ruining it. (GZ; Female, 18, Turkish)

Theme: Behavior

All participants described behaviour beliefs. These beliefs referred to ideas about how stress affected the ability to act or behave in everyday life. In some cases, these beliefs referred to how stress changed behaviour in general “It [stress] would motivate me to study harder or study more” (CT; Male, 18, Chinese), but in other cases beliefs referred to how the individual behaviorally responds to stress “To alleviate or to take my mind off stress I clean. You can turn the vacuum cleaner on and frown out any other noise, it is fantastic, it is physical, and you are doing something constructive” (RD; Female, 49, Australian). Beliefs in this theme centred around three subthemes: performance, confidence, and coping efficacy.

Subtheme: Performance. This subtheme represents views about how stress affects motivation and productivity and was reported by 31 participants (89%). For the most part, stress was seen as positively improving both of these domains:

I do everything faster. I think stress is something that forces me to do something faster. (MB; Male, 21, Chinese)

It [stress] makes people more motivated and to be more focused on things. (LG; Female, 20, Korean)

Subtheme: Confidence. For three (7%) participants, the feeling of stress altered how confident they felt in their ability to perform.

In some ways, stress is really bad because it makes you feel like you are going to do worse than you really are. (AU; Female, 18, Chinese)

Subtheme: Coping Efficacy. Thirty-four participants (97%) expressed views about how they perceived their ability to cope with stressful situations. Some discussed the ritualistic use of the same coping strategy:

I tend to sleep a lot, because I want to forget about the things [causing the stress], so I will sleep a lot. I will go to sleep for 13 to 14 hours if I get really stressed because I want to forget about it. (LG; Female, 20, Korean)

Many participants spoke about using multiple coping strategies, such as emotion-focused coping strategies during stressful times followed by the use of problem-focused coping strategies. It was suggested that the emotion-focused coping strategies helped to alleviate intense negative emotions that might be preventing the individual from working through a stressful situation:

I'll try and sort of calm down first, and then just try to get as much done as I can. (ML; Female, 18, Chinese)

I try and busy myself with an activity that would be a physical activity, maybe some music to go with it, because it gives me time to think. It gives me time to calm down and to reassess or evaluate the situation and then readdress it. (RD; Female, 49, Australian)

Some participants described beliefs around whether the sensation of stress or the stimulus eliciting the sensation of stress, could be controlled:

Stress only builds if there's no circumstantial evidence that you are not getting out of that situation any time soon ... If you can't change the situation or you can't improve the situation. (BP; Female, 37, Australian)

As soon as I'm stressed, I know that the stress is caused by something other than myself, so I attribute that to an external, rather than an internal, kind of expression. (IL; Male, 30, Chinese)

Theme: Physical Health

All participants described some physical health consequence of stress. Both the nature of the physical health and whether it was a good or bad consequence varied greatly from person to person. Physical consequences included changes in appetite (increased and decreased), sleeping patterns (increased and decreased), heart rate (increase), body temperature (increase), and feelings of exhaustion/adrenaline, stomach cramps, nausea, dry skin, headaches, shortness of breath, sweating, and acne/warts. In some cases, changes to habits such as eating and sleeping were thought to be due to a shift in attention either towards or away from the cause of the stressful situation.

I notice that there were times when I just don't want to eat. Like, normally, I'm one of those people who has to eat every few hours. I'm not the sort of person who can go for 3 meals a day, I have a crazy appetite. So, when I'm stressed, all that gets cut out, and I might only have 2 meals a day ... I guess, I just don't feel like that's my priority, there's no desire to eat because I'm so focused on other things. (DR; Female, 18, Greek)

I can feel my physical body temperature rise [when stressed]. It is really obvious to me. (IL; Male, 30, Chinese)

In some cases, there was conflict around the sorts of physical consequences associated with stress. Here for one participant, stress debilitates energy levels, but simultaneously promote one's motivation to act:

I feel like stress tires me out a lot, like, I feel very drained when I'm stressed. But I feel an innate urge in me to be active, so it's like this conflict with being tired but also being productive. (EV; Female, 18, Indian)

Part 2 – Delphi panel

Experts (mean age 48 years, SD = 10 years) had a mean of 22 years in stress research (SD = 9 years). One (7.1%) expert was an Assistant Professor, one (7.1%) held the title of

Doctor, four (28.5%) were Associate Professors, one (7.1%) was a Research Professor, and seven (50%) held full Professorships. Experts primarily came from the USA ($N = 8$; 57.1%), followed by the UK ($N = 2$; 14.2%). Germany, Hong Kong, Norway, and Switzerland were each represented by one expert (7.1%).

The Delphi achieved consensus in the first iteration. All themes received 100% endorsement (i.e., no expert labelled a category as not important). All subthemes received at least 80% endorsement. Of the 13 subthemes, eight (62%) were primarily rated as ‘very important’, four (31%) were equally rated as either very important or somewhat important. Only one subcategory (confidence; 7%) was primarily rated as ‘somewhat important’. No new beliefs were offered in the free responses.

Discussion

This study identified five major themes of stress beliefs across 13 subthemes. Collectively, these beliefs suggest that people conceptualise stress as a change in the way their body functions in terms of mental, emotional, and physical capacities. This appears to hold for the antecedents of, behavioural responses to, and consequences of stress. All previously documented stress beliefs were identified (Crum et al., 2013; Daniels et al., 2006; Febles and Ogden, 2005; Furnham, 1997; Kawanishi, 1995; Keller et al., 2013; Kinman and Jones, 2005; Laferton et al., 2018; Nabi et al., 2013; Parker et al., 2011; Shadel and Mermelstein, 1993; Thomae, 1981). Importantly, this study identified several previously undocumented stress beliefs (e.g., cognition, interpersonal relations) going beyond the current emphasis on stress belief consequences (Crum et al., 2013; Laferton et al., 2018) and control (Laferton et al., 2018).

This is the first qualitative study to explore general beliefs about stress outside of a specific context, such as the workplace (Kinman and Jones, 2005). This study has identified

beliefs not-yet-identified in the stress literature, such as beliefs about stress and working memory, focusing on the self, time, uncertainty, and interpersonal relations. Moreover, the findings of this paper have highlighted beliefs related to the timeline category from the CSM that have not previously been identified (Kilby et al., 2019). All participants reported beliefs about stress and time. Moreover, the types of beliefs identified relating to stress fit nicely with the two concepts of timeline described by the CSM; namely chronicity, with some participants reporting there is always some lingering amount of stress, and the ebb and flow of stress with others reporting that there are periods in life that are categorised as being more or less stressful than others. With no study previously exploring timeline-based beliefs about stress, this demonstrates a new area of stress beliefs that could be crucial in future work.

Another category of beliefs from the CSM highlighted as being under-researched in Kilby et al. (2019) was beliefs about how people identify stress. This study has documented a range of ways in which people believe they identify the sensation of stress including through the meaning they place on stress, changes in perceptions of time as a marker of stress, and stress as an emotion. This further extends on our understanding of how people conceptualise the notion of stress.

The use of the ABC model (Lehman and Geller, 2005) allowed for the identification for general antecedents, or causes, of stress. This study has identified general beliefs about negative thoughts, time, uncertainty, emotion, and other people's stress can all cause an individual feelings of stress. This further supports the findings of Kilby et al. (2019) that there may have been yet-to-be-identified beliefs in the literature.

These findings have important implications for the measurement of stress beliefs as there is a need for measures of stress beliefs to better reflect this full range of these beliefs. For example, in this study stress and cognition beliefs were a complex and common category

identified by participants, and yet existing measures (Crum et al., 2013; Laferton et al., 2018) do not tap into these beliefs.

Participants in Part 1 of this study represented a range of ages, gender, and ethnicity, despite all being recruited from a single Undergraduate Psychology student research pool. Therefore, the findings of this qualitative elicitation research review should be further evaluated and confirmed using a general community-based sample. Additionally, we did not report on context-specific beliefs reported by participants, such as which specific stressors made participants feel stressful, or specific coping strategies utilised in response to specific stressors, as they were tangential to the aims of the paper.

Conclusion

This study has documented a wide range of beliefs about stress and highlighted the complexities therein. Beliefs about stress encompass not only how we identify when we are feeling stressed, but also what can cause or modulate the stress response, the way we behave or respond to stress, and the consequences associated with stress. These findings suggest that more comprehensive measures of stress beliefs are needed in order to reflect the broader range of stress beliefs identified.

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Chapter 6 – The Subjective Thoughts REgarding Stress Scale (STRESS)

This chapter contains a 4-study paper prepared for the Journal of Personality and Social Psychology reporting on the development and validation of a new measure for stress beliefs, the Subjective Thoughts Regarding Stress Scale (STRESS). Study 1 contains the generation and piloting of the scale items. Study 2 reports on the exploratory factor analysis and concurrent validity. Study 3 outlines the results of the confirmatory factor analysis, convergent and divergent validity, and replication of the concurrent validity found in Study 2. Study 4 assesses the predictive validity with test-retest reliability of the newly developed scale. The predictive validity in Study 4 involved the recreation of the stress induction study reported in Chapter 3 using the new scale. It was decided that this paradigm was best suited for determining predictive validity as it was by this paradigm that we deemed the previous measure unfit. The ethics approval letters for the studies in this chapter can be found in Appendix A.2 and A.4. The measures used in the studies in this chapter can be found in Appendices B.6 to B.17. The Online Supplemental A containing the inter-item correlations between all items of the STRESS can be found in Appendix C. The final version of the STRESS can be found in Appendix D. American English and APA formatting is used throughout in alignment with journal guidelines.

Believing is seeing:

Development and validation of the STRESS (Subjective Thoughts REGARDing Stress Scale)

for measuring stress beliefs

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Abstract

With growing interest in the relationship between stress beliefs, the stress response, and health, there is a need for a rigorously developed stress belief scale. The absence of such a scale has prevented the stress belief research from demonstrating an association between stress beliefs and stressor appraisals – the theoretical link between stress beliefs and the stress response. This paper addresses this gap by rigorously developing a new stress belief scale, the Subjective Thoughts REgarding Stress Scale (STRESS). The STRESS initially contained 78 Likert-type items assessing beliefs about stress and cognition, emotion, interpersonal relations, and behaviour, and a checklist containing 44 physical sensations. In Study 1, the Likert-type items of the STRESS were piloted on an international online sample ($N = 107$), highlighting that all items were commonly held beliefs; no new beliefs were suggested. Study 2, utilizing an exploratory factor analysis ($N = 419$), reduced the Likert-type items of the STRESS to 19 items over three factors (beliefs about the consequences of stress, interpersonal relations in stress, and coping efficacy) which demonstrated acceptable construct validity and internal reliability. Study 3 replicated this factor structure in confirmatory factor analysis ($N = 300$) and demonstrated acceptable levels of convergent and divergent reliability. Study 4 ($N = 137$) demonstrated predictive validity with stressor appraisals and acceptable test-retest reliability over two weeks. The STRESS is the first stress belief scale to demonstrate predictive validity with stressor appraisals, suggesting that the STRESS addresses shortcomings of existing stress belief scales.

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Almost all individuals will experience stress at some point in their lives, which is reflected by a range of generic measures of trait and state levels of perceived stress (e.g., Cohen, Kamarck, & Mermelstein, 1983; Gil et al., 2005; Kohn & Macdonald, 1992). Despite stress being such a common experience, this construct demonstrates complex effects, with evidence that stress can lead to negative and positive outcomes, often in the same domains. For example, the effects of stress on attention (Moore, Vine, Wilson, & Freeman, 2015; Vine et al., 2015), memory (Pedraza et al., 2016), physical health (Lupien, Maheu, Tu, Fiocco, & Schramek, 2007; Schneiderman, Ironson, & Siegel, 2005), and mental health (Shallcross, Troy, & Mauss, 2015) can be both facilitatory and detrimental to wellbeing. Understanding possible causes of these differences may help inform the development of appropriate interventions to enable individuals to minimize the negative impact of experiencing stress on their health while maximizing the positive gains that experiencing stress may offer.

Stress, as defined by both the Cognitive Activation Theory of Stress (Ursin & Eriksen, 2010) and the Transactional Model of Stress (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Lazarus & Folkman, 1984), encapsulates four distinct components: i) the stress stimulus or stressor – the situation or event that is initiating a stress response in the individual; ii) the stress experience or stressor appraisals – the subjective psychological and emotional processing and experience of information from the stress stimulus that may produce positive and/or negative emotions; iii) a general non-specific increase in physiological and psychological arousal with specific responses targeted at addressing the stress stimulus, also known as coping; and, iv) an automatic and nonconscious reappraisal process or feedback mechanism by which the experience and response to the stressor are moderated depending on changes in the stress stimulus. In both theoretical models, the specific responses to address stress stimuli are informed by how information from the stress stimuli is processed. Moreover, there are interindividual differences in how information is

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processed for any given stressful situation (Folkman et al., 1986; Gaab, Rohleder, Nater, & Ehler, 2005). These interindividual differences produce different specific responses to the stressful situation that can be maladaptive, and which in turn can prolong exposure to stress, promote health-endangering coping strategies (such as drinking alcohol or consuming high calorie foods) and feelings of helplessness and hopelessness in addressing the stress stimuli (Folkman et al., 1986; Lazarus & Folkman, 1984; Lipschitz, Paiva, Redding, Butterworth, & Prochaska, 2015; Ursin & Eriksen, 2007).

One construct that may help explain these interindividual differences in information processing is lay beliefs, specifically, beliefs about stress. Lay beliefs represent the personal explanations used by an individual to make sense of the world around them (Furnham, 1988; Kilby & Sherman, 2018). As such, people are more likely to interpret information in ways that agree with their existing lay beliefs, rather than contradicting the lay beliefs. These differences in how information is interpreted will then produce different behavioral responses to the environment (Denscombe, 1993). Applied to the context of stress, this would imply that an individual will be biased toward interpreting stressful situations in alignment with their personal beliefs about stress and that this bias results in different behavioral responses to the stressful situation. Given the already established link between information processing in stressful situations and coping (Bouchard, 2003; Folkman et al., 1986; Nicholls, Polman, & Levy, 2012), there is good reason to suspect that stress beliefs may also be implicated in the stress response.

Research into stress beliefs has been characterized by a lack of unity in measurement, with a range of study-specific unvalidated measures of stress beliefs being utilized (Kilby, Sherman, & Wuthrich, 2019a). To date, only two validated measures of stress beliefs have been developed, the Stress Mindset Measure (Crum, Salovey, & Achor, 2013) and the Beliefs About Stress Scale (Laferton, Stenzel, & Fischer, 2018). Both scales measure beliefs about

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the consequences of stress. The Beliefs About Stress Scale additionally measures beliefs about control over stress (Laferton et al., 2018). Predictive validity regarding physical and mental health outcomes has been demonstrated for both scales, with negative beliefs associated with adverse outcomes (e.g., somatic complaints), and positive beliefs mostly being associated with positive outcomes (e.g., utilising adaptive coping strategies; Crum, Akinola, Martin, & Fath, 2017; Crum et al., 2013; Fischer, Nater, & Laferton, 2016; Keech, Hagger, O'Callaghan, & Hamilton, 2018).

Although several studies have explored the relationship between stress beliefs with behavioral and physical stress-related outcomes, less is known about the relationship between stress beliefs and how information from stress stimuli is processed. This is a vital link given that how information from stressful situations is processed influences behavioral and physical stress outcomes (Folkman et al., 1986; Ursin & Eriksen, 2010), and that beliefs are generally thought to influence how we interpret information from our environment (Kilby & Sherman, 2018). One study, using the Stress Mindset Measure, found partial support for this association with more positive beliefs about the consequences of stress associated with making stronger challenge appraisals (a type of stress-related information processing) in a standardized stress induction (Kilby & Sherman, 2016). However, stress beliefs were not associated with threat appraisals, another kind of stress-related information processing (Kilby & Sherman, 2016). Other studies found no association between challenge and threat appraisals and stress mindset (Crum et al., 2017), and no predictive association between stress beliefs of university students at the beginning of the semester to their perceived stress levels during the end of semester exams (Laferton et al., 2018).

One possibility for the inconsistency on findings between these studies may be due to the limited range of beliefs that the two validated stress belief scales address (Crum et al., 2013; Laferton et al., 2018). Essentially, these scales are measuring lay beliefs, the

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individual's unique understanding of how the world works around them (Kilby & Sherman, 2018). To this extent, lay beliefs about stress do not need to adhere to scientific facts about stress; rather they represent the explanations an individual develops over their lifetime to account for their personal experience of stress (Furnham, 1988). However, a scoping review of stress belief research has highlighted that no stress belief measure, either the two validated or the 11 unvalidated measures, adequately reflects the range of stress beliefs empirically identified thus far (Kilby et al., 2019a). Moreover, utilizing the Common-Sense Model of Self-Regulation of Health and Illness as a guiding framework, the scoping review found that the majority of these approaches to measuring stress beliefs only focused on beliefs relating to the consequences of stress, with only two unvalidated measures assessing beliefs about the cause of stress, timeline of stress, or how stress is identified.

Additionally, a qualitative study (Kilby, Sherman, & Wuthrich, 2019b) revealed five broad themes of stress beliefs including beliefs about the relationship between stress and cognition (including stress and perceptions of time), emotion, behavior, interpersonal relations, and physical health (Kilby et al., 2019b). Almost all themes in this qualitative study included both cause and consequence beliefs (e.g., certain cognitions were associated with being a precursor to stress, with others being a consequence of stress). With the Stress Mindset Measure capturing only beliefs about consequences of stress (Crum et al., 2013) and the Beliefs About Stress Scale capturing consequences and control beliefs (Laferton et al., 2018), there is a need for a more comprehensive measure of stress beliefs reflecting the breadth of such beliefs.

In a sequence of four distinct studies, this research aimed to develop and validate a new, comprehensive stress belief scale, the Subjective Thoughts REGARDing Stress Scale (STRESS). Study 1 describes the item generation process. Study 2 applies an exploratory factor analysis for item reduction and identification of latent factors, providing initial support

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for the construct validity of the STRESS. Study 3 reports on a confirmatory factor analysis of the STRESS regarding the stability of the factor structure, and evidence for its convergent and divergent validity, and the replicability of the construct validity findings reported in Study 2. Study 4 reports on predictive validity and test-retest reliability of the STRESS using a standardized stress induction.

Study 1

Introduction

Based on prior qualitative and scoping review research into stress beliefs (Kilby et al., 2019a, 2019b) an initial set of 78 beliefs about stress and cognition, emotion, behavior, and interpersonal relations were identified. Six alternative wordings were written for each belief, three of which were reverse worded. Then through a process of elimination, the authors removed alternative wordings one by one based upon what was deemed the least representative wording until there was only one item remaining for each of the 78 beliefs. Selected items were balanced for forward and reverse wordings. The final selection of items was then presented to the coders and interviewers of the qualitative study (Kilby et al., 2019b) to ensure that the items and their wording reflected the full breadth of content of the qualitative study. The final set of items for the scale involved 21 cognition items (12 reverse coded), 19 emotion items (nine reverse coded), 18 behavior items (nine reverse coded), and 20 interpersonal relations items (10 reverse coded). A 6-point Likert-type scale was chosen for the STRESS.

Additionally, a checklist containing all aspects of physical wellbeing identified across the qualitative study and systematic review was developed to assess beliefs about stress and physical wellbeing. These were supplemented by additional aspects of physical wellbeing that were included in the Illness Perception Questionnaire (a commonly used scale that

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assesses how individuals conceptualize illnesses as per the Commonsense Model of Self-Regulation of Health and Illness; Weinman, Petrie, Moss-Morris, & Horne, 1996), but not identified in the interviews. This resulting in a total of 44 physical wellbeing items.

Table 1. Initial 78 items of the STRESS

Theme	Item	
Cognition	Stress allows me to help other people in need	
Cognition	It is harder for me to make decisions when I am stressed	R
Cognition	I make better decisions when under pressure	
Cognition	I am constantly analysing what is making me feel stressed	R
Cognition	I cannot think clearly when stressed	R
Cognition	I find it harder to remember things when I am stress	R
Cognition	I feel like I am narrow minded when I am stressed	R
Cognition	Stress helps me to see the bigger picture	
Cognition	Stress is an alert that I need to do something	
Cognition	I get stressed over little things	R
Cognition	I don't know why I stress	R
Cognition	A little stress is a good thing for me	
Cognition	Too much stress is a bad thing for me	R
Cognition	I think about what I could have done differently in past stressful situations	R
Cognition	I lose track of time when I am stressed	
Cognition	Time goes by much more slowly when I am stressed	R
Cognition	There are things that I can do to control my stress	
Cognition	When stressed, I feel like there is nothing I can do to change the situation	R
Cognition	Stress is all in my mind	
Cognition	I am surprised by the way stress affects me	R
Cognition	Being uncertain can make me feel stressed	
Emotion	Stress makes me anxious	R
Emotion	Being stressed does not make me feel nervous	
Emotion	I feel frustrated when I am stressed	R
Emotion	I do not act aggressively when I am under pressure	R
Emotion	I do not feel sad when I am stressed	
Emotion	I feel like crying when I am stressed	R
Emotion	I become very irritable when I am not on top of things	R
Emotion	I do not become short tempered when feeling stressed	
Emotion	I get envious of people who are not as stressed as I am	R
Emotion	I does not bother me if others are experiencing less stress than me	
Emotion	I feel calm when I am stressed	
Emotion	When stressed, I often feel a sense of panic	R
Emotion	I feel uncomfortable when stressed	R

Table 1 (cont). Initial 78 items of the STRESS

Theme	Item	
Emotion	I feel like my usual self when I am stressed	
Emotion	Stress makes me feel good	
Emotion	I do not mind feeling stressed	
Emotion	I always try to look at the positive side of my stress	
Emotion	I can only think about stress in negative ways	R
Emotion	When I'm in a good mood I respond to stress in a positive way	
Interpersonal Relations	When I am feeling stressed, there are people who can help me	
Interpersonal Relations	I wish I had someone to turn to when I am stressed (R)	R
Interpersonal Relations	Other people only make my stress worse	R
Interpersonal Relations	I know I have someone who can help me with my stress	
Interpersonal Relations	My friends do not understand my stress	R
Interpersonal Relations	Other people's stress does not bother me	
Interpersonal Relations	Being around other people who are stressed makes me feel stressed	R
Interpersonal Relations	I do not mind being in the same room as someone who is stressed	
Interpersonal Relations	I can't be around other people when they are stressed	R
Interpersonal Relations	I do not become stressed if I am around other stressed people	
Interpersonal Relations	I experience stress in the same way as other people	
Interpersonal Relations	Other people's stress is different to mine	R
Interpersonal Relations	My stress is the same as other people's stress	
Interpersonal Relations	Nobody feels stress like I do	R
Interpersonal Relations	My stress is unique to me	R
Interpersonal Relations	I tend to avoid people when I am stressed	R
Interpersonal Relations	I am comfortable around others when I am stressed	
Interpersonal Relations	I do not like socialising when I am stressed	R

Table 1 (cont). Initial 78 items of the STRESS

Theme	Item	
Interpersonal Relations	Stress does not affect my ability to be social	
Interpersonal Relations	I am happy to be around other people when I am stressed	
Behaviour	Stress inspires me to start new projects	
Behaviour	Stress stops me from starting new tasks	R
Behaviour	Stress helps me to be more productive	
Behaviour	I feel immobilised by stress	R
Behaviour	I do my best work when I'm under pressure	
Behaviour	My stress leads to positive outcomes	
Behaviour	Being stressed always ends badly	R
Behaviour	I am confident in my abilities when I am stressed	
Behaviour	I underestimate myself when I am stressed	R
Behaviour	Nothing I do helps me cope with my stress	R
Behaviour	I find it hard to wind down after being under pressure	R
Behaviour	There is always a way to respond when stressed	R
Behaviour	I change my coping strategies to match the situation	
Behaviour	I always cope the same way because it has worked in the past	R
Behaviour	I know how to deal with stressful situations	
Behaviour	I cannot cope with stress	R
Behaviour	I do lots of different things to cope with stress	
Behaviour	I can respond to stress in many different ways	
Physical Wellbeing Items		
Decreased appetite	Tense muscles	Sweating
Difficulties sleeping	Dry skin	Acne, warts, etc
Exhaustion	Skin peeling	Heavy breathing
Increased heart rate	Body shaking	Increased blood pressure
Increased body temperature	Headaches	Increased arousal
Upset stomach	Short of breath	Tiredness
Nausea	Red face	Increased hunger
Increased sickness	Increased health	Bruising
Loss of strength	Increased strength	Breathlessness
Fatigue	Stiff joints	Sore eyes
Dry mouth	Increased energy	Bleeding
		Decreased heart rate
		Decreased body temperature
		Weakened immune system
		Improved immune system
		Worsened digestion
		Improved digestion
		Aches and pains
		Hair loss
		Weight loss
		Dizziness
		Sores

Note. R = reverse worded

Method

Participants.

An online invitation was placed on psychology participant recruitment websites and related Facebook pages. A total of 107 participants self-enrolled into the study; a sample size far exceeding the recommended minimum of 20 participants for scale item piloting (Johanson & Brooks, 2009). All participants had to be at least 18 years old and residing within Australia, New Zealand, US, or the UK for reimbursement purposes. For their time, participants were put into a draw to win one gift card worth AUD\$100 (paid in the participant's local currency).

Procedure.

Following online consent, participants completed a demographics questionnaire and rated the 78 items of the scale for their relevance to the participant (descriptive of them, descriptive of the opposite of them, not descriptive of them at all). The 44-item checklist was not piloted as the checklist included short one- or two-word statements. Moreover, the absence of an aspect of physical wellbeing under stress would be just as meaningful as if it was present or absent, and therefore it would not be possible to apply the selected criteria for determining a common belief. Text boxes were provided at the end of the questionnaire for participants to provide general feedback (e.g., to suggest additional stress beliefs). The item pilot was approved by the Macquarie University University Human Research Ethics Committee (REF #5201700422).

Measures.

The STRESS.

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Participants categorized each of the 78 self-report items of the STRESS as either “This describes me”, “This describes the opposite of me”, “This does not describe me at all”, or “I do not understand this phrase” to assess the appropriateness and readability of each item.

Internal reliability was not calculated as each item was evaluated individually.

Descriptives.

Participants provided descriptive information on their age, country of residence, country of birth, gender, years of education, and the highest level of education (10 years, 12 years, vocational, Bachelor degree, Masters degree, or PhD).

Statistical Analysis

All analyses were conducted in SPSS version 25 (IBM, 2016). Univariate descriptives outlined sample characteristics. Items were deemed to be common stress beliefs if $\geq 50\%$ of participants indicated the item described them or the opposite of them. If $>20\%$ of participants indicated that they did not understand the item, then the item wording was revised. If $>50\%$ of participants said that an item did not describe them, then it was removed from the scale.

Results and Discussion

Sample characteristics are provided in Table 2. All 78 items received $>50\%$ endorsement as being descriptive either of the individual or the opposite of the individual. Therefore, no item was removed. Fewer than 20% of participants indicated that any item was difficult to understand and therefore the original wording for all items was retained. No new beliefs were suggested. General comments all contained positive feedback (e.g., “I think the phrases spanned a broad network of stress”); however, some participants suggested the scale was too long. This is addressed in the item reduction in Study 2. Given that this pilot contained many beliefs not included in prior validated stress belief scales (Crum et al., 2013;

Laferton et al., 2018) these results reinforce previous research (Kilby et al., 2019a, 2019b) suggesting the need to expand on the range of beliefs assessed by established scales.

Table 2. Sample characteristics for Study 1.

	<i>N</i>	%
Female	88	82
Country of Residence		
USA	89	83
Australia	15	14
UK	3	3
Country of Birth		
USA	80	75
Australia	13	12
UK	3	3
Mexico	3	3
Vietnam	2	2
Philippines	1	1
Germany	1	1
New Zealand	1	1
Bosnia	1	1
Russian	1	1
South Korea	1	1
Education		
10 years	1	1
12 years	58	54
Vocational Education	12	11
Bachelor's degree	28	26
Master's degree	8	8
PhD	0	0
Age (yrs); Mean(SD)	25(10)	

Study 2 – Exploratory Factor Analysis

Introduction

Following item generation and piloting of STRESS items in Study 1, we then conducted an item reduction process via exploratory factor analysis (EFA) and internal

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reliability analysis to achieve the most succinct comprehensive measure of stress beliefs (Tabachnick & Fidell, 2019). EFA also allowed the subscales to be identified (Field, 2013).

Method

Participants.

In alignment with exploratory factor analysis recommendations (Field, 2013; Tabachnick & Fidell, 2019), we sampled 300 participants from MTurk in exchange for USD\$3. Additionally, 133 first-year psychology students from an Australian University participated in the study in exchange for course credit. First-year students are a demographically different population to general MTurk users (Mortensen & Hughes, 2017), providing greater diversity of responses. All participants were at least 18 years of age.

Procedure.

Following online consent, participants completed a demographics survey, followed by the Stress Mindset Measure (Crum et al., 2013) the Beliefs About Stress Scale (Laferton et al., 2018), the STRESS, and the Perceived Stress Scale (Cohen et al., 1983). The stress scales were presented in a random order to counter-balance any priming effects between scales. The item reduction was approved by the Macquarie University University Human Research Ethics Committee (REF #5201800297).

Measures.

Stress Mindset Measure.

This 8-item measure assesses beliefs about the consequences of stress (Crum et al., 2013). Participants rate their agreement on items such as “Experiencing stress improves my health and vitality” on a 5-point Likert-type scale (0 “Strongly Agree” to 4 “Strongly Disagree”). Higher mean scores (range 0 to 4) represent stronger beliefs that stress produces

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positive consequences, whereas lower scores represent stronger beliefs that stress produces negative consequences. Internal reliability for this scale was acceptable in this study (Cronbach's $\alpha=.88$).

Beliefs About Stress Scale.

This scale measures the extent to which people hold positive, negative, and control-related beliefs about stress. Participants rate their agreement with all items on a 4-point Likert-type scale (1 “Completely Disagree” to 4 “Definitely Agree”) on items such as “Being stressed is, for me, a predominantly negative thing”. Items are summed such that higher scores represent a stronger endorsement in that particular subscale's belief. Scores range from 7 to 28 for the Negative beliefs subscale, 4 to 16 for the Positive beliefs subscale, and 3 to 12 for the Control subscale. Internal reliability in this study was acceptable for the Negative (Cronbach's $\alpha=.88$), Positive (Cronbach's $\alpha=.91$), and Control (Cronbach's $\alpha=.74$) beliefs subscales.

Perceived Stress Scale.

This scale captures the subjective level of stress participants believe they have experienced over the last month. Over 13 items, participants rate their agreement with statements such as “In the last month, how often have you felt that things were going your way?” on a 5-point Likert-type scale (0 “Very often” to 4 “Never”). Item scores are summed to produce a total score from 0 to 52 in which higher scores represent greater subjectively perceived levels of stress. Internal reliability in this study was acceptable (Cronbach's $\alpha=.90$).

The STRESS (see Study 1).

Demographics.

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Participants reported on their age, gender, country of residence, place of birth, self-reported ancestral ethnicity, the highest level of education, and employment status.

Attention Checkers.

Three attention checkers containing a direction for participants to follow, such as “If you are reading this, select 1 – Almost Never” were embedded in the survey. No attention checker was placed in the STRESS to prevent possible contamination effects in the factor analysis.

Statistical Analysis.

All analyses were conducted in SPSS version 25 (IBM, 2016). Participants who made two or more errors on the attention checkers were not included in the study for analysis. Descriptives outlined sample characteristics. ANOVAs and chi-squares were used (where appropriate) to compare MTurk and first-year students on all variables. Inter-item correlations for all 78 items of the STRESS were used to ensure all items held correlations between 0.30 and 0.70, and that negatively worded items were negatively correlated with positively worded items. These cut-offs were selected as correlations above 0.70 represent collinearity, and those below 0.30 represent a non-factorable item (Tabachnick & Fidell, 2019). Negatively worded items were then reverse-scored before being entered into the EFA.

EFA using a principle axis factoring extraction method with direct oblimin rotation was then conducted with the 78 items of the STRESS. An iterative approach was taken to item reduction. The determinant of the matrix, Barlett’s Sphericity test, and the Kaiser-Meyer-Olkin test were used to assess the factorability of each iteration. In each iteration, all items with communalities ≤ 0.40 or ≥ 0.80 , and those that held item loadings above .40 across two or more factors (i.e., that cross-loaded) were removed. This process was repeated until no further items needed to be removed. The number of factors to be extracted was determined

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via the Kaiser criterion, scree plot, and variance extraction. Following the EFA, Cronbach's internal reliability was calculated for all identified subscales with a cut-off of $\alpha \geq 0.70$ to represent an internally consistent subscale. Pearson's correlations were then used to explore construct validity with the Stress Mindset Measure, Beliefs About Stress Scale, and Perceived Stress Scale. Correlations between 0.30 and 0.80 were deemed evidence of construct validity. Cut-offs were chosen to ensure that the subscales of the STRESS were neither too different nor too similar to existing scales. The physical wellbeing items were not included in the factor analysis, but the five most and five least frequently selected wellbeing items are reported for descriptive purposes.

Results

Two MTurk participants failed the attention checkers (2 or more errors) and were removed from the study; their data were replaced with two additional participants. Fourteen first-year students failed the attention checkers and were also removed from the study. The characteristics of the final analyzable sample of 419 participants ($N_{\text{MTurk}} = 300$, 71.6%, $N_{\text{first year}} = 119$, 28.4%) are provided in Table 3. MTurk participants differed from the student sample in being older, and more likely to be male, more educated, in full-time employment or self-employed, identify as Caucasian, and born and residing within either USA or India. MTurk participants also reported lower perceived stress, more negative beliefs about stress on the Stress Mindset Measure, and more negative and less positive beliefs on the Beliefs About Stress Scale; albeit these differences were of a small magnitude and within one standard deviation. There were no between-sample differences in control beliefs on the Beliefs About Stress Scale.

Table 3. Sample characteristics for Study 2

	Whole		MTurk		Students		χ^2/t	<i>p</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Country of Residence							385.50	<.0005
Australia	93	23.8	1	0.3	92	100		
USA	246	62.9	246	82.3	0	0		
India	44	11.3	44	14.7	0	0		
Other	8	2.0	8	2.7	0	0		
Place of Birth							332.54	<.0005
Australia	70	17.9	0	0	70	76.1		
USA	244	62.4	244	81.6	0	0		
India	45	11.5	42	14.0	3	3.3		
Other	32	8.2	13	4.3	19	20.7		
Gender							26.70	<.0005
Male	205	52.4	178	59.5	27	29.3		
Female	186	47.6	121	40.5	65	70.7		
Highest Education							134.01	<.0005
High School	146	37.4	65	21.7	81	88.0		
College/Vocation	49	12.5	46	15.4	3	3.3		
Bachelor	148	37.9	142	47.5	6	6.5		
Masters	47	12.0	45	15.1	2	2.2		
PhD	1	0.3	1	0.3	0	0		
Employment							238.05	<.0005
Full time	215	55.0	210	70.2	5	5.4		
Part time	43	11.0	19	6.4	24	26.1		
Casual	48	12.3	3	1.0	45	48.9		
Self-employed	62	15.9	58	19.4	4	4.3		
Unemployed	23	5.9	9	3.0	14	15.2		
Mean(SD)								
Age	33(12)		38(10)		20(5)		23.92	<.0005
Perceived Stress	22.77(9.44)		21.28(9.62)		27.61(6.94)		-6.93	<.0005
Stress Mindset	1.51(0.77)		1.41(0.79)		1.82(0.63)		-5.08	<.0005
BASS - Positive	8.48(3.13)		8.13(3.12)		9.61(2.89)		-4.15	<.0005
BASS - Negative	20.98(4.44)		21.23(4.53)		20.16(4.02)		2.03	<.0005
BASS - Control	7.84(1.97)		7.83(2.02)		7.86(1.81)		-0.12	.333

Inter-item correlations (see Online Supplemental A) identified 11 items that held correlations above 0.70 with at least one other item. Four pairs of items shared high correlations. From each pair, the item with the simplest wording was retained. Two other items were strongly correlated with a third item, but not with each other; hence, the third item was removed. Overall, five items were removed from the pool of 78 due to high correlations. No item pairs were weakly correlated. The remaining 73 items were EFA. All negatively

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worded items demonstrated negative correlations with positively worded items prior to being reverse coded. In terms of the physical health checklist, the top five most endorsed beliefs about stress and physical health were: difficulty sleeping (336 participants endorsed this option, representing 80% of the sample); fatigue ($n=285$, 68%); increased heart rate ($n=265$, 63%); headaches ($n=263$, 96%); and, exhaustion ($n=258$, 62%).

In total, nine iterations of the EFA were needed to arrive at a final factor structure (see Table 4), with a resultant six-factor structure: Factor 1 (5 items) - beliefs about consequences of stress (e.g., “I find it harder to remember things when I am stressed”); Factor 2 (6 items) - beliefs about coping efficacy (e.g., “I do lots of different things to cope with stress”); Factor 3 (3 items) - beliefs about the uniqueness of an individual’s experience of stress in reference to other people (e.g., “Nobody feels stress like I do”); Factor 4 (4 items) - beliefs about being around other people who are stressed (e.g., “I do not mind being in the same room as someone who is stressed”); Factor 5 (4 items) – interactions with others when feeling stressed (e.g., “I do not like socializing when I am stressed”); and, Factor 6 (2 items) - social support beliefs (e.g., “When I am feeling stressed, there are people who can help me”). Factor 6 was labelled “support beliefs”.

Internal reliability was acceptable for Factor 1 (Cronbach’s $\alpha=.861$) and Factor 2 (Cronbach’s $\alpha=.852$). Given that Factors 3, 4, 5, and 6 concerned different aspects of interpersonal relations with stress, and that Factors 3 and 6 had a small number of items, we combined all of these items into a single factor, labelled “interpersonal relations beliefs”. The internal reliability was acceptable (Cronbach’s $\alpha=.820$), but was further improved by the removal of all but 8 items (Cronbach’s $\alpha=.867$). As such, the STRESS now contains 19 items over three stress beliefs subscales: Consequences (5 items), Coping Efficacy (6 items), and Interpersonal Relations (8 items). The reduced STRESS is described in Table 5.

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Pearson's correlations to assess construct validity are described in Table 6. The Consequence and Interpersonal relations subscales demonstrated acceptable construct validity ($0.30 \geq r \geq 0.80$) with the Stress Mindset Measure and all subscales of the Beliefs About Stress Scale. The Coping efficacy subscale only demonstrated acceptable construct validity with the Control beliefs subscale of the Beliefs About Stress Scale. Convergent validity was demonstrated for all subscales against the Perceived Stress Scale. Inter-factor correlations between the STRESS subscales revealed, as expected that these factors are weakly to moderately associated with each other.

Table 4. Results of each iteration of the exploratory factor analysis

	Factorability			Number of factors			Items removed		
	Determinant	Sphericity	KMO	Kaiser	Scree plot	Variance	Low	Low	Cross
Iteration				Criterion		extraction	communalities	loading	loading
First	1.22 E ⁻²¹	p < .0005	0.93	15 factors	4 or 7 factors	15 factors	9 items	12 items	2 items
Second	1.04 E ⁻¹⁵	p < .0005	0.93	10 factors	4 or 7 factors	7 factors	4 items	6 items	4 items
Third	1.61 E ⁻¹¹	p < .0005	0.92	8 factors	3 or 7 factors	7 factors	2 items	1 item	2 items
Fourth	3.00 E ⁻¹⁰	p < .0005	0.91	8 factors	3 or 6 factors	6 factors	1 item	0 items	0 items
Fifth	4.65 E ⁻¹⁰	p < .0005	0.91	7 factors	3 or 6 factors	6 factors	0 items	1 item	5 items
Sixth	4.62 E ⁻⁸	p < .0005	0.88	7 factors	3 or 6 factors	6 factors	0 items	0 items	2 items
Seventh	1.65 E ⁻⁷	p < .0005	0.88	7 factors	3 or 6 factors	6 factors	0 items	0 items	2 items
Eight	5.39 E ⁻⁷	p < .0005	0.88	6 factors	3 or 5 factors	5 factors	0 items	0 items	1 item
Ninth	2.98 E ⁻⁶	p < .0005	0.87	6 factors	6 factors	6 factors	0 items	0 items	0 items

Table 5. Reduced items for the STRESS

Item Number	Subscale	Item
1	Consequences	It is harder for me to make decisions when I am stressed
2	Consequences	I cannot think clearly when stressed
3	Consequences	I find it harder to remember things when I am stressed
4	Consequences	I feel immobilised by stress
5	Consequences	Being stressed always ends badly
6	Coping Efficacy	There are things that I can do to control my stress
7	Coping Efficacy	There is always a way to respond when stressed
8	Coping Efficacy	I change my coping strategies to match the situation
9	Coping Efficacy	I know how to deal with stressful situations
10	Coping Efficacy	I do lots of different things to cope with stress
11	Coping Efficacy	I can respond to stress in many different ways
12	Interpersonal Relations	Being around other people who are stressed makes me feel stressed
13	Interpersonal Relations	I do not mind being in the same room as someone who is stressed
14	Interpersonal Relations	I can't be around other people when they are stressed
15	Interpersonal Relations	I do not become stressed if I am around other stressed people
16	Interpersonal Relations	I tend to avoid people when I am stressed
17	Interpersonal Relations	I am comfortable around others when I am stressed
18	Interpersonal Relations	I do not like socialising when I am stressed
19	Interpersonal Relations	I am happy to be around other people when I am stressed

Table 6. Correlations for construct validity in Study 2

	Consequences	Coping Efficacy	Interpersonal Relations
STRESS Consequences	.386		
STRESS Coping Efficacy			
STRESS Interpersonal Relations	.555	.389	
Perceived Stress Scale	-.447	-.541	-.418
Stress Mindset Measure	.594	.280	.477
BASS Negative	-.679	-.254	-.600
BASS Positive	.520	.298	.436
BASS Control	.432	.641	.416

Note. All correlations significant at the $p < .0005$ level.

Discussion

The EFA, coupled with internal reliability analyses, allowed for the reduction of items from 78 items to 19. The Consequences and Interpersonal Relations subscales of the STRESS demonstrated construct validity with all other measures, but the Coping Efficacy subscale only demonstrated construct validity with scales related to control or coping with stress. No action was taken in response to this, as this highlights that the Coping Efficacy subscale targets coping specific aspects of stress. A confirmatory factor analysis is needed to confirm that the factor structure identified in this study holds in a separate sample. Furthermore, an assessment of convergent and divergent validity is needed across a broader range of variables related to stress.

Study 3 – Confirmatory Factor Analysis

The stability of the factor structure outlined in Study 2 was evaluated via confirmatory factor analysis (CFA) in a new sample. To provide additional evidence for convergent validity, the STRESS was compared to a range of constructs known to relate to stress: reappraisal as an emotion regulation strategy (Shallcross et al., 2015), resiliency (Windle, 2011), trait anxiety (Hemenover & Dienstbier, 1996), and neuroticism (Gallagher, 1990). The STRESS was also compared to religiosity and altruism to determine divergent validity. Religiosity and altruism were selected as these constructs should not necessarily relate to the beliefs about stress measured by the STRESS. The construct validity of the STRESS against the Stress Mindset Measure and the Beliefs About Stress Scale and the convergent validity with the Perceived Stress Scale was reassessed for replicability.

Therefore, it was hypothesized that all subscales of the STRESS would demonstrate weak-to-moderate ($.30 < r < .70$) correlations in a positive direction with reappraisal as an emotion

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regulation strategy and resiliency. A negative correlation of the same magnitude was expected between all subscales of the STRESS with neuroticism and trait anxiety. For divergent validity, it was expected that the correlation between the STRESS subscales with religiosity and altruism would be weaker and not greater than .30. It was expected that the STRESS would replicate the correlations from Study 2 with the Stress Mindset Measure, Beliefs About Stress Scale, and the Perceived Stress Scale.

Method

Participants

Based on the recommendation (Tabachnick & Fidell, 2019) that approximately 300 participants are required to sufficiently power a CFA, 300 participants from MTurk were recruited into this online study for USD\$3. Participants were all at least 18 years of age and did not participate in Study 2.

Procedure

Participants provided online consent, and then completed the demographics survey from Study 2, followed by the STRESS, the Perceived Stress Scale (Cohen et al., 1983), the Stress Mindset Measure (Crum et al., 2013), the Beliefs About Stress Scale (Laferton et al., 2018), the Emotion Regulation Questionnaire (Gross & John, 2003), the Brief Resilience Scale (Smith et al., 2008), the Trait Anxiety subscale of the State Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970), the Neuroticism subscale of the Mini International Personality Inventory Protocol (Donnellan, Oswald, Baird, & Lucas, 2006), the Self-Reported Altruism Scale (Rushton, Chrisjohn, & Fekken, 1981), and the Strength of Religious Faith Scale (Plante & Boccaccini, 1997), all in random order. All scales, except for the STRESS, contained one attention checker item. This study was approved by the Macquarie University Human Research Ethics Committee (REF #5201800297).

Materials Not Previously Described

Emotion Regulation Questionnaire

The 6-item reappraisal subscale of the Emotion Regulation Questionnaire (Gross & John, 2003) assessed self-reported levels of an individual's ability to change their emotions. Participants respond with their agreement to statements such as "I control my emotions by changing the way I think about the situation I'm in" on a 7-point Likert-type scale (1 "Strongly Disagree" to 7 "Strongly Agree"). Scores are averaged to produce scores from 1 to 7, where higher scores represent greater abilities to reappraise or suppress emotions. The internal reliability in this study was acceptable ($\alpha = 0.88$).

Brief Resilience Scale

This scale assessed participants' ability to return to life as usual following a stressful situation (Smith et al., 2008). Participants respond with their agreement to six statements such as "I tend to bounce back quickly after hard times" on a 5-point scale from 1 "Strongly Disagree" to 5 "Strongly Agree". Scores are averaged to create a score from 1 to 5, where higher scores represent greater levels of resiliency. This scale demonstrated acceptable internal reliability in this study ($\alpha = 0.94$).

State Trait Anxiety Inventory

The trait subscale of this inventory evaluated the level of anxiety an individual has self-reportedly experienced over the last week (Spielberger et al., 1970). Participants rate the extent to which they have experienced each of 20 statements such as "I feel nervous and restless" on a 4-point Likert-type scale from 1 "Not at all" to 4 "Very much". Scores are summed to produce a range from 20 to 80. Higher scores represent greater levels of trait anxiety. The scale demonstrated acceptable internal reliability in this study ($\alpha = 0.96$).

Mini IPIP

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The mini IPIP (Donnellan et al., 2006) is an abridged version of the larger IPIP and assesses the Big Five Personality domain with five subscales (four items each). The mini IPIP is correlated with both the full IPIP and the NEO-PI-R (Donnellan et al., 2006), and is advantageous over shorter scales, such as the Ten Item Personality Inventory as there are sufficient items to calculate internal reliability for each subscale, whereas shorter items often are too brief to do so (Herzberg & Brähler, 2006). Participants respond to 20 statements such as “I am the life of the party” on a 5-point scale (1 “Very inaccurate” to 5 “Very accurate”). Scores are averaged to produce a range of 1 to 5 where higher scores represent a stronger representation of that subscale’s trait. The Neuroticism subscale demonstrated acceptable levels of internal reliability in this study ($\alpha = 0.83$).

Self-Reported Altruism Scale

Over 20 items, participants answered items such as “I have offered my seat on a bus or train to a stranger who was standing” to measure self-reported levels of common altruistic acts (Rushton et al., 1981). Responses are made on 5-point Likert-type scales ranging from 1 “Never” to 5 “Always”. Scores are summed to produce scores from 20 to 100 where higher scores represent people who, at the self-report level, are more altruistic. This scale demonstrated acceptable internal reliability in this study ($\alpha = 0.93$).

Strength of Religious Faith Scale

This scale measured levels of religiosity over 10 items such as “I pray daily” for which participants rate their agreement on a 7-point Likert-type scale (1 “Strongly Disagree” to 7 “Strongly Agree”)(Plante & Boccaccini, 1997). Scores are summed to produce ranges from 10 to 70, where higher scores represent a greater strength of religiosity. This scale demonstrated acceptable internal reliability in this study ($\alpha = 0.99$).

Statistical Analysis

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Descriptive statistics outlined sample characteristics. Correlations were used to assess construct, convergent, and divergent validity. Descriptives and correlations were conducted in SPSS version 25 (IBM, 2016). Given that the study was overpowered for significance testing in correlations and given that external validity is assessed via the magnitude of Pearson's r irrespective of the correlation's significance, p -values are not interpreted.

The confirmatory factor analysis using a Robust Maximum Likelihood estimator was conducted in Mplus version 6 (Muthén & Muthén, 2011). The confirmatory factor analysis model assessed the 3-factor model of Study 2 and a single factor model to assess the appropriateness of a total score. The models were re-fit using modification indices to create inter-item correlations. Items in the 3-factor model with modification indices across factors were removed as this represented an item that cross-loaded. Akaike Index Criterion (AIC), Bayesian Index Criterion (BIC), and the adjusted Bayesian Index Criterion (BIC_{adj}) were used to compare the 3-factor and single-factor model fits. RMSEA, CFI, SRMR were used as fit indices in this study.

Results

The MTurk sample in this study was comparable to the MTurk sample obtained in Study 2. Only one participant made more than two errors on the attention checkers and was removed and replaced. The mean age was 38 years (SD = 10 years). Participants were primarily male, held a Bachelor's degree as their highest level of education, and worked full time. See Table 7 for all sample characteristics. The top five endorsed physical health beliefs were difficulty sleeping ($n=224$, 74%), headaches ($n=211$, 70%), tense muscles ($n=196$, 65%), increased heart rate ($n=192$, 64%), and increased blood pressure ($n=193$, 64%).

The CFA assessed the appropriateness of both a single factor model (assessing the appropriateness of using a total score for the scale) and the 3-factor model proposed in Study

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2. Table 8 contains all fit indices for each model, and Figures 1 and 2 contain graphical representations of each final model. The initial fit of both models was used to extract modification indices. The models were then refit and incorporated all modification indices. For the one-factor model, the modification indices suggested no items were to be removed, but that some items needed to be correlated. No further modifications to the single factor model were suggested. The single factor model fit poorly, suggesting that a total score for the STRESS is inappropriate.

Modification indices for the 3-factor model indicated that two items were cross-loading (one from the coping efficacy factor and one from the interpersonal relations factor); these were subsequently removed. Acceptable internal reliability levels were maintained after removing these items (α 's $> .84$). No further modifications were needed. The fit indices for the final 3-factor model were all acceptable. Furthermore, the AIC, BIC, and adjusted BIC indices were all smaller for the final 3-factor model than for the single-factor model, suggesting that the three-factor model is a better fit than the single-factor model.

Table 7. Sample characteristics for Study 3.

	Whole	
	<i>n</i>	%
Country of Residence		
America	216	72%
India	43	14%
Other	43	14%
Place of Birth		
America	254	84%
India	35	12%
Other	13	4%
Gender		
Male	162	54%
Female	140	46%
Highest Education		
High School	74	25%
College/Vocation	41	14%
Bachelor	143	46%
Master	41	14%
PhD	3	1%
Employment		
Full time	189	63%
Part time	37	12%
Casual	1	<1%
Self-employed	56	19%
Unemployed	19	6%
Mean(<i>SD</i>)		
Age	38.13 (10.73)	
STRESS		
Consequences	3.29 (1.19)	
Coping	4.18 (0.95)	
Interpersonal Relations	3.08 (1)	
Stress Mindset	1.28 (0.77)	
BASS		
Positive	21.44 (4.08)	
Negative	7.79 (2.12)	
Control	8.2 (3.05)	
Perceived Stress	21.65 (10.23)	
Reappraisal	4.96 (1.13)	
Resilience	3.19 (1.06)	
Trait Anxiety	43.21 (14.43)	
Neuroticism	2.48 (1.17)	
Altruism	56.61 (15.57)	
Religiosity	22.49 (10.92)	

Table 8. Fit indices for final models.

		RMSEA		CFI	SRMR	AIC	BIC	BIC(adj)
	Statistic	95%CI	<i>p</i>					
3-factor	.053	.041-.065	<.0005	.954	.062	15288.077	15540.386	15324.272
1-factor	.064	.053-.076	.023	.949	.049	16880.663	17303.652	16942.106

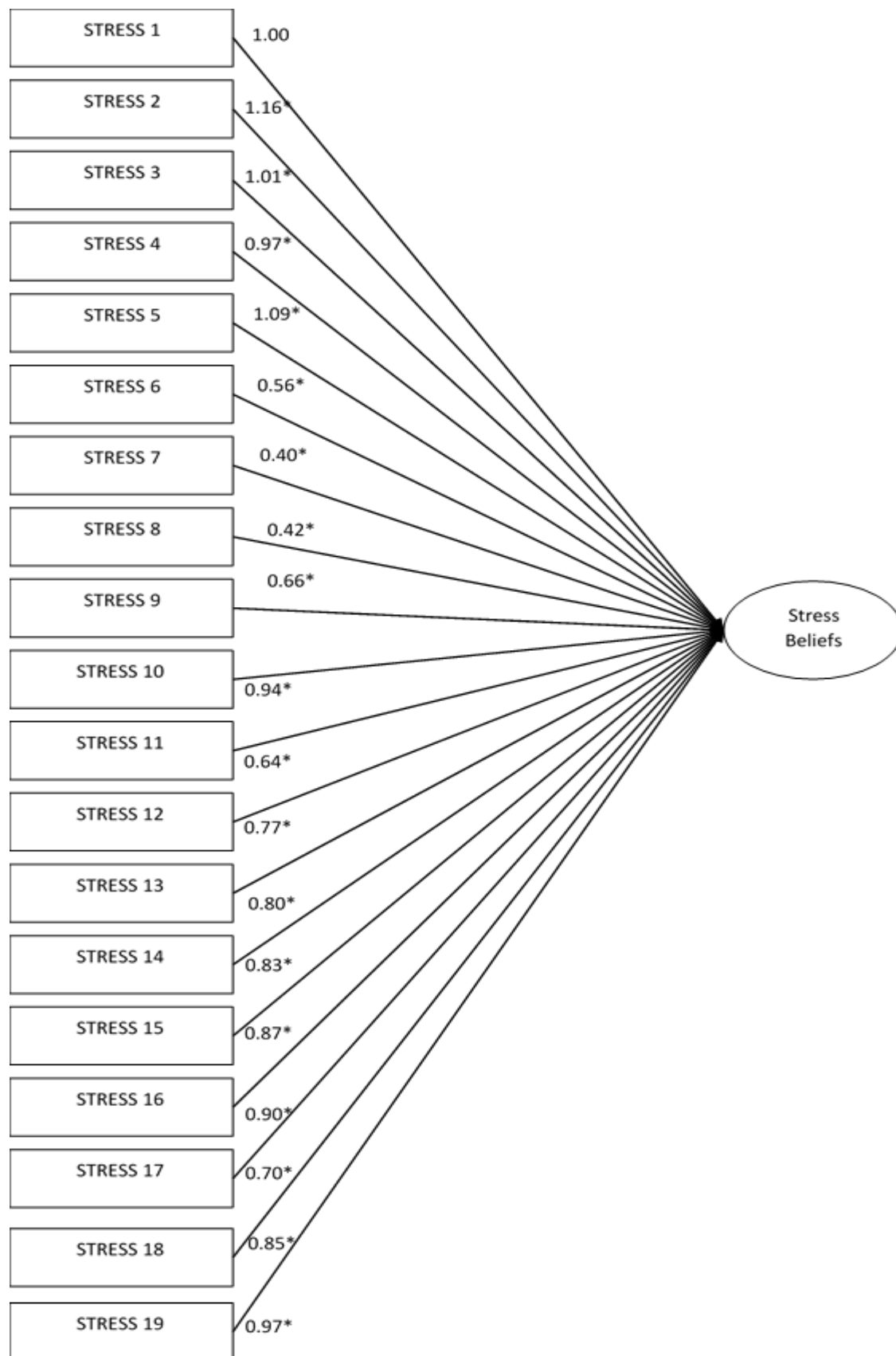


Figure 1. Graphical representation of the final single-factor model. Values represent unstandardized betas. * $p < .0005$.

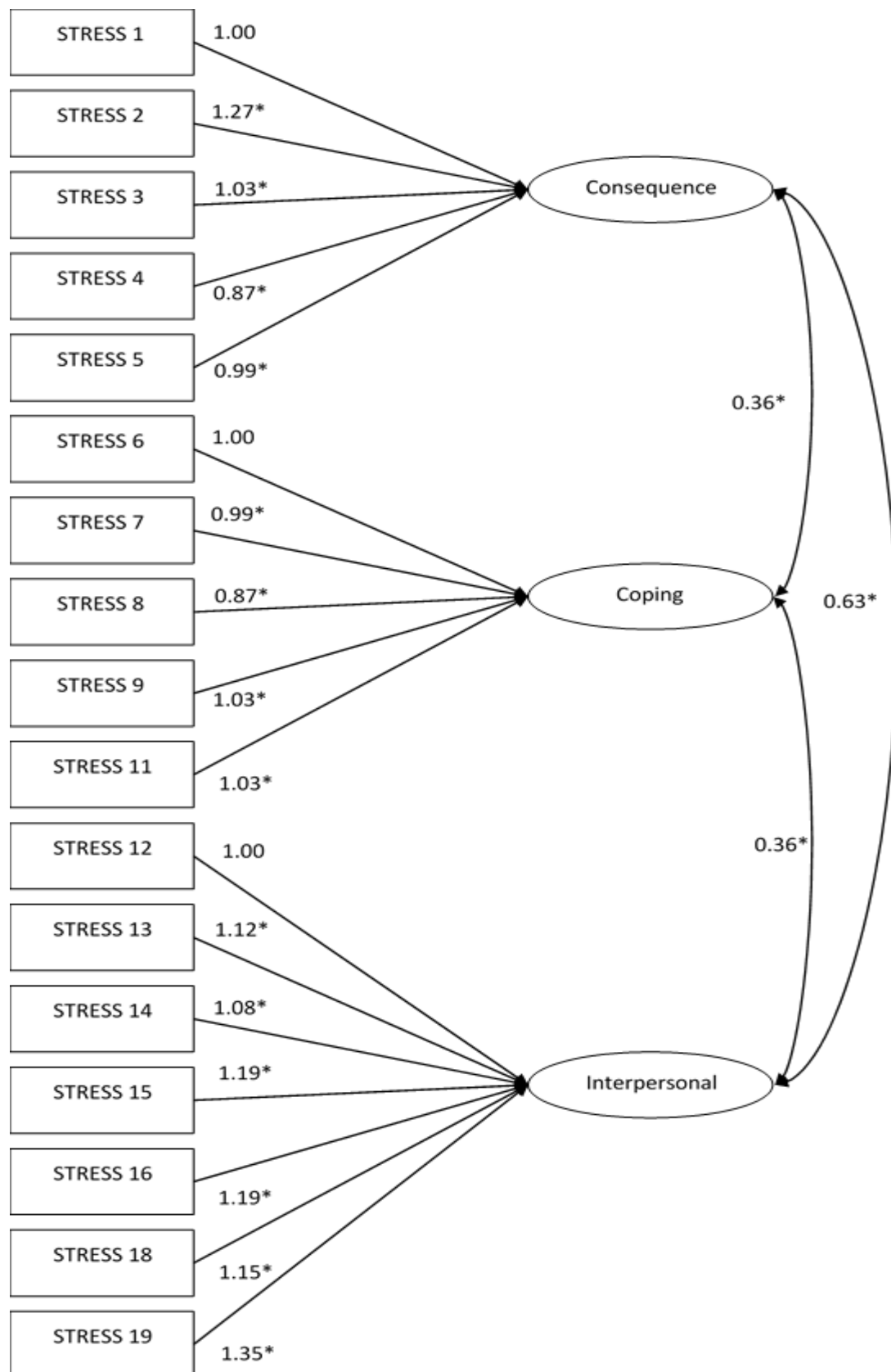


Figure 2. Graphical representation of the final three-factor model. Values represent unstandardized betas. * $p < .0005$.

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Regarding convergent validity, all three subscales demonstrated acceptable positive correlations with resilience and acceptable negative correlations with trait anxiety and neuroticism; however, only coping efficacy demonstrated acceptable levels of convergent validity with reappraisal. All subscales shared weak ($r < 0.40$) to non-existent correlations with altruism and religiosity. Construct validity with the Stress Mindset Measure, and the Beliefs About Stress Scale, as well as convergent validity with the Perceived Stress Scale results from Study 2 were reproduced in this study. Table 9 contains all correlations.

Table 9. Pearson's correlations between the STRESS and convergent, divergent, and construct validity variables

	STRESS		
	Consequences	Coping	Social
Convergent Validity			
Reappraisal	.210	.586	.230
Resilience	.689	.548	.585
Trait Anxiety	-.656	-.518	-.565
Neuroticism	-.657	-.487	-.556
Divergent Validity			
Altruism	.093	.347	.177
Religiosity	.023	.157	.160
Construct Validity			
Stress Mindset	.439	.249	.394
BASS			
Positive	.381	.303	.348
Negative	-.605	-.251	-.491
Control	.528	.643	.477
Perceived Stress	-.645	-.522	-.494

Note. All p -values $< .0005$.

Discussion

This study reproduced the factor structure of the STRESS across 17 items. A total score did not accurately represent the data, suggesting that stress beliefs should be measured as a multi-dimensional construct, rather than with a single scale. This makes sense as each subscale represents a very different kind of belief. This is most strongly highlighted by the coping efficacy factor, demonstrating a different pattern of construct validity compared to the consequences and interpersonal relations subscales.

All constructs used to assess convergent validity shared a Pearson's r greater than 0.30 with at least one subscale of the STRESS. This confirms that stress beliefs are multi-dimensional and should be measured as such. More specifically, reappraisal is known to be involved in how we perceive stressful situations, yet reappraisal was only associated with coping efficacy beliefs. This may be because reappraisal is a type of coping strategy (Sammy et al., 2017), and therefore, those who believe they are more able to cope are more likely to employ this additional coping strategy. This is a favorable result as it highlights that the coping efficacy subscale is associated with coping-based aspects of stress, while beliefs unrelated to coping are not. Finally, validity findings from Study 2 were reproduced in this study. In the next study, predictive validity is assessed.

Study 4 – Predictive validity

To ensure that the STRESS can demonstrate an association with stressor appraisals, a behavioral experiment was employed to assess whether the scale could predict the types of appraisals made in response to a commonly used standardized stress induction, the Trier Social Stress Test (Kudielka, Hellhammer, & Kirschbaum, 2007). Both the 19 and 17 item forms of the STRESS were considered to confirm whether the removal of the two items

highlighted in Study 3 is necessary. This study was also used as an opportunity to assess the test-retest reliability of the STRESS over two weeks.

Method

Participants

First-year psychology students ($N = 137$) were recruited into this study in exchange for course credit. All participants were 18 years or older and self-reported being free of any current or previous psychological or stress-related condition. This was necessary for the safety of participants, given that the Trier Social Stress Test (Kudielka et al., 2007) is a social-based stress induction known to elevate cortisol, adrenaline, and heart rate levels, as well as subjectively reported state anxiety levels (Kudielka et al., 2007). Due to an administration error, 15 participants did not have complete data and were not included in the final analyses but were replaced with an additional 15 participants.

Procedure

Participants were greeted by the lead author in a waiting room and brought into the laboratory. These small interactions have minimal impact on the integrity of the stress induction (Kim, Nickels, & Maestripieri, 2018). For ethics, participants were aware that the study involved a stress induction but were not told what the induction involved. Participants provided electronic consent and completed the same demographics survey as in Studies 2 and 3 (except country of residence). Participants then completed the STRESS and a self-reported momentary measure of perceived stress before being shown a standardized set of instructions for the Trier Social Stress Test. After reading these instructions, participants completed two measures of stress appraisals and another momentary perceived stress measure. Participants then completed the speech task of the Trier Social Stress Test before completing a third momentary perceived stress measure, and then completed the mathematics task. This was

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followed by a standardized debriefing page explaining the deception in the Trier Social Stress Test which was followed by a final momentary perceived stress measure. Momentary perceived stress was measured throughout the study to track participant stress levels to ensure the induction did elicit acute stress (i.e., stress levels increased during the induction and returned to baseline by the end of the debrief). Two weeks later, participants were asked to complete the STRESS again for test-retest reliability.

Measures Not Previously Described

Stress Appraisal

Given that there are multiple approaches to measuring stress appraisals with no reason to suspect that any single approach is more appropriate than the other (Kilby, Sherman, & Wuthrich, 2018), it was important to measure appraisals in terms of challenge and threat being two separate constructs (Skinner & Brewer, 2002), challenge and threat as being opposite ends of the same construct and challenge and threat being the ratio of both primary and secondary appraisals in which higher scores represent challenge appraisals and lower scores represent threat appraisals (Schneider, 2008). This also allowed the examination of secondary appraisals in isolation of primary appraisals.

The Cognitive Appraisals Measure (Skinner & Brewer, 2002) is a valid and reliable measure of primary appraisals designed in a student population for performance-based stressful situations. This is appropriate for this study as the Trier Social Stress Test is a performance-based stress induction. This scale divides challenge and threat appraisals into two separate constructs such that participants may perceive the situation as both challenging and threatening simultaneously (hereafter referred to Challenge Appraisal and Threat Appraisal, respectively). Participants respond with their agreement to 18 statements such as “I am concerned others will not approve of me” on a 6-point Likert-type scale (1 “Strongly

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disagree” to 6 “Strongly agree”). Averaged scores produce a range from 1 to 6 in which higher scores represent a stronger challenge or threat appraisal. Internal reliability was acceptable for all measurements ($\alpha > .871$).

The Stress Appraisal Scale (Schneider, 2008) is a general stress appraisal scale that treats challenge and threat as being opposite ends of the same construct (hereafter referred to as Primary Appraisal). This scale overcomes the shortcomings of other scales in this area that may comprise only one or two items (Schneider, 2008). The scale also includes a secondary appraisal subscale (hereafter Secondary Appraisal). It is also possible, and recommended, to take the ratio of primary to secondary appraisals (hereafter, Ratio Appraisal). As such, this scale captures the two alternative approaches to measuring stress appraisals not otherwise captured by the Cognitive Appraisal Scale. Participants, in this scale, respond with their agreement to 10 items such as “How threatening do you expect the upcoming task to be?” on a 7-point Likert-type scale (1 “Low” to 7 “High”). Averages of the relevant items were taken to create the primary and secondary appraisal subscales. A ratio of these two scales was also created. Internal reliability was acceptable for all measurements ($\alpha > .769$).

Momentary Perceived Stress Scale

Participants completed the Stress Thermometer, a version of the Distress Thermometer (Mitchell, 2007) adjusted to read ‘stress’ rather than ‘distress’. This measure asks participants to “Please slide the scale to change the thermometer to best describe how much stress you are experiencing right now” on an 11-point visual analogue scale in which participants rate their current stress levels from 0 “no stress” to 10 “extreme stress”. This was administered five times; before participants receiving the instructions for the stress induction, immediately after receiving the instructions but before completing the stress induction, mid induction, post-induction, and post-debrief.

Statistical Analysis

All analyses were conducted in SPSS (IBM, 2013). Sample characteristics were examined via descriptive analyses. A manipulation check was conducted via a non-parametric repeated measures ANOVA (Friedman's test) on all five momentary perceived stress scales. A non-parametric analysis was chosen given the ordinal and non-normally distributed data of each thermometer (Harpe, 2015). Correlations between each appraisal scale and each subscale of the STRESS were used to assess bivariate predictive validity. Five multiple regressions were then conducted in which each stress appraisal scale was regressed onto all three STRESS subscales to examine the combined predictive validity of the scale. Test-retest reliability between each subscale of the STRESS across the two-time points, following the advice of Koo and Li (2016), was assessed with a single measure, absolute agreement, two-way mixed intra-class correlation. Intra-class correlations between .50 to .75 were considered evidence of moderate reliability, between .75 and .90 indicate good reliability, and correlations above .90 represent excellent reliability (Koo & Li, 2016). Significance was defined at $p = .05$ for all analyses. Power calculations in G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) revealed a minimum sample size of 119 participants was required to find a medium effect size with three predictors while maintaining Type I error at 0.05 and power at 0.95.

Results

Table 10 outlines the sample characteristics. The manipulation check revealed that perceived stress changed significantly throughout the study ($p < .0005$). Bonferroni adjusted comparisons revealed that perceived stress levels significantly increased from before reading the instructions (*Median* = 3, *interquartile range [IQR]*: 1-6) to after reading the instructions (*Median* = 7, *IQR*: 5-8; $p < .0005$), remained stable through to mid-induction (*Median* = 7,

IQR: 4-9; $p = 1.00$) and began to decline from mid-induction to post-induction (*Median* = 5, *IQR*: 3-7; $p < .0005$) and post-debrief (*Median* = 3, *IQR*: 1-4; $p < .0005$). Post-debrief levels were equivalent to levels before reading the instructions ($p = 1.00$). At baseline, the top five endorsed physical health beliefs were difficulty sleeping ($n=127$, 84%), sweating ($n=116$, 75%), decreased appetite ($n=114$, 75%), increased heart rate ($n=114$, 75%), and fatigue ($n=114$, 75%). At the follow-up, the top five endorsed physical health beliefs were difficulty sleeping ($n=120$, 86%), increased heart rate ($n=118$, 84%), sweating ($n=115$, 82%), tense muscles ($n=108$, 77%), and decreased appetite ($n=104$, 74%).

Table 10. Sample characteristics for Study 4

Variable	<i>N</i>	%
Born in Australia	103	75.2
Female	101	73.7
Highest level of education		
High school	127	92.7
Vocational education	4	2.9
Bachelor degree	6	4.4
Employment		
Full time	5	3.6
Part time	32	23.4
Casual	73	53.3
Self-employed	1	0.7
Unemployed	26	19.0
	<i>M (SD)</i>	
Age (yrs)	20.21(5.10)	
STRESS - baseline		
Consequences	3.39 (0.94)	
Coping	4.37 (0.71)	
Social Relations	3.34 (0.89)	
STRESS – follow-up		
Consequences	3.32 (0.85)	
Coping	4.29 (0.80)	
Social Relations	3.28 (0.84)	
Challenge Appraisal	3.67 (0.90)	
Threat Appraisal	3.95 (0.99)	
Primary Appraisal	4.93 (0.93)	
Secondary Appraisal	3.98 (1.13)	
Ratio Appraisal	1.41 (0.73)	

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Correlations revealed that all STRESS subscales were related in the expected direction with each appraisal scale. The Consequences and the Social Relations subscales were weakly to moderately significantly correlated with all appraisal scales. The Coping subscale was weakly to moderately correlated with all appraisal scales except for Primary Appraisal (see Table 11 for correlations).

Table 11. Correlations between the STRESS subscales and stress appraisals

	Consequences	Coping	Social Relations
Challenge Appraisal	.29*	.41*	.20*
Threat Appraisal	-.43*	-.34*	-.40*
Primary Appraisal	-.29*	-.13	-.34*
Secondary Appraisal	.36*	.38*	.25*
Ratio Appraisal	-.40*	-.27*	-.25*

Note. * $p \leq .05$

Regression analyses revealed that at least one subscale uniquely predicted each appraisal scale. However, the pattern of significance differed depending on the type of appraisal scale. The STRESS explained between 14% of the variance (Primary Appraisal) and 29% of the variance (Threat Appraisal). For Challenge Appraisal, only the Coping subscale was uniquely related. For Threat Appraisal, all three subscales were uniquely related. For Primary Appraisal, only the Social Relations subscale was uniquely related. For Secondary Appraisal, Consequences and Coping were related, but Social Relations was not. For the Ratio Appraisal, only Consequences was related. See Table 12 for all regression statistics.

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Table 12. Regression results of the STRESS and appraisals.

					95% <i>CI</i>	
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	Lower	Upper
Challenge Appraisal – $F(3,133)=10.86, p < .0005, R^2 = .20$						
Consequences	.10	.09	1.10	.273	-.08	.28
Coping	.42	.10	4.17	<.0005	.22	.63
Social	.12	.09	1.38	.171	-.05	.28
Threat Appraisal – $F(3,133)=17.71, p < .0005, R^2 = .29$						
Consequences	-.251	.10	-2.60	.010	-.44	-.06
Coping	-.302	.11	-2.79	.006	-.52	-.09
Social	-.313	.09	-3.47	<.001	-.49	-.14
Primary Appraisal – $F(3,133)=7.32, p < .0005, R^2 = .14$						
Consequences	-.18	.10	-1.83	.070	-.37	.014
Coping	-.03	.11	-0.32	.751	-.25	.18
Social	-.27	.09	-2.94	.004	-.44	-.09
Secondary Appraisal – $F(3,133)=12.14, p < .0005, R^2 = .22$						
Consequences	.23	.11	2.05	.042	.01	.45
Coping	.43	.13	3.48	.001	.19	.68
Social	.18	.10	1.68	.095	-.03	.38
Ratio Appraisal – $F(3,133)=10.19, p < .0005, R^2 = .19$						
Consequences	-.24	.07	-3.27	.001	-.38	-.09
Coping	-.12	.08	-1.54	.126	-.28	.04
Social	-.09	.07	-1.33	.186	-.22	.04

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Twenty participants did not complete the follow-up test, resulting in a final sample size of 117 participants for the test-retest analyses. Intra-class correlations revealed that all subscales of the STRESS had moderate test-retest reliability (Consequences ICC = .68, Coping Efficacy ICC = .53, and Interpersonal Relations ICC = .74).

Discussion

The relationship between the STRESS and information processing in stressful situations was examined through three common approaches to appraisals. Correlational results suggest that the Consequences and Social Relations subscales significantly related to all approaches to appraisals in the expected directions, providing bivariate support for their predictive validity. Interestingly, the Coping subscale was related to all appraisals except for Primary Appraisals. The relationship between Coping and Secondary Appraisals (and in turn, the Ratio Appraisal) makes sense given that Secondary Appraisals refers to one's perceived ability to cope with a stressful situation (Schneider, 2008). However, the Coping subscale was related to Challenge Appraisals and Threat Appraisals, but not Primary Appraisals. This is unexpected as the only difference between Challenge and Threat Appraisals, and Primary Appraisals is that the former treats challenge and threat as two separate constructs, while the latter treats the two as extreme opposites of the same construct (Kilby et al., 2018). This may be evidence that these two approaches to measuring appraisals behave slightly differently, warranting further research.

The regression analyses evaluated the combined influence of the STRESS on each appraisal measure. In each analysis, at least one of the subscales was a unique predictor of appraisals. This is a noteworthy finding as other stress belief scales have failed to consistently demonstrate any relationship with how information has been interpreted from stressful situations (Crum et al., 2017; Kilby & Sherman, 2016; Laferton et al., 2018).

General Discussion

There is reason to suspect that our general beliefs about stress may influence how we process information from stressful situations (Leventhal, Phillips, & Burns, 2016). However, current stress belief scales have failed to demonstrate this effect in terms of either stress appraisals (Crum et al., 2017; Kilby & Sherman, 2016) or perceived stress levels (Laferton et al., 2018). One possible reason for the lack of findings could be due to the previous scales being constructed in the absence of systematic reviews and qualitative studies providing overarching descriptions of stress beliefs, such as Kilby et al. (2019b, 2019a). To overcome this, the present study utilized these findings to develop a new stress belief scale, the STRESS. The STRESS contained a larger initial pool of items than either of the previous scales in their construction and a larger pool of alternative wordings for each item. The initial item pool for the STRESS was also piloted on a larger and more global sample than previous scales (Crum et al., 2013; Laferton et al., 2018). The EFA and CFA revealed a stable three-factor structure for the STRESS spanning beliefs about consequences, coping efficacy, and interpersonal relations. The three-factor STRESS demonstrated acceptable levels of internal and test-retest reliability, and evidence for convergent, divergent, construct, and predictive validity.

The STRESS is the first stress belief scale that is associated with individual variations in stress appraisals in a standardized stressful situation, overcoming the limitations found in the Stress Mindset Measure (Crum et al., 2017; Kilby & Sherman, 2016). Predictive validity was demonstrated against the three approaches to self-reported appraisals (Kilby et al., 2018; Schneider, 2008; Skinner & Brewer, 2002), suggesting that regardless of the approach to appraisals, stress beliefs may be important factors that influence interindividual differences. Moreover, the specific factor of the STRESS that was related to stress appraisals differed depending on the type of appraisal, suggesting that stress beliefs are multi-dimensional. Not

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only did the STRESS predict appraisals, but it also demonstrated concurrent validity with the Perceived Stress Scale over two separate samples, overcoming limitations of the Beliefs About Stress Scale (Laferton et al., 2018). This suggests that the STRESS is an appropriate measure for predicting interindividual differences in how information from stressful situations is processed.

The results of the predictive validity study support the use of the STRESS and the notion of extending the Transactional Model of Stress to include stress beliefs as an essential antecedent to stressor appraisals. Until now, such a notion has only been theorized, but never demonstrated (Kilby & Sherman, 2016; Kilby et al., 2019a). This extension would suggest that beliefs bias primary and secondary appraisals. This suggests that the previous findings of stress beliefs to predict coping, coping outcomes, emotion, and health (for a review, see Kilby et al., 2019a) may be an indirect result of the influence of stress beliefs on the appraisal process. Moreover, with preliminary evidence that stress beliefs may be readily modifiable via short informational films (Crum et al., 2017, 2013), stress beliefs may be a target for population-based stress management interventions.

Despite the success of the STRESS in overcoming limitations of previous scales, some limitations of these four studies should be highlighted. Not all originally identified categories of stress beliefs were included in the EFA. The initial pool of items spanned five thematic groups of stress beliefs: cognition, emotion, behaviour, physical wellbeing, and interpersonal relations. The physical wellbeing group was treated separately to the other groups. A selection of the interpersonal relations items remained to form the interpersonal relations subscale. Similarly, a selection of the behaviour items remained to create the coping efficacy scale. However, a selection of behaviour and cognition items were pooled together in the EFA to form the consequences subscale. There were no items from the emotions category that were retained. One possible reason for the lack of emotional items being retained could

be because stress and emotion are so intricately associated together (Shallcross et al., 2015) with classical stress theories, such as the Transactional Model of Stress proposing that stress elicits a range of emotional responses depending on the individual's ability to coping with the stressful situation (Folkman & Lazarus, 1980). If so, then given that stress beliefs appear to be predictive of stressor appraisals, which are known to influence coping (Lazarus & Folkman, 1984), then beliefs about stress and emotions may be a byproduct of other beliefs about stress. As such, it may not necessarily be the case that people do not hold beliefs about stress and emotion, but that, these beliefs become statistically redundant from a measurement perspective in the presence of beliefs about stress and consequences, coping, and interpersonal relations.

Another limitation was that in the CFA, two of the scale items cross-loaded. These two items were not cross loading in the EFA and increased the internal reliability of the scale in the predictive validity study. This brings to question the integrity of these two items. However, the fact that the items did not highly cross load in the EFA and given that the scale was improved by including these two items, the 19-item version of the scale is most likely the best to employ. If there is concern about the integrity of these two items, researchers are encouraged to assess the internal reliability of both the 17- and 19-item form, using whichever form produces the highest internal reliability.

The STRESS is self-report and is, therefore, susceptible to limitations common to self-report scales. However, despite there being evidence for the existence of implicit beliefs that are not accessible via self-report (Greenwald, McGhee, & Schwartz, 1998), a recent study in stress beliefs evaluating implicit stress beliefs failed to support the validity of implicit stress beliefs (Keech et al., 2018). Moreover, the study found that self-reported stress beliefs demonstrated relationships that were more theoretically consistent with related constructs

than implicit stress beliefs (Keech et al., 2018). This suggests self-reported measures may be a more optimal approach for measuring stress beliefs.

A final limitation is that these studies did not assess the predictive validity of the STRESS to predict other aspects of the stress response, such as physiological responses to stress, coping, or the outcomes associated therein. Other stress belief measures (Crum et al., 2013; Fischer et al., 2016; Laferton et al., 2018) have already demonstrated such relationships, and the relationship between appraisals, copings, and outcomes has been well established (Folkman & Lazarus, 1980; Folkman et al., 1986; Lazarus & Folkman, 1984; Tomaka, Blascovich, Kibler, & Ernst, 1997). As such, it was not deemed pertinent to examine these as part of the scale construction and psychometric testing of the STRESS. Nevertheless, future studies should explore whether the STRESS does indirectly predict these other aspects of the stress response via appraisals.

Despite these limitations, the STRESS stands as the first stress belief measure that demonstrates theoretically sound relationships with the stress response. The use of this scale by stress researchers will further the understanding of the complexity of the stress response and provide insight into new approaches to improving the way individuals respond to everyday stress. This study has demonstrated the soundness and usefulness of the STRESS in stress research. There is now a strong need to use the STRESS to further understand the role of stress beliefs in the subjective stress response.

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Chapter 7 – General Discussion and Conclusions

This thesis aimed to demonstrate that our beliefs about stress predict how we appraise information from stressful situations. The underlying premise was grounded in a wealth of theoretical models claiming that our beliefs, however they may be defined, are used to quickly interpret information from the environment and aid in the selection of appropriate behavioural responses to environmental stimuli (Axelrod, 1973; Gross & John, 2003; Khetrapal & Khetrapal, 2007; Leventhal, Phillips, Burns, Phillips, & Burns, 2016; Usó-Doménech & Nescolarde-Selva, 2016). This relationship between beliefs and how we interpret information was coupled with research in both the Transactional Model of Stress (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Tomaka, Blascovich, Kibler, & Ernst, 1997) and the Cognitive Activation Theory of Stress (Meurs & Perrewe, 2011; Ursin & Eriksen, 2010) suggesting that our appraisals or expectations of stressful situations are a key determinant of individual differences in physiological (Blascovich, 2008; Eriksen, Murison, Pensgaard, & Ursin, 2005) and behavioural (Lazarus & Folkman, 1984; Ursin & Eriksen, 2004) responses to stress.

The systematic review in Chapter 2 (Kilby, Sherman, & Wuthrich, 2018) revealed that, despite the strong theoretical link between stress beliefs and stressor appraisals, this link was highly under-researched (Crum, Akinola, Martin, & Fath, 2017; Kilby & Sherman, 2016) with scope for methodological improvement. As such, this thesis addressed the methodological limitations of the previous research in Chapter 3 and, using the only existing psychometrically valid measure of stress beliefs at the time (the Stress Mindset Measure), found no association between appraisals and stress beliefs. It was therefore concluded that there was scope for a new measure. Over six studies in Chapters 4, 5, and 6 (Kilby, Sherman, & Wuthrich, 2019a, 2019b, 2019c), the notion of stress beliefs was redefined, and a new scale was developed. This scale was predictive of appraisals using the same stress induction

methodology as in Chapter 3, thus demonstrating that stress beliefs do predict how we interpret information from stressful situations.

An important point to discuss is the different categories of stress beliefs that were proposed across the systematic review of stress beliefs (Chapter 4; Kilby et al., 2019a), the qualitative study of stress beliefs (Chapter 5; Kilby et al., 2019c), and finally by the factor analyses in the scale construction studies (Chapter 6; Kilby et al., 2019b). In the systematic review, the Common-Sense Model of Self-Regulation of Health and Illness (Leventhal et al., 2016) was used as a guiding framework by which the different stress beliefs studied thus far could be categorised into beliefs about the identity, cause, consequence, control, and timeline of stress (Chapter 4; Kilby et al., 2019a). Taking this approach, it was possible to identify areas of stress beliefs not yet considered. To ensure that these understudied areas were specifically targeted, the qualitative study used the same model to guide the development of the interview questions (Chapter 5; Kilby et al., 2019c). However, doing so precluded the option of then categorising the results based upon this framework as these categories would naturally arise as a result of the specific questions, rather than identifying the naturally occurring themes across these questions (Braun & Clarke, 2006). Despite this limitation, the themes identified qualitatively did include aspects of all the representational categories highlighted in the Common-Sense Model of Self-Regulation of Health and Illness. Hence, despite there being two different approaches to describing the structure of stress beliefs across these studies, the results are still comparable. That is, the two different approaches to categorising stress beliefs are not contradictory, but rather, complementary.

A completely new three-category structure of beliefs emerged during the exploratory factor analysis, which was reinforced by the confirmatory factor analysis (Chapter 6; Kilby et al., 2019b). While the qualitative study revealed themes of cognition, emotion, behaviour, interpersonal relations, and physical wellbeing, the exploratory factor analysis retained the

interpersonal relations factor, highlighted only items from the behaviour theme relating to coping, and created a group of cognition and behaviour items representing beliefs about consequences of stress. There were no beliefs relating to emotions retained in the exploratory factor analysis. The lack of emotion beliefs was unexpected. However, given the tight interconnectedness between emotions and stress (Beltzer, Nock, Peters, & Jamieson, 2014), with arising emotions reflecting one's ability to adaptively cope (Folkman, 2014), it is possible that stress beliefs about emotion are the by-product of other stress beliefs. In other words, given that stress beliefs may underlie appraisals and that appraisals underlie coping, then the beliefs about stress and emotions may arise due to the indirect influence of other beliefs (such as those of consequences, coping efficacy, and interpersonal relations) on appraisals and coping.

If this was the case, then the emotion belief items would all, from a measurement perspective, be redundant or would cross-load over the other factors identified by the exploratory factor analysis. Indeed, this is what happened. This is not to say that people do not hold beliefs about stress and emotions, nor does this invalidate the results of the qualitative study (Chapter 5; Kilby et al., 2019c) or systematic review (Chapter 4; Kilby et al., 2019a) which both highlighted stress beliefs about emotion as being important. Instead, this suggests that, in a comprehensive measure of stress beliefs, items targeting stress and emotion beliefs do not explain any additional variance over and above other beliefs. In addition to the emotion items being removed, the behaviour items were separated into two themes, one exclusively focusing on coping efficacy, and the other combining with cognition to create a theme representing consequences of stress. Again, despite the scale producing different categories of stress beliefs to the qualitative study, this does not diminish from the qualitative study. Rather, it would suggest that the consequences and coping efficacy dichotomy of behaviour is a more parsimonious structure for measuring stress beliefs. As

such, the scale does not represent the actual belief structures of an individual, but rather, represents the most parsimonious approach to measuring individual variations in the actual belief structure (Field, 2013).

Implications and Future Directions

Improving Beliefs About Stress

There are several major implications for the stress literature now that this thesis has demonstrated that stress beliefs influence appraisals. The most significant implication is that there is now evidence of a modifiable construct, stress beliefs, predisposing appraisals (Chapter 6; Kilby et al., 2018, 2019b). Stress beliefs should be an easily accessible construct with which to intervene, given that they are lay beliefs and that lay beliefs can be influenced by persuasive communications (Zlius, Müller, & Schooler, 2017). Indeed, there is some evidence that stress beliefs can be primed through the use of brief videos designed to expose the viewer to information supporting either the positive or negative effects of stress, producing changes in responses to stressful situations (Crum et al., 2017; Crum, Akinola, Turnwald, Kaptchuk, & Hall, 2018; Crum, Salovey, & Achor, 2013; Jamieson, Crum, Goyer, Marotta, & Akinola, 2018; Park & Hahm, 2019). If such stress belief priming interventions could be upscaled to public level health interventions, then it is possible that entire communities could be targeted to improve the way they respond to stressful situations, potentially minimising the financial burden of stress on society (Hassard, Teoh, Visockaite, Dewe, & Cox, 2018; Knight, Bean, Wilton, & Lin, 2015). Harnessing stress in a positive way via stress beliefs may also provide a pathway to improved health since appraisals and expectations have been found to influence our physiology (Tomaka et al., 1997; Ursin & Eriksen, 2004). This would suggest that such an intervention may not only minimise the financial burden of stress on society but could also improve health and, in turn, minimise the

general need for dependence on the health system. However, there are a number of steps necessary between the present state of the stress belief literature and the attainment of these major health outcomes. These steps are listed below.

What Does it Mean to Have the ‘Right Pattern of Stress Beliefs’?

The notion of the right pattern of stress beliefs, or ‘adaptive beliefs’, is one such area that needs to be explored in the stress belief literature before being able to investigate the broader implications of improving stress beliefs on society. Current thinking in the stress belief literature, as documented in the systematic review of Chapter 4 (Kilby et al., 2019a), is that less negative and more positive beliefs about stress are desirable as they are associated with lower mental (e.g., Daniels, Hartley, & Travers, 2006) and physical (e.g., Keller et al., 2012) pathology. However, given that this thesis has demonstrated a relationship between stress beliefs and appraisals using the STRESS (Chapter 6; Kilby et al., 2019b), and if there needs to be flexibility in one’s ability to appropriately appraise a stressful situation as challenging or threatening to promote adaptive coping (Folkman, Lazarus, Dunkel-Schetter, et al., 1986), then having exclusively all positive or exclusively all negative beliefs about stress may be hindering. Rather, what may be needed is a balanced perspective that encapsulates the notion that in some situations, stress can be detrimental, but in others, it can be empowering.

To this effect, research using the STRESS is needed to further map out the relationship not only between stress beliefs and appraisals but also between stress beliefs and adaptive responding under stress. This would require a study to measure stress beliefs with the STRESS before implicating multiple stressful situations to gauge the way that the individual responds to different situations, along with having a systematic way for measuring the level of “adaptiveness” of each person’s stress response. This would allow for the

identification as to which pattern of stress beliefs promote adaptive responding under a multitude of stressful situations, rather than merely aiming for the unilateral “positive is always better” approach that has failed stress research in the past (Liu, Vickers, Reed, & Hadad, 2017; Tan, Teo, Anderson, & Jensen, 2011).

An extension of this idea is to consider whether these ideal patterns of stress beliefs maintain across cultures or, even more fundamentally, if stress beliefs change as a function of culture. Although the systematic review considered stress belief research from multiple countries (Chapter 4; Kilby et al., 2019a), none of this research elicited beliefs from the participants, instead, the beliefs were prespecified, which precluded the ability to identify culturally unique stress beliefs. Moreover, a strength of the qualitative study in this thesis was that the results were validated in an international sample of experts in stress research (Chapter 5; Kilby et al., 2019c); however, the interviews were conducted on first-year psychology students who are known to be a unique demographic (Henrich, Heine, & Norenzayan, 2010). Finally, although the item pilot, exploratory factor analysis, and confirmatory factor analysis were all conducted in international samples (Chapter 6; Kilby et al., 2019b), the predictive validity study was on only first-year psychology students. Although the largely international approach to sampling should theoretically increase the generalisability of the scale across cultures, this is yet to be empirically demonstrated.

What Does it Mean to Have Beliefs About Stress?

It is important to note that despite the time-ordered relationship between stress beliefs and appraisals reported in the predictive validity study of Chapter 6 (Kilby et al., 2019b), those results are not evidence of a causal relationship. Despite the theoretical implications of this thesis and the empirical findings of stress belief manipulation studies all suggesting that stress beliefs should be manipulable and should result in a change of appraisals, no study has

demonstrated this effect. Such a study would have to take some baseline measure of stress beliefs with the STRESS as well as a measure of appraisals, then manipulate stress beliefs, before tracking changes in both stress beliefs and appraisals over time.

It is quite possible, however, that the findings of this thesis are a result of a number of other factors associated with stress beliefs. For example, although research is yet to demonstrate precisely how beliefs about stress arise, general belief research would suggest that this is due to one's life experiences both lived and vicarious (Hagger, Koch, Chatzisarantis, & Orbell, 2017; Kilby & Sherman, 2018; Pace, 1988; Prior, 2003; Zlius et al., 2017). Such experiences, in the context of stress, may include predictors of stress exposure during development and young adulthood, the intensity and frequency of stress exposure during these times, and the outcomes of these stressful situations (Bourne Jr & Yaroush, 2003; Lupien, McEwen, Gunnar, & Heim, 2009). Indeed, these factors have been associated with interindividual differences in some aspects of the stress response (Bourne Jr & Yaroush, 2003; Lupien et al., 2009; Segerstrom & Miller, 2004). It may be that the documented association between stress beliefs and the stress response shown in both this thesis (Chapter 6; Kilby et al., 2019b) and prior work (Crum et al., 2013; Fischer, Nater, & Laferton, 2016; Laferton, Stenzel, & Fischer, 2018) may be a spurious finding that is superseded if these other factors are considered. However, the reverse may also be true, such that stress beliefs may mediate the relationship between prior experiences with stress and interindividual differences in the stress response. In that, the relationship previously found between past stress experiences and differences in the stress response may only have arisen because of the mediating effect of stress beliefs. If so, then manipulating stress beliefs would remove the influence of past experiences with stress on the stress response.

Accounting for the Cyclical Nature of Stress

The stress response, as formalised by both the Cognitive Activation Theory of Stress (Ursin & Eriksen, 2010) and the Transactional Model of Stress (Lazarus & Folkman, 1984), contains a feedback loop in which current efforts to influence a stressful situation modulates the cognitive, physiological, and behavioural responses to the stressful situation (Folkman, Lazarus, Gruen, & DeLongis, 1986; Reme, Eriksen, & Ursin, 2008). If this feedback system existed, then what would be the role of stress beliefs? With evidence from this thesis that stress beliefs are associated with the appraisals made of a stressful situation prior to engaging with that situation (Chapter 6; Kilby et al., 2019b) and with this feedback system being employed after coping has commenced (Folkman, Lazarus, Dunkel-Schetter, et al., 1986), we propose that stress beliefs would be a predetermining factor that influences the appraisals made at the initiation of the stress response. The stress beliefs would be used to influence the initial or anticipatory appraisals and evaluations of the stressful situation upon which the first attempt at coping is based. From there, stress beliefs may become irrelevant or may continue to exert some weakened influence on appraisals. While this thesis has demonstrated that stress beliefs do predict the anticipatory appraisals made of a stressful situation, we have not tracked the possible change in influence of stress beliefs over the life of the stressful situation. One feasible way to do this would be to measure stress beliefs at a baseline assessment and then track appraisals of a stressful situation that spans a considerable amount of time, such as the lead up to a university exam, and measure various aspects of the stress response regularly (e.g., every day or every second or third day). Then the changing nature of stress beliefs on the stress response could be documented.

How to Implement a Stress Beliefs Intervention?

If the foundational issues raised above can be addressed, then it would be possible to turn to policymakers and suggest ways in which stress belief interventions may be implemented. The most logical idea, for a community-wide intervention, would be to

implement such an intervention in early adolescence possibly via the school system. Research has highlighted that it is this age group that begins to experience psychosocial stress as is commonly observed in adults, whereas earlier years are subjected more so to traumatic stress rather than the daily stress experienced in adulthood (Lupien et al., 2009). Moreover, the schooling environment is already used to implement a range of health-protective interventions (Bond et al., 2004) and is, therefore, an already established outlet for such interventions. However, before such an intervention can be developed or proposed, it would be essential to examine the stress beliefs of children further and to examine how they influence childhood behaviour. Longitudinal observational studies would be needed to see how certain sets of stress beliefs influence developmental trajectories throughout adolescence. This is an issue of ethical importance as changing the beliefs of an adolescent could potentially have greater implications on them beyond just how they handle stress. For example, adolescence is a time characterised by risk taking (Sanci, Webb, & Hocking, 2018). It is possible that promoting adaptive beliefs about stress may, inadvertently, increase the likelihood of risk-taking if 'adaptive beliefs' refers to a belief pattern that plays down threat appraisal. It is for reasons such as this that further observational studies are required to understand how stress beliefs relate to other key factors in adolescence and, in turn, how manipulating stress beliefs may have knock-on effects for development into adulthood. The conclusion of such studies may suggest that, although adolescence is a theoretically relevant time to introduce a stress belief intervention, it may not be safe to do so. In which case, the intervention would be more appropriate to target adults.

Although mass media outlets have been used regularly for informing positive health behaviours of adults via reframing or rebranding tactics (Randolph & Viswanath, 2004), if there is a risk that manipulating the stress beliefs of adolescents could influence their developmental trajectory in negative ways, then mass media outlets would not be a safe

platform for stress interventions as they may inadvertently influence adolescents. A possible outlet for stress belief interventions to target adults would be the workplace. However, while this is certainly one option, it would only target the working population and would inadvertently miss unemployed individuals. To this extent, a government-led online or paper-based intervention could be given to individuals on unemployment benefits or other unemployment-related government initiatives. There are hurdles to having an intervention adopted by a Government agency, and as such, this may be one of the most significant and long-term future directions for this area of research. However, despite the difficulties associated with this, the Government bodies do have the ability to target adult populations not accessible via the workplace. Another consideration for targeting workplaces would be that not all workplaces would be willing to uptake such an intervention. To this extent, market research could be used to identify possible outlets for stress belief interventions deemed acceptable by the target audience (Maibach, Van Duyn, & Bloodgood, 2006). Of course, therapist-led interventions are also an option, but these would not have the same reach as other alternatives suggested above.

Conclusion

Over nine studies, this thesis has highlighted the significant issues in previously developed measures of stress beliefs (particularly the lack of predictive validity with appraisals). The idea of stress beliefs has been reconceptualised. This paved the way for the development of a novel measure of stress beliefs. This new measure was further demonstrated to predict appraisals, standing as a significant contribution and advancement in the field of stress beliefs. Although there are still many questions to be answered about the role of stress beliefs in the stress response, this thesis has highlighted that such endeavours are not only justified but are needed to further understand both stress beliefs and their place in the stress response as well as to understand stress phenomenology more generally. The

potential impact of such research to improve the stress response is extensive, provided the solid foundational research and theory building can be achieved coherently. This foundational research, however, is needed to not only ensure the safety and ethics of such interventions, but also to ensure that there is an empirically demonstrated understanding of what changing a stress belief entails and how that affects the individual. In closing, this thesis has highlighted that, at least for stress, believing may very well be seeing; that our beliefs about stress may be an important and poorly understood predisposing factor to subjective differences in the stress response.

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Appendix A of this thesis has been removed as it may contain sensitive/confidential content

Appendix B: Measures Used Throughout Thesis

Appendix B.1 - Positive and Negative Affect (Chapter 3)

The Positive and Negative Affect Scale

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>

This scale consists of a number of words that describe feelings and emotions. Read each item and then select the option that indicates to what extent you feel this way over the past week.

1. Very slightly 2. A little 3. Moderately 4. Quite a bit 5. Extremely
or not at all

	1	2	3	4	5
Interested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Guilty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hostile	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enthusiastic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Proud	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Irritable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ashamed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inspired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Attentive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jittery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.2 – Perceived Overall Health (Chapter 3)

Medical Outcomes Survey Short Form-36 (item 1 only)

Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey. *Medical Care*, 30(6), 473–483.

In general, would you say your health is:

Excellent	Very good	Good	Fair	Poor
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.3 – Public Speaking Anxiety (Chapter 3)

Personal Report of Public Speaking Anxiety Scale

McCroskey, J. C. (1970). Measures of communication-bound anxiety. *Speech Monographs*, 37(4), 269–277. <https://doi.org/10.1080/03637757009375677>

Below are 34 statements that people sometimes make about themselves. Please indicate the extent to which you believe each statement applies to you

Scale:

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

	1	2	3	4	5
While preparing for giving a speech, I feel tense and nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel tense when I see the words "speech" and "public speech" on a course outline when studying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My thoughts become confused and jumbled when I am giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Right after giving a speech I feel that I have had a pleasant experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I get anxious when I think about a speech coming up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have no fear of giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Although I am nervous just before starting a speech, I soon settle down after starting and feel calm and comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I look forward to giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When the instructor announces a speaking assignment in class, I can feel myself getting tense	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My hands tremble when I am giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel relaxed while giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy preparing for a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am in constant fear of forgetting what I prepared to say	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I get anxious if someone asks me something about my topic that I don't know	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I face the prospect of giving a speech with confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1	2	3	4	5
I feel that I am in complete possession of myself while giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My mind is clear when giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not dread giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I perspire just before starting a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My heart beats very fast just as I start a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I experience considerable anxiety while sitting in the room just before my speech starts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Certain parts of my body feel very tense and rigid while giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Realizing that only a little time remains in a speech makes me very tense and anxious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While giving a speech, I know I can control my feelings of tension and stress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I breathe faster just before starting a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel comfortable and relaxed in the hour or so just before giving a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do poorer on speeches because I am anxious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel anxious when the teacher announces the date of a speaking assignment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I make a mistake while giving a speech, I find it hard to concentrate on the parts that follow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
During an important speech I experience a feeling of helplessness building up inside me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have trouble falling asleep the night before a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My heart beats very fast while I present a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel anxious while waiting to give a speech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While giving a speech, I get so nervous I forget the facts that I really know	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.4 - Math Anxiety (Chapter 3)

Abbreviated Math Anxiety Scale

Hopko, D. R., Mahadevan, R., Bare, R. L., & Hunt, M. K. (2003). The abbreviated math anxiety scale (AMAS). *Assessment*, 10(2), 178–182. <https://doi.org/10.1177/1073191103252351>

Below are some common mathematics scenarios that some people face. Please specify how anxious you think each of these scenarios would make you feel from 1 (low anxiety) to 5 (high anxiety)

	1	2	3	4	5
Having to use the tables in the back of a math book	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thinking about an upcoming math test 1 day before	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watching a teacher work an algebraic equation on a whiteboard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Taking an examination in a math course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being given a homework assignment of many difficult problems that is due in the next class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listening to a lecture in a math class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Listening to another student explain a math formula	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being given a pop quiz in a math class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starting a new chapter of a math book	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.5 – Depression, Anxiety, and Stress (Chapter 3)

Depression, Anxiety, and Stress Scale

Lovibond, P. F., & Lovibond, S. H. (1995). The structure negative emotional states: comparison of the depression anxiety stress scale (DASS) with the beck depression and anxiety inventories.

Behavior Research and Therapy, 33, 335-343.

Please read each statement and select the response which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

Scale:

1. Did not apply to me at all
2. Applied to me to some degree, or some of the time
3. Applied to me to a considerable degree, or a good part of the time
4. Applied to me very much, or most of the time

	1	2	3	4
I found it hard to wind down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was aware of dryness of my mouth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I couldn't seem to experience any positive feeling at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I experienced breathing difficult (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found it difficult to work up the initiative to do things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tended to over-react to situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I experienced trembling (e.g., in the hands)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I was using a lot of nervous energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was worried about situations in which I might panic and make a fool of myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I had nothing to look forward to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found myself getting agitated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found it difficult to relax	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt down-hearted and blue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was intolerant of anything that kept me from getting on with what I was doing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt I was close to panic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was unable to become enthusiastic about anything	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt I wasn't worth much as a person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that I was rather touchy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1	2	3	4
I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt cared without any good reason	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt that life was meaningless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.6 - Emotion Regulation (Chapter 3 and Chapter 6)

Emotion Regulation Questionnaire

Gross, J. J., & John, O. P. (2003). Emotion Regulation Questionnaire. *NeuroImage*, 48(10), 9–9.

<https://doi.org/10.1037/0022-3514.85.2.348>

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. The questions below involve two distinct aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each statement, please answer with your agreement.

Scale: 1. Strongly disagree 4. Neutral 7. Strongly agree

	1	2	3	4	5	6	7
When I want to feel more positive emotion (such as joy or amusement), I change what I'm thinking about	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I keep my emotions to myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I am feeling positive emotions, I am careful not to express them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I am faced with a stressful situation, I make myself think about it in a way that helps me stay calm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I control my emotions by not expressing them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I want to feel more positive emotion, I change the way I'm thinking about the situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I control my emotions by changing the way I think about the situation I am in	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I am feeling negative emotions, I make sure not to express them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I want to feel less negative emotion, I change the way I am thinking about the situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.7 – Resiliency (Chapter 3 and Chapter 6)

Brief Resilience Scale

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(3), 194–200. <https://doi.org/10.1080/10705500802222972>

Please indicate the extent to which you agree with each of the following statements

0 – Strongly Disagree

1 – Disagree

2 – Neutral

3 – Agree

4 – Strongly Agree

	0	1	2	3	4
I tend to bounce back quickly after hard times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have a hard time making it through stressful events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It does not take me long to recover from a stressful event	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is hard for me to nap back when something bad happens	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I usually come through difficult times with little trouble	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to take a long time to get over setbacks in my life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

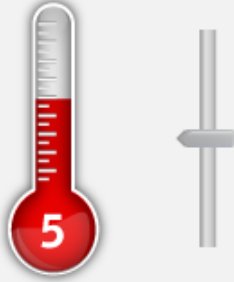
Appendix B.8 – Momentary Stress (Chapter 3 and Chapter 6)

Stress Thermometer

Mitchell, A. J. (2007). Pooled results from 38 analyses of the accuracy of distress thermometer and other ultra-short methods of detecting cancer-related mood disorders. *Journal of Clinical Oncology*, 25(29), 4670–4681. <https://doi.org/10.1200/JCO.2006.10.0438>

Please slide the scale to change the thermometer to best describe how much stress you are experiencing right now.

0 = No stress
10 = Extreme stress



The image shows a digital interface for a 'Stress Thermometer'. It features a thermometer with a red bulb and a vertical scale. The red liquid inside the thermometer is filled up to the number 5. To the right of the thermometer is a horizontal slider control with a vertical line and a horizontal bar in the middle, which can be moved to adjust the thermometer's level. The background is a light gray.

Appendix B.9 - Stress Mindset (Chapter 3 and Chapter 6)

Stress Mindset Measure

Crum, A. J., Salovey, P., & Achor, S. (2013). Rethinking stress: The role of mindsets in determining the stress response. *Journal of Personality and Social Psychology*, 104(4), 716–733.

<https://doi.org/10.1037/a0031201>

Please rate the extent to which you agree or disagree with the following statements.

0. Strongly disagree
1. Disagree
2. Neither agree nor disagree
3. Agree
4. Strongly Agree

	0	1	2	3	4
The effects of stress are negative and should be avoided	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Experiencing stress facilitates my learning and growth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Experiencing stress depletes my health and vitality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Experiencing stress enhances my performance and productivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Experiencing stress inhibits my learning and growth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Experiencing stress improves my health and vitality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Experiencing stress debilitates my performance and productivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The effects of stress are positive and should be utilised	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.10 – Stressor Appraisals (Chapter 3 and Chapter 6)

Cognitive Appraisals Scale

Skinner, N., & Brewer, N. (2002). The dynamics of threat and challenge appraisals prior to stressful achievement events. *Journal of Personality and Social Psychology*, 83(3), 678–692.

<https://doi.org/10.1037/0022-3514.83.3.678>

Thinking about the tasks you are about to complete, please rate the extent to which you agree or disagree with the following statements

	1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Somewhat agree	5 Agree	6 Strongly agree
I am focusing on the positive aspects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry that I will say or do the wrong things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am thinking about what it would be like if I do very well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that this stressful situation contains the potential for positive benefits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Somewhat agree	5 Agree	6 Strongly agree
I worry about the kind of impression I will make	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am concerned that others will find fault with my performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall I expect that I will achieve success rather than experience failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, I look forward to the rewards and benefits of success	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think that I am too concerned with what other people think of me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Somewhat agree	5 Agree	6 Strongly agree
I feel that difficulties are piling up so that I cannot overcome them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I lack self-confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, I anticipate being successful at this task, rather than failing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry what other people will think of me even when I know that it doesn't make any difference	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am concerned that others will not approve of me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Somewhat agree	5 Agree	6 Strongly agree
I look forward to this opportunity to fully test the limits of my skills and abilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry about what other people may be thinking about me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The thought of this task makes me feel like a failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.11 – Beliefs About Stress Scale (Chapter 6)

Beliefs About Stress Scale

Laferton, J. A. C., Stenzel, N. M., & Fischer, S. (2018). The beliefs about stress scale (BASS): Development, reliability, and validity. *International Journal of Stress Management*, 25(1), 72–83.
<https://doi.org/10.1037/str0000047>

Please rate the extent to which you agree with or disagree with the following statements.

	1 Completely disagree	2 Mostly disagree	3 Somewhat agree	4 Definitely agree
Being stressed is not problematic for me to deal with	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed drains a good deal of my energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed is, for me, a predominantly negative thing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed is something I need to avoid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed impacts negatively on my ability to perform	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed causes damage to my health in the long run	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed causes damage to my health in the short-term	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed is something I am able to mitigate using particular strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed is something I able to influence positively using my thoughts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed is something I am able to control to a certain degree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1 Completely disagree	2 Mostly disagree	3 Somewhat agree	4 Definitely agree
Being stressed makes me more productive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed enables me to work in a more focused manner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed enables me to reach my full potential	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed activates my resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.12 – Perceived Stress (Chapter 6)

Perceived Stress Scale

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396. <https://doi.org/10.2307/2136404>

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate *how often* you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

Scale:

0. Never
1. Almost never
2. Sometimes
3. Fairly often
4. Very often

In the last month, how often have you...	0	1	2	3	4
Been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt nervous or “stressed”?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dealt successfully with irritating life hassles?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt that you were effectively coping with important changes that were occurring in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt confident about your ability to handle your personal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Been angered because of things that happened that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Found yourself thinking about things that you have to accomplish?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Been able to control the way you spend your time?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.13 – Trait Anxiety (Chapter 6)

State Trait Anxiety Scale (Trait subscale only)

Spielberger, C., Gorsuch, R. L., & Lushene, R. E. (1970). *The state-trait anxiety inventory (test manual)*. Palo Alto, CA: Consulting Psychologists.

Directions: A number of statements that people use to describe themselves are given below. Read each statement and then circle the number corresponding to the statement that indicates how you **GENERALLY FEEL**. There are no right or wrong answers. Do not spend too much time on any statement. Please give the answer that seems to describe how you generally feel.

	Not at All	Very Little	Moderately	Very Much
I feel pleasant.	1	2	3	4
I feel nervous and restless.	1	2	3	4
I feel satisfied with myself.	1	2	3	4
I wish I could be as happy as others seem to be.	1	2	3	4
I feel like a failure.	1	2	3	4
I feel rested.	1	2	3	4
I am "calm, cool, and collected ".	1	2	3	4
I feel that difficulties are piling up so that I cannot overcome them.	1	2	3	4
I worry too much over something that really doesn't matter.	1	2	3	4
I am happy.	1	2	3	4
I have disturbing thoughts.	1	2	3	4
I lack self-confidence.	1	2	3	4
I feel secure.	1	2	3	4
I make decisions easily.	1	2	3	4
I feel inadequate.	1	2	3	4
I am content.	1	2	3	4
Some unimportant thought runs through my mind and they bother me.	1	2	3	4

	Not at All	Very Little	Moderately	Very Much
I take disappointments so keenly that I can't put them out of my mind.	1	2	3	4
I am a steady person.	1	2	3	4
I get in a state of tension or turmoil as I think over my recent concerns and interests.	1	2	3	4

Appendix B.14 – Personality (Chapter 6)

Mini International Personality Item Pool Scale

Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The Mini-IPIP Scales: Tiny-yet-effective measures of the Big Five Factors of Personality. *Psychological Assessment, 18*(2), 192–203. <https://doi.org/10.1037/1040-3590.18.2.192>

Below are 20 statements that may or may not apply to you. Please rate the extent to which you agree with each statement. Please answer honestly with regard to how you see yourself in the present moment, not how you would like to be in the future. There are no incorrect answers, nor any profile that is inherently more desirable than another.

	Very inaccurate	Moderately inaccurate	Neither inaccurate nor accurate	Moderately accurate	Very accurate
I talk to a lot of different people at parties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often forget to put things back in their proper place	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have a vivid imagination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sympathize with others' feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I seldom feel blue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I keep in the background	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I get chores done right away	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have difficulty understanding abstract ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not really interested in others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am relaxed most of the time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am the life of the party	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Very inaccurate	Moderately inaccurate	Neither inaccurate nor accurate	Moderately accurate	Very accurate
I like order	○	○	○	○	○
I am not interested in abstract ideas	○	○	○	○	○
I feel others' emotions	○	○	○	○	○
I get upset easily	○	○	○	○	○
I don't talk a lot	○	○	○	○	○
I make a mess of things	○	○	○	○	○
I do not have a good imagination	○	○	○	○	○
I am not interested in other people's problems	○	○	○	○	○
I have frequent mood swings	○	○	○	○	○

Appendix B.15 – Altruism (Chapter 6)

Self-Reported Altruism Scale

Rushton, J. P., Chrisjohn, R. D., & Fekken, G. C. (1981). The altruistic personality and the self-report altruism scale. *Personality and Individual Differences*, (2), 293–302.

Check the category on the right that conforms to the frequency with which you carried out the following acts

	Never	Once	About half the time	Most of the time	Always
I have helped push a stranger's car (out of the snow, off the road, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have given directions to a stranger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have made change for a stranger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have given money to a charity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have given money to a stranger who needed it (or asked me for it)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have donated goods or clothes to a charity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have done volunteer work for a charity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have donated blood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have helped carry a stranger's belongings (books, parcels, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have delayed an elevator and held the door open for a stranger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Once	About half the time	Most of the time	Always
I have allowed someone to go ahead of me in a lineup (at photocopy machine, in the supermarket, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have given a stranger a lift in my car	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have pointed out a clerk's error (in a bank, at the supermarket, etc) in undercharging me for an item	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have let a neighbour whom I didn't know too well borrow an item of some value to me (e.g., a dish, tools, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have bought 'charity' Christmas cards deliberately because I knew it was a good cause	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have helped a classmate who I did not know that well with a homework assignment when my knowledge was greater than his or hers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Once	About half the time	Most of the time	Always
I have, before being asked, voluntarily looked after a neighbour's pets or children without being paid for it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have offered to help a handicapped or elderly stranger across a street	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have offered my seat on a bus or train to a stranger who was standing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have helped an acquaintance to move households	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.16 – Strength of Religious Faith (Chapter 6)

Santa Clara Strength of Religious Faith Scale

Plante, T. G., & Boccaccini, M. T. (1997). The Santa Clara Strength of Religious Faith Questionnaire. *Pastoral Psychology*, 45(5), 375–387. <https://doi.org/10.1007/BF02230993>

Please answer the following questions about religious faith using the scale below. Indicate the level of agreement (or disagreement) for each statement

	Strongly disagree	Disagree	Agree	Strongly agree
My religious faith is extremely important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I pray daily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I look to my faith as a source of inspiration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I look to my faith as providing meaning and purpose in my life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consider myself active in my faith or church	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My faith is an important part of who I am as a person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My relationship with God is extremely important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy being around others who share my faith	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I look to my faith as a source of comfort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My faith impacts many of my decisions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B.17 – Stress Appraisal Scale (Chapter 6)

Stress Appraisal Scale

Schneider, T. R. (2008). Evaluations of stressful transactions: What's in an appraisal? *Stress and Health*, 24(2), 151–158. <https://doi.org/10.1002/smi.1176>

Please answer the following questions regarding how you feel towards the upcoming task

	Low						High
How threatening do you expect the upcoming task to be?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How demanding do you think the upcoming task will be?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How stressful do you expect the upcoming task to be?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To what extent do you think you will need to exert yourself to deal with this task?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much effort (mental or physical) do you think the situation will require you to expend?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How important is it for you to do well on this task?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How uncertain are you about what will happen during this task?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well do you think you can manage the demands imposed on you by this task?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How able are you to cope with this task?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well do you think you will perform this task?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix C: Inter-Item Correlations for the STRESS (Online Supplemental A)

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13
Item 1													
Item 2	.330**												
Item 3	.531**	.485**											
Item 4	-.063	.157**	-.047										
Item 5	.292**	.600**	.441**	.212**									
Item 6	.305**	.590**	.442**	.150**	.640**								
Item 7	.167**	.284**	.235**	.127**	.509**	.456**							
Item 8	.511**	.344**	.557**	-.072	.341**	.371**	.320**						
Item 9	.169**	.042	.274**	-.206**	.151**	.067	.148**	.330**					
Item 10	.067	.259**	.120*	.234**	.384**	.298**	.274**	.067	.012				
Item 11	-.064	.206**	-.017	.111*	.263**	.167**	.229**	-.031	.118*	.372**			
Item 12	.446**	.343**	.571**	-.115*	.408**	.313**	.248**	.498**	.312**	.124*	.042		
Item 13	.341**	.344**	.316**	.085	.359**	.375**	.216**	.327**	.002	.188**	.081	.341**	
Item 14	.066	.158**	.064	.462**	.241**	.244**	.208**	.047	-.153**	.276**	.075	-.043	.241**
Item 15	-.031	.173**	.056	.158**	.303**	.331**	.265**	.013	.075	.359**	.336**	-.005	.075
Item 16	-.002	.128**	-.024	.101*	.176**	.159**	.141**	-.006	.002	.125*	.093	.041	.122*
Item 17	.195**	.277**	.170**	-.031	.248**	.157**	.186**	.232**	.200**	.295**	.239**	.225**	-.042
Item 18	.117*	.324**	.178**	.161**	.424**	.331**	.369**	.185**	.143**	.459**	.325**	.236**	.163**
Item 19	-.099*	.084	-.089	.057	.092	.038	.128**	-.058	-.017	.102*	.202**	-.043	-.039

Note. * $p < .05$, ** $p < .01$

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13
Item 20	-.112*	.213**	-.001	.228**	.224**	.244**	.152**	-.082	.056	.284**	.352**	-.042	.062
Item 21	.141**	.273**	.165**	.300**	.385**	.349**	.251**	.171**	.030	.484**	.253**	.144**	.261**
Item 22	.298**	.400**	.291**	.252**	.471**	.437**	.309**	.297**	.082	.448**	.220**	.266**	.456**
Item 23	.332**	.291**	.476**	.075	.291**	.241**	.212**	.407**	.144**	.224**	.065	.339**	.264**
Item 24	.296**	.452**	.331**	.206**	.522**	.473**	.371**	.311**	.092	.398**	.192**	.315**	.382**
Item 25	.149**	.117*	.121*	-.013	.138**	.085	.110*	.101*	.033	.155**	-.019	.053	.033
Item 26	.169**	.128**	.211**	.190**	.286**	.150**	.126**	.146**	.116*	.255**	.047	.172**	.059
Item 27	-.009	.260**	.115*	.153**	.365**	.302**	.246**	.059	.096	.520**	.324**	.113*	.075
Item 28	.206**	.303**	.201**	.130**	.337**	.344**	.276**	.212**	.048	.442**	.217**	.191**	.320**
Item 29	.293**	.233**	.342**	.003	.248**	.206**	.194**	.296**	.082	.191**	-.019	.230**	.137**
Item 30	.081	.266**	.116*	.269**	.334**	.339**	.321**	.067	-.059	.428**	.279**	.049	.171**
Item 31	.121*	.147**	.135**	.150**	.182**	.181**	.181**	.057	.075	.321**	.098*	.102*	.010
Item 32	.429**	.324**	.494**	-.041	.267**	.248**	.169**	.444**	.148**	.201**	-.015	.365**	.287**
Item 33	.131**	.353**	.187**	.241**	.494**	.403**	.326**	.154**	.058	.511**	.297**	.156**	.207**
Item 34	.345**	.472**	.391**	.166**	.504**	.490**	.344**	.353**	.091	.361**	.162**	.314**	.443**
Item 35	.343**	.284**	.446**	-.035	.251**	.253**	.099*	.377**	.128**	.108*	-.030	.355**	.296**
Item 36	.473**	.352**	.548**	-.067	.255**	.279**	.098*	.518**	.149**	.083	-.090	.480**	.452**
Item 37	.366**	.300**	.456**	.041	.350**	.357**	.234**	.485**	.189**	.172**	.032	.520**	.314**
Item 38	.435**	.308**	.425**	-.070	.389**	.336**	.282**	.457**	.294**	.257**	.083	.472**	.306**
Item 39	.354**	.457**	.388**	.060	.523**	.470**	.412**	.377**	.222**	.369**	.219**	.513**	.381**
Item 40	.439**	.305**	.472**	-.097*	.307**	.295**	.212**	.404**	.280**	.197**	.034	.463**	.192**

Note. * $p < .05$, ** $p < .01$

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13
Item 41	.241**	.178**	.156**	-.050	.162**	.111*	.176**	.153**	.043	.242**	.082	.186**	.022
Item 42	.033	.154**	-.025	.201**	.178**	.151**	.205**	.035	-.073	.214**	.113*	.006	.155**
Item 43	.129**	.162**	.027	.072	.255**	.206**	.285**	.023	-.019	.319**	.199**	.103*	.102*
Item 44	.132**	.090	.118*	-.029	.153**	.080	.166**	.071	.043	.167**	.060	.115*	-.047
Item 45	.056	.151**	-.012	.093	.225**	.231**	.237**	.054	-.038	.267**	.270**	.054	.059
Item 46	.029	.064	.110*	.036	.155**	.101*	.072	.060	.070	.088	-.052	.134**	.101*
Item 47	.090	.293**	.093	.152**	.292**	.369**	.209**	.087	-.029	.351**	.167**	.109*	.198**
Item 48	.188**	.180**	.259**	.005	.259**	.257**	.205**	.196**	.061	.240**	.040	.288**	.128**
Item 49	.149**	.265**	.129**	.118*	.386**	.326**	.303**	.099*	.014	.294**	.207**	.175**	.213**
Item 50	.136**	.167**	.201**	.051	.253**	.226**	.196**	.184**	.079	.321**	.088	.237**	.169**
Item 51	.049	-.005	.054	.085	.056	.035	.008	.041	.073	.150**	.067	.034	-.025
Item 52	-.074	.093	-.076	.176**	.163**	.116*	.090	-.076	-.027	.165**	.218**	-.078	.126*
Item 53	.003	-.018	.056	.049	.058	-.021	-.019	.012	.070	.092	.098*	.046	-.031
Item 54	-.088	.054	-.096*	.146**	.095	.064	.012	-.134**	-.005	.279**	.287**	-.119*	-.026
Item 55	-.111*	.005	-.098*	.192**	.074	.044	-.030	-.179**	-.018	.235**	.187**	-.064	.041
Item 56	.235**	.362**	.259**	.106*	.395**	.397**	.410**	.248**	.098*	.419**	.233**	.247**	.338**
Item 57	.322**	.294**	.369**	-.028	.303**	.276**	.271**	.347**	.139**	.314**	.050	.349**	.270**
Item 58	.297**	.375**	.310**	.089	.366**	.368**	.329**	.284**	.041	.366**	.145**	.292**	.351**
Item 59	.331**	.283**	.357**	.029	.293**	.264**	.225**	.355**	.148**	.304**	.036	.351**	.272**
Item 60	.350**	.319**	.410**	-.022	.302**	.249**	.284**	.388**	.112*	.304**	.028	.372**	.325**
Item 61	.524**	.344**	.549**	-.087	.300**	.340**	.226**	.547**	.205**	.071	-.113*	.491**	.309**

Note. * $p < .05$, ** $p < .01$

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13
Item 62	.302**	.490**	.404**	.160**	.436**	.508**	.382**	.310**	.078	.327**	.157**	.364**	.364**
Item 63	.480**	.425**	.642**	-.056	.385**	.365**	.309**	.577**	.331**	.108*	.040	.593**	.264**
Item 64	.224**	.523**	.363**	.187**	.563**	.530**	.444**	.286**	.098*	.475**	.314**	.334**	.351**
Item 65	.434**	.419**	.646**	-.063	.414**	.391**	.294**	.559**	.296**	.146**	.045	.590**	.309**
Item 66	.497**	.456**	.673**	-.038	.469**	.420**	.317**	.594**	.331**	.142**	.085	.627**	.329**
Item 67	.247**	.486**	.302**	.137**	.544**	.466**	.384**	.312**	.157**	.320**	.312**	.386**	.286**
Item 68	.347**	.437**	.511**	.065	.473**	.431**	.379**	.460**	.274**	.352**	.197**	.448**	.290**
Item 69	.078	.336**	.195**	.238**	.403**	.361**	.390**	.185**	.028	.381**	.302**	.181**	.225**
Item 70	.056	.334**	.089	.200**	.421**	.378**	.344**	.071	.076	.466**	.410**	.123*	.142**
Item 71	.210**	.399**	.300**	.143**	.470**	.423**	.360**	.240**	.128**	.407**	.269**	.347**	.327**
Item 72	.192**	.271**	.276**	-.068	.325**	.253**	.289**	.259**	.239**	.317**	.285**	.255**	.100*
Item 73	.173**	.127**	.219**	-.105*	.143**	.089	.173**	.241**	.167**	.217**	.145**	.214**	-.034
Item 74	.199**	.087	.219**	-.089	.030	.042	.056	.216**	.110*	.083	.034	.105*	.113*
Item 75	.222**	.284**	.250**	.050	.373**	.259**	.315**	.254**	.207**	.419**	.346**	.214**	.128**
Item 76	.103*	.354**	.128**	.143**	.467**	.388**	.400**	.134**	.143**	.492**	.413**	.169**	.217**
Item 77	.163**	.143**	.229**	-.121*	.079	.114*	.147**	.186**	.154**	.188**	.097*	.170**	.040
Item 78	.172**	.165**	.168**	-.135**	.124*	.127**	.167**	.186**	.131**	.216**	.212**	.231**	.063

Note. * $p < .05$, ** $p < .01$

	Item 14	Item 15	Item 16	Item 17	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24	Item 25	Item 26
Item 15	.230**												
Item 16	.133**	-.087											
Item 17	.008	.118*	.064										
Item 18	.219**	.273**	.239**	.470**									
Item 19	.084	.182**	.090	.027	.173**								
Item 20	.218**	.326**	.208**	.125*	.338**	.192**							
Item 21	.348**	.298**	.106*	.056	.304**	.149**	.205**						
Item 22	.349**	.318**	.130**	.148**	.384**	.140**	.211**	.584**					
Item 23	.199**	.086	-.080	.183**	.194**	-.011	.041	.342**	.480**				
Item 24	.323**	.224**	.060	.209**	.380**	.033	.175**	.457**	.606**	.361**			
Item 25	.056	.063	.018	.185**	.159**	-.048	.065	.037	.074	.223**	.214**		
Item 26	.218**	.080	.119*	.246**	.322**	-.039	.103*	.188**	.211**	.362**	.260**	.268**	
Item 27	.249**	.336**	.145**	.294**	.498**	.085	.301**	.308**	.341**	.189**	.390**	.056	.383**
Item 28	.260**	.282**	.119*	.231**	.386**	.070	.168**	.355**	.461**	.361**	.483**	.214**	.255**
Item 29	.096*	.032	-.082	.279**	.158**	-.079	-.040	.194**	.202**	.431**	.339**	.383**	.357**
Item 30	.309**	.315**	.093	.260**	.428**	.086	.266**	.357**	.303**	.205**	.353**	.220**	.173**
Item 31	.155**	.146**	.050	.286**	.242**	-.010	.202**	.179**	.122*	.196**	.188**	.304**	.292**
Item 32	.131**	.046	-.055	.245**	.203**	-.097*	-.015	.174**	.313**	.520**	.359**	.257**	.283**
Item 33	.334**	.405**	.137**	.295**	.520**	.073	.352**	.389**	.494**	.282**	.475**	.219**	.391**

Note. * $p < .05$, ** $p < .01$

	Item 14	Item 15	Item 16	Item 17	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24	Item 25	Item 26
Item 34	.261**	.252**	.120*	.189**	.372**	-.020	.149**	.388**	.543**	.379**	.574**	.160**	.273**
Item 35	.110*	-.007	.004	.120*	.049	-.083	.019	.133**	.235**	.376**	.285**	.219**	.241**
Item 36	.149**	-.022	-.050	.120*	.064	-.074	-.101*	.183**	.319**	.519**	.335**	.127**	.194**
Item 37	.193**	.022	.043	.248**	.239**	-.040	.011	.199**	.350**	.533**	.366**	.153**	.277**
Item 38	.041	.100*	.043	.386**	.341**	-.048	-.023	.223**	.294**	.426**	.336**	.246**	.246**
Item 39	.112*	.237**	.146**	.328**	.539**	.036	.160**	.310**	.434**	.288**	.446**	.107*	.200**
Item 40	.043	.025	.053	.329**	.244**	.010	-.036	.183**	.241**	.378**	.185**	.174**	.188**
Item 41	-.012	.093	-.082	.466**	.317**	.019	.028	.047	.041	.097*	.113*	.193**	.099*
Item 42	.198**	.175**	.156**	.066	.335**	.069	.185**	.176**	.255**	.118*	.186**	.080	.119*
Item 43	.139**	.244**	.083	.242**	.423**	.073	.132**	.200**	.259**	.070	.269**	.171**	.092
Item 44	.031	.112*	.008	.342**	.250**	-.005	.061	.058	-.006	.052	.002	.166**	.080
Item 45	.128**	.275**	.075	.270**	.384**	.097*	.177**	.133**	.194**	-.029	.221**	.129**	.072
Item 46	.117*	.056	-.011	-.041	.027	-.112*	.010	.037	.137**	.202**	.149**	.086	.220**
Item 47	.226**	.200**	.066	.074	.278**	.025	.229**	.332**	.380**	.200**	.362**	.030	.159**
Item 48	.099*	.083	-.001	.172**	.223**	-.126*	.157**	.164**	.214**	.299**	.223**	.150**	.190**
Item 49	.153**	.192**	.072	.171**	.362**	.044	.269**	.283**	.328**	.160**	.346**	.063	.114*
Item 50	.146**	.109*	-.026	.163**	.201**	-.123*	.159**	.200**	.270**	.310**	.256**	.185**	.260**
Item 51	.084	.122*	.060	.163**	.186**	.075	.013	.020	.033	.065	.070	.155**	.158**
Item 52	.194**	.207**	.120*	.049	.256**	.174**	.165**	.190**	.226**	-.032	.216**	.127**	.040
Item 53	.051	.092	.031	.128**	.153**	.084	.031	.012	.032	.090	.052	.202**	.167**
Item 54	.062	.287**	.110*	.133**	.310**	.193**	.240**	.100*	.111*	-.115*	.088	.054	-.036

Note. * $p < .05$, ** $p < .01$

	Item 14	Item 15	Item 16	Item 17	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24	Item 25	Item 26
Item 55	.163**	.224**	.125*	-.008	.224**	.131**	.193**	.176**	.184**	-.078	.092	.031	.100*
Item 56	.276**	.247**	.206**	.252**	.465**	.056	.196**	.352**	.436**	.266**	.422**	.103*	.230**
Item 57	.148**	.125*	.032	.315**	.329**	-.058	.051	.255**	.334**	.488**	.350**	.264**	.338**
Item 58	.224**	.202**	.125*	.219**	.361**	.041	.117*	.345**	.487**	.368**	.458**	.114*	.215**
Item 59	.174**	.105*	.036	.288**	.269**	-.012	.047	.250**	.309**	.513**	.374**	.222**	.329**
Item 60	.125*	.113*	-.039	.205**	.245**	-.051	.016	.232**	.339**	.504**	.380**	.261**	.261**
Item 61	.048	-.069	.008	.179**	.163**	-.093	-.072	.115*	.264**	.423**	.268**	.185**	.183**
Item 62	.245**	.199**	.140**	.192**	.392**	.062	.150**	.341**	.444**	.317**	.463**	.062	.190**
Item 63	.048	.040	-.003	.241**	.199**	.001	-.010	.191**	.284**	.448**	.353**	.149**	.227**
Item 64	.291**	.309**	.154**	.261**	.496**	.101*	.288**	.375**	.459**	.283**	.479**	.120*	.248**
Item 65	.065	.066	.055	.276**	.214**	-.030	.027	.189**	.304**	.428**	.322**	.094	.213**
Item 66	.068	.119*	-.044	.345**	.271**	.005	.005	.185**	.318**	.492**	.372**	.131**	.270**
Item 67	.131**	.257**	.149**	.326**	.467**	.142**	.211**	.286**	.354**	.144**	.409**	.125*	.184**
Item 68	.102*	.250**	-.053	.396**	.344**	.065	.121*	.305**	.378**	.453**	.435**	.236**	.331**
Item 69	.273**	.255**	.216**	.111*	.401**	.213**	.246**	.373**	.410**	.221**	.362**	.123*	.134**
Item 70	.195**	.292**	.214**	.401**	.609**	.220**	.370**	.250**	.320**	.098*	.290**	.180**	.242**
Item 71	.240**	.244**	.147**	.210**	.439**	.120*	.275**	.331**	.449**	.320**	.453**	.131**	.237**
Item 72	-.010	.158**	.011	.490**	.410**	-.019	.122*	.094	.103*	.226**	.218**	.253**	.233**
Item 73	-.056	.052	-.054	.370**	.275**	-.002	.002	.073	.008	.227**	.031	.182**	.208**

Note. * $p < .05$, ** $p < .01$

	Item 14	Item 15	Item 16	Item 17	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24	Item 25	Item 26
Item 74	-.014	-.036	-.044	.168**	.058	-.052	-.047	-.012	.035	.212**	.067	.069	.068
Item 75	.071	.227**	-.003	.536**	.442**	.104*	.182**	.207**	.222**	.317**	.284**	.220**	.291**
Item 76	.184**	.270**	.137**	.376**	.588**	.165**	.316**	.286**	.343**	.136**	.408**	.193**	.261**
Item 77	-.061	.034	-.078	.390**	.168**	.016	-.049	.036	.043	.167**	.026	.110*	.136**
Item 78	-.044	.057	-.015	.480**	.293**	.067	.037	.054	.084	.158**	.102*	.189**	.183**

Note. * $p < .05$, ** $p < .01$

	Item 27	Item 28	Item 29	Item 30	Item 31	Item 32	Item 33	Item 34	Item 35	Item 36	Item 37	Item 38	Item 39
Item 28	.465**												
Item 29	.233**	.336**											
Item 30	.346**	.401**	.141**										
Item 31	.308**	.273**	.267**	.480**									
Item 32	.217**	.394**	.413**	.154**	.197**								
Item 33	.533**	.445**	.285**	.369**	.278**	.304**							
Item 34	.306**	.415**	.292**	.316**	.122*	.480**	.514**						
Item 35	.068	.214**	.403**	.016	.116*	.505**	.259**	.390**					
Item 36	.053	.246**	.372**	.015	.111*	.609**	.151**	.450**	.528**				
Item 37	.237**	.344**	.379**	.183**	.262**	.550**	.283**	.389**	.453**	.627**			
Item 38	.158**	.324**	.365**	.212**	.264**	.494**	.384**	.397**	.342**	.454**	.536**		
Item 39	.326**	.435**	.226**	.333**	.193**	.335**	.462**	.528**	.226**	.319**	.436**	.632**	
Item 40	.147**	.255**	.329**	.116*	.273**	.465**	.267**	.300**	.333**	.444**	.472**	.616**	.468**
Item 41	.115*	.124*	.192**	.209**	.204**	.190**	.102*	.171**	.087	.191**	.198**	.282**	.198**
Item 42	.218**	.158**	.016	.352**	.160**	.039	.214**	.196**	.000	-.014	.115*	.054	.194**
Item 43	.221**	.290**	.110*	.366**	.105*	.026	.229**	.232**	-.007	.004	.091	.178**	.297**
Item 44	.097*	.109*	.136**	.192**	.200**	.118*	.066	.073	.028	.101*	.175**	.228**	.171**
Item 45	.256**	.210**	.036	.380**	.135**	.046	.251**	.237**	-.041	-.054	.075	.211**	.270**
Item 46	.094	.028	.122*	.034	.213**	.161**	.159**	.238**	.147**	.217**	.232**	.080	.054
Item 47	.345**	.359**	.096*	.304**	.182**	.161**	.332**	.373**	.131**	.097*	.189**	.194**	.271**

Note. * $p < .05$, ** $p < .01$

	Item 27	Item 28	Item 29	Item 30	Item 31	Item 32	Item 33	Item 34	Item 35	Item 36	Item 37	Item 38	Item 39
Item 48	.190**	.197**	.200**	.216**	.277**	.287**	.186**	.244**	.212**	.197**	.360**	.285**	.224**
Item 49	.303**	.273**	.082	.358**	.200**	.189**	.317**	.334**	.138**	.063	.219**	.255**	.361**
Item 50	.239**	.209**	.222**	.173**	.268**	.300**	.272**	.271**	.238**	.254**	.312**	.256**	.192**
Item 51	.103*	.064	.097*	.116*	.247**	.086	.134**	-.006	.102*	.070	.127**	.138**	-.011
Item 52	.216**	.186**	-.038	.259**	.128**	-.039	.162**	.092	-.052	-.125*	-.076	.013	.061
Item 53	.093	.043	.114*	.102*	.239**	.078	.101*	-.050	.096*	.070	.098*	.118*	-.052
Item 54	.246**	.117*	-.118*	.268**	.141**	-.113*	.203**	.013	-.124*	-.231**	-.106*	.018	.096
Item 55	.247**	.125*	-.080	.183**	.084	-.113*	.184**	.008	-.119*	-.199**	-.082	-.045	.049
Item 56	.322**	.474**	.201**	.425**	.177**	.320**	.410**	.464**	.238**	.242**	.322**	.361**	.491**
Item 57	.293**	.402**	.411**	.283**	.254**	.445**	.321**	.420**	.355**	.442**	.476**	.444**	.402**
Item 58	.269**	.476**	.281**	.348**	.169**	.321**	.361**	.521**	.259**	.304**	.330**	.348**	.446**
Item 59	.213**	.431**	.426**	.270**	.301**	.439**	.281**	.413**	.361**	.438**	.448**	.427**	.348**
Item 60	.172**	.403**	.418**	.290**	.234**	.460**	.260**	.402**	.358**	.491**	.469**	.450**	.400**
Item 61	.002	.202**	.302**	.136**	.175**	.376**	.172**	.329**	.407**	.528**	.476**	.500**	.409**
Item 62	.290**	.439**	.214**	.409**	.226**	.296**	.370**	.505**	.242**	.333**	.391**	.365**	.548**
Item 63	.114*	.222**	.346**	.142**	.146**	.438**	.171**	.368**	.402**	.525**	.540**	.458**	.458**
Item 64	.424**	.401**	.267**	.468**	.226**	.268**	.530**	.514**	.216**	.196**	.323**	.324**	.522**
Item 65	.160**	.260**	.245**	.158**	.125*	.424**	.261**	.332**	.385**	.445**	.520**	.488**	.458**
Item 66	.177**	.303**	.377**	.167**	.184**	.472**	.264**	.403**	.393**	.565**	.555**	.561**	.502**
Item 67	.311**	.275**	.123*	.423**	.185**	.184**	.444**	.434**	.161**	.148**	.283**	.396**	.588**

Note. * $p < .05$, ** $p < .01$

	Item 27	Item 28	Item 29	Item 30	Item 31	Item 32	Item 33	Item 34	Item 35	Item 36	Item 37	Item 38	Item 39
Item 68	.346**	.378**	.381**	.277**	.368**	.497**	.447**	.452**	.418**	.431**	.489**	.525**	.452**
Item 69	.254**	.339**	.127**	.331**	.123*	.185**	.365**	.387**	.204**	.129**	.204**	.238**	.375**
Item 70	.362**	.296**	.106*	.462**	.254**	.056	.487**	.296**	.025	-.048	.180**	.329**	.466**
Item 71	.344**	.429**	.181**	.382**	.119*	.291**	.395**	.462**	.266**	.189**	.330**	.376**	.550**
Item 72	.293**	.222**	.330**	.267**	.301**	.287**	.350**	.279**	.156**	.136**	.236**	.427**	.361**
Item 73	.133**	.110*	.278**	.114*	.246**	.214**	.174**	.109*	.082	.164**	.179**	.328**	.228**
Item 74	.054	.075	.175**	.032	.084	.203**	.022	.103*	.200**	.189**	.096*	.211**	.062
Item 75	.303**	.289**	.331**	.311**	.349**	.269**	.421**	.271**	.190**	.173**	.300**	.480**	.390**
Item 76	.439**	.314**	.208**	.441**	.259**	.152**	.517**	.350**	.103*	.040	.217**	.333**	.475**
Item 77	.067	.100*	.213**	.100*	.205**	.186**	.101*	.092	.098*	.142**	.222**	.355**	.155**
Item 78	.118*	.183**	.260**	.175**	.270**	.185**	.252**	.114*	.075	.138**	.176**	.362**	.259**

Note. * $p < .05$, ** $p < .01$

	Item 40	Item 41	Item 42	Item 43	Item 44	Item 45	Item 46	Item 47	Item 48	Item 49	Item 50	Item 51	Item 52
Item 41	.199**												
Item 42	-.026	.206**											
Item 43	.051	.504**	.291**										
Item 44	.201**	.767**	.245**	.493**									
Item 45	.078	.414**	.259**	.502**	.402**								
Item 46	.080	-.037	.061	-.089	-.044	-.124*							
Item 47	.147**	.028	.269**	.237**	.021	.156**	.302**						
Item 48	.248**	.185**	.132**	.136**	.203**	.113*	.355**	.539**					
Item 49	.126**	.177**	.221**	.312**	.141**	.302**	.189**	.569**	.618**				
Item 50	.264**	.132**	.113*	.085	.121*	.061	.455**	.550**	.679**	.450**			
Item 51	.103*	.152**	.123*	.057	.123*	.174**	.086	-.026	.093	.023	.065		
Item 52	-.130**	.015	.206**	.193**	.010	.344**	-.060	.094	.031	.175**	.002	.555**	
Item 53	.098*	.131**	.044	.033	.100*	.175**	.109*	-.063	.131**	.009	.082	.774**	.570**
Item 54	-.065	.058	.240**	.186**	.059	.393**	-.061	.068	.027	.205**	-.009	.430**	.557**
Item 55	-.078	-.027	.209**	.158**	.002	.314**	.046	.096	.004	.149**	.014	.442**	.535**
Item 56	.249**	.340**	.279**	.475**	.265**	.412**	.074	.323**	.264**	.427**	.222**	.073	.172**
Item 57	.376**	.367**	.169**	.293**	.296**	.229**	.238**	.310**	.420**	.346**	.383**	.153**	.022
Item 58	.257**	.317**	.297**	.425**	.239**	.383**	.132**	.352**	.293**	.358**	.280**	.020	.101*
Item 59	.389**	.332**	.202**	.246**	.256**	.172**	.203**	.340**	.402**	.278**	.389**	.084	-.031
Item 60	.390**	.348**	.119*	.314**	.257**	.214**	.186**	.298**	.413**	.291**	.409**	.042	-.003

Note. * $p < .05$, ** $p < .01$

	Item 40	Item 41	Item 42	Item 43	Item 44	Item 45	Item 46	Item 47	Item 48	Item 49	Item 50	Item 51	Item 52
Item 61	.444**	.189**	.072	.039	.105*	.007	.136**	.106*	.215**	.147**	.175**	.112*	-.066
Item 62	.328**	.183**	.336**	.283**	.140**	.232**	.057	.341**	.226**	.318**	.160**	.069	.145**
Item 63	.499**	.227**	.064	.073	.150**	.097*	.124*	.106*	.246**	.187**	.204**	.105*	-.066
Item 64	.299**	.185**	.307**	.340**	.143**	.291**	.099*	.330**	.285**	.373**	.250**	.105*	.173**
Item 65	.491**	.171**	.055	.055	.100*	.113*	.126**	.200**	.289**	.238**	.285**	.083	-.056
Item 66	.542**	.248**	.010	.122*	.159**	.114*	.160**	.160**	.254**	.186**	.251**	.073	-.089
Item 67	.328**	.218**	.260**	.307**	.152**	.380**	.057	.272**	.220**	.388**	.186**	.064	.197**
Item 68	.460**	.291**	.141**	.204**	.204**	.157**	.134**	.214**	.251**	.246**	.289**	.149**	.048
Item 69	.153**	.096*	.236**	.287**	.120*	.265**	.024	.249**	.125*	.298**	.146**	.135**	.255**
Item 70	.232**	.319**	.323**	.459**	.283**	.455**	-.014	.290**	.173**	.334**	.208**	.149**	.220**
Item 71	.303**	.152**	.267**	.333**	.189**	.360**	.119*	.377**	.299**	.395**	.319**	.076	.188**
Item 72	.342**	.381**	.080	.241**	.307**	.311**	.146**	.104*	.302**	.304**	.264**	.191**	.059
Item 73	.337**	.379**	.021	.197**	.321**	.123*	.047	.020	.190**	.090	.141**	.138**	-.019
Item 74	.181**	.080	-.058	-.089	.007	-.035	.138**	.073	.161**	.005	.175**	.163**	.038
Item 75	.365**	.438**	.200**	.316**	.384**	.243**	.069	.157**	.274**	.269**	.294**	.219**	.100*
Item 76	.193**	.260**	.332**	.396**	.198**	.394**	.090	.291**	.242**	.435**	.253**	.151**	.252**
Item 77	.299**	.326**	-.013	.145**	.262**	.141**	-.034	.023	.150**	.080	.138**	.127**	-.024
Item 78	.341**	.372**	.027	.221**	.308**	.189**	-.004	.040	.190**	.155**	.168**	.111*	-.022

Note. * $p < .05$, ** $p < .01$

	Item 53	Item 54	Item 55	Item 56	Item 57	Item 58	Item 59	Item 60	Item 61	Item 62	Item 63	Item 64	Item 65
Item 54	.422**												
Item 55	.435**	.626**											
Item 56	.016	.142**	.112*										
Item 57	.142**	-.013	-.003	.573**									
Item 58	-.014	.062	.091	.745**	.594**								
Item 59	.108*	-.065	-.057	.498**	.661**	.620**							
Item 60	.101*	-.034	-.055	.531**	.656**	.669**	.747**						
Item 61	.117*	-.087	-.075	.203**	.384**	.285**	.402**	.422**					
Item 62	.037	.100*	.085	.460**	.406**	.485**	.401**	.361**	.516**				
Item 63	.109*	-.104*	-.091	.281**	.425**	.344**	.452**	.477**	.658**	.494**			
Item 64	.051	.171**	.145**	.515**	.367**	.480**	.339**	.378**	.296**	.607**	.437**		
Item 65	.062	-.069	-.088	.316**	.428**	.352**	.434**	.459**	.558**	.475**	.673**	.414**	
Item 66	.075	-.094	-.122*	.332**	.461**	.348**	.480**	.521**	.603**	.466**	.719**	.424**	.742**
Item 67	.033	.226**	.151**	.454**	.293**	.400**	.257**	.286**	.253**	.494**	.404**	.629**	.443**
Item 68	.131**	.042	-.034	.382**	.495**	.361**	.448**	.460**	.440**	.460**	.508**	.511**	.565**
Item 69	.093	.177**	.135**	.428**	.244**	.365**	.251**	.223**	.246**	.433**	.241**	.448**	.211**
Item 70	.105*	.350**	.276**	.420**	.244**	.305**	.173**	.186**	.114*	.389**	.176**	.540**	.200**
Item 71	.044	.185**	.176**	.527**	.401**	.507**	.392**	.405**	.212**	.425**	.327**	.523**	.398**
Item 72	.211**	.152**	.058	.296**	.353**	.248**	.322**	.327**	.263**	.254**	.322**	.381**	.310**
Item 73	.173**	.042	-.057	.149**	.332**	.122*	.264**	.268**	.272**	.134**	.217**	.163**	.200**

Note. * $p < .05$, ** $p < .01$

	Item 53	Item 54	Item 55	Item 56	Item 57	Item 58	Item 59	Item 60	Item 61	Item 62	Item 63	Item 64	Item 65
Item 74	.189**	-.074	-.100*	.088	.180**	.102*	.180**	.218**	.188**	.053	.169**	.037	.155**
Item 75	.207**	.198**	.050	.378**	.419**	.350**	.359**	.367**	.211**	.255**	.300**	.446**	.323**
Item 76	.134**	.339**	.257**	.419**	.286**	.310**	.179**	.227**	.138**	.395**	.210**	.588**	.256**
Item 77	.139**	.012	-.066	.172**	.238**	.116*	.166**	.193**	.229**	.130**	.207**	.167**	.234**
Item 78	.139**	.072	.011	.235**	.278**	.188**	.232**	.261**	.219**	.183**	.196**	.239**	.217**

Note. * $p < .05$, ** $p < .01$

	Item 66	Item 67	Item 68	Item 69	Item 70	Item 71	Item 72	Item 73	Item 74	Item 75	Item 76	Item 77
Item 67	.464**											
Item 68	.617**	.501**										
Item 69	.222**	.376**	.348**									
Item 70	.222**	.561**	.334**	.391**								
Item 71	.385**	.496**	.361**	.418**	.464**							
Item 72	.361**	.380**	.446**	.215**	.448**	.338**						
Item 73	.312**	.197**	.357**	.043	.257**	.113*	.481**					
Item 74	.193**	.052	.190**	.022	-.009	.140**	.267**	.133**				
Item 75	.391**	.434**	.530**	.261**	.514**	.397**	.598**	.437**	.198**			
Item 76	.247**	.589**	.413**	.336**	.660**	.468**	.507**	.272**	.066	.598**		
Item 77	.283**	.137**	.323**	.028	.209**	.127**	.401**	.534**	.133**	.469**	.271**	
Item 78	.300**	.293**	.324**	.088	.333**	.128**	.498**	.542**	.104*	.518**	.370**	.602**

Note. * $p < .05$, ** $p < .01$

Appendix D: Interview Schedule for Chapter 5

Question	Statement
1	Let's start by talking about the first thought that comes to mind when you think about "stress"
2	How do you know when you are stressed?
3	What things make you feel stressed?
4	In general, do you think that experiencing stress is a positive or negative experience?
5	How long does it take you to stop feeling stressed?
6	In what ways might stress affect you?
7	What do you do when you are stressed?
8	Summarise key findings and conclude with "Did we miss anything?" statement

Appendix E: The Subjective Thoughts REgarding Stress Scale (STRESS)

Below is a list of statements that some people associate with stress. Not all statements apply to all people. Please rate your level of agreement from 'Completely not like me' to 'Completely like me' with each statement.

	Completely not like me	Very much not like me	Slightly not like me	Slightly like me	Very much like me	Completely like me
It is harder for me to make decisions when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I cannot think clearly when stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I find it harder to remember things when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being stressed always ends badly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel immobilized by my stress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can respond to stress in many different ways	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do lots of different things to cope with my stress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I change my coping strategies to match the situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

There is always a way to respond when stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know how to deal with stressful situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are things that I can do to control my stress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not mind being in the same room as someone who is stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not become stressed if I am around other stressed people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being around other people who are stressed makes me feel stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can't be around other people when they are stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not like socializing when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am happy to be around other people when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to avoid people when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am comfortable around others when I am stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Different people think that stress is associated with different physical consequences. Below is a list of some physical consequences.

Please select the physical consequences that you think are associated with stress.

- ☐ Decreased appetite
- ☐ Difficulties sleeping
- ☐ Exhaustion
- ☐ Increased heart rate
- ☐ Increased body temperature
- ☐ Upset stomach
- ☐ Nausea
- ☐ Increased sickness
- ☐ Loss of strength
- ☐ Fatigue
- ☐ Dry mouth
- ☐ Tense muscles
- ☐ Dry skin
- ☐ Skin peeling
- ☐ Body shaking

- ☐ Headaches
- ☐ Shortness of breath
- ☐ Red face
- ☐ Improved health
- ☐ Increased strength
- ☐ Stiff joints
- ☐ Increased energy
- ☐ Sweating
- ☐ Acne, warts, etc
- ☐ Heavy breathing
- ☐ Increased blood pressure
- ☐ Increased energy
- ☐ Tiredness
- ☐ Increased hunger
- ☐ Bruising
- ☐ Breathlessness
- ☐ Sore eyes

- ☐ Bleeding
- ☐ Decreased heart rate
- ☐ Decreased body temperature
- ☐ Weakened immune system
- ☐ Improved immune system
- ☐ Worsened digestion
- ☐ Improved digestion
- ☐ Aches and pains
- ☐ Hair loss
- ☐ Weight loss
- ☐ Dizziness
- ☐ Sores