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**The Association Between Stress Mindset and Physical and Psychological Wellbeing:
Testing a Stress Beliefs Model in Police Officers**

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Abstract

Objective: Emergency service workers like police officers experience high levels of stress in the course of their regular duties. Holding particular stress mindsets may help to mitigate the deleterious effects of stress and promote wellbeing in workers experiencing regular stress. The study aimed to examine the processes by which stress mindsets relate to health and wellbeing in police officers. A stress beliefs model in which perceived somatic symptoms and coping behaviours mediate effects of stress mindsets on outcomes was tested. **Design:** Police officers ($N=134$) completed an online cross-sectional survey. **Main outcome measures:** Perceived somatic symptoms, proactive coping behaviours, physical and psychological wellbeing, and perceived stress. **Results:** Bayesian path analysis with informative priors revealed indirect effects of stress mindsets on psychological wellbeing and perceived stress through proactive coping behaviours and perceived somatic symptoms. Physical and psychological wellbeing, and perceived stress were predicted by stress mindsets directly, and through perceived somatic symptoms. **Conclusion:** The findings support model predictions that behaviours aimed at proactively meeting demands and perceived somatic symptoms mediated the relationship between stress mindset and health-related outcomes. The findings provide further foundational knowledge on mechanisms through which stress mindset is associated with outcomes and can inform future longitudinal and experimental research.

Keywords: Stress, mindsets, coping, occupational stress, emergency services

Emergency service personnel regularly experience critical incidents and are exposed to a highly stressful work environment (Nielsen, Mearns, Matthiesen, & Eid, 2011). In particular, police officers operating in the field frequently experience occupational stressors including exposure to verbal abuse, physical harm, and violence (Chopko, Palmieri, & Adams, 2015). They are, therefore, at high risk of experiencing deleterious stress-related health consequences. Identifying potentially modifiable factors that offer protection from the insidious effects of work-related stress in police officers may provide useful formative research on which to base interventions aimed at effective stress management in these essential workers.

One potential protective factor that may influence the impact of the stress response on health are peoples' beliefs about stress itself and several studies have considered the association between stress beliefs and stress-related outcomes. Negative stress beliefs, in particular, have been found to predict negative affect (Daniels, Hartley, & Travers, 2006), somatic symptoms (Laferton, Stenzel, & Fischer, 2018), and perceived stress (Fischer, Nater, & Laferton, 2016). A specific conceptualisation of beliefs about stress, stress mindset, has also been linked to a broader range of health and wellbeing outcomes. Stress mindsets are sets of beliefs that individuals hold about the consequences of experiencing stress (Crum, Salovey, & Achor, 2013; Keech & Hamilton, 2019). Mindsets refer to beliefs regarding the malleability of personal qualities, and serve as a framework through which people make predictions about, and judge the meaning of, life events (Dweck, Chiu, & Hong, 1995; Yeager & Dweck, 2012). Crum et al. (2013) applied the mindset concept to stress research, finding that holding a *stress-is-enhancing* mindset—the belief that stress has positive implications for health and performance—was associated with a range of stress-related health and wellbeing outcomes. This is contrasted with a *stress-is-debilitating* mindset—the belief that stress has negative implications for health and performance—which is associated with poorer stress-related outcomes.

Several experimental and observational studies have observed effects of stress mindset on physical and psychological wellbeing, and on physiological, behavioural, performance, and

affective outcomes in response to laboratory-induced stressors and ecological stress experiences over short periods of time (Casper, Sonnentag, & Tremmel, 2017; Crum, Akinola, Martin, & Fath, 2017; Crum et al., 2013; Keech, Hagger, O’Callaghan, & Hamilton, 2018; Park et al., 2018). Crum et al. (2013) also found that stress mindset is distinct from other important variables in the stress process such as amount of stress and stressor appraisal. As exposure to many operational stressors is unavoidable among emergency service personnel like police officers (e.g., sudden exposure to threat of violence), the distinction between stress mindsets and amount of stress is particularly relevant to police officers (Ricciardelli, 2018).

Theoretical Basis of a Stress Beliefs Model

The stress beliefs model proposes that stress mindset influences health and performance through two mechanisms: (1) changes in physiological responses to stress and (2) changes in behavioural responses to stress (Keech et al., 2018). It is well established that stress triggers activation of the sympathetic nervous system, which results in production of catecholamines such as adrenaline and noradrenaline. The activation produces changes in heart rate, blood pressure, pupil dilation, and sweat secretion, which is characteristic of a “fight-or-flight” response (Cannon, 1932). Stress also triggers increases in hypothalamic-pituitary-adrenocortical (HPA) axis activation, which results in increased production of corticosteroids such as cortisol (Selye, 1956, 1975). Crum et al. (2013) found that stress mindset was associated with adaptive cortisol reactivity profiles when students were exposed to a laboratory stressor. Specifically, stress mindset was associated with lower cortisol responses in those with high cortisol reactivity to stress, and with increased cortisol responses in those with low cortisol reactivity to stress. Two other studies have also observed that negative stress beliefs predict increased somatic symptoms in students (Fischer et al., 2016; Laferton et al., 2018). Prolonged or frequent sympathetic nervous system or HPA activations can result in overstimulation of these systems, which is referred to as allostatic load (McEwen, 2017). While these physiological systems are designed to maintain “stability through change”, returning the body to homeostasis following

the response to an acute stressor (Sterling & Eyer, 1988), overstimulation can prevent these systems from performing normally, leading to dysregulated patterns of cortisol secretion (Adam et al., 2017; Miller, Chen, & Cole, 2009). More recent research has also identified that vulnerability to physical and psychological health problems occurs through dysregulated patterns of cortisol secretion affecting the functioning of bodily systems such as the immune, metabolic, nervous, and vascular systems (Adam et al., 2017; Kumari et al., 2009; Kumari, Shipley, Stafford, & Kivimaki, 2011). This overstimulation is referred to as allostatic load and can lead to disease over long periods of time (McEwen, 1998; McEwen, 2008, 2017; McEwen & Stellar, 1993) and has been associated with negative health and wellbeing outcomes (Almadi, Cathers, & Chow, 2013; Dhabhar, 2014; Johnston, 2002). It is therefore expected that if beliefs can influence physiological activations under stress, this may in turn lead to better health and wellbeing outcomes (Keech et al., 2018). Specifically, the extent to which individuals experience the physiological stress response over a set period of time is expected to be a key mechanism through which stress mindset relate to health and wellbeing outcomes.

Given the symptoms commonly associated with the stress response, such as headaches, muscle tension, fatigue, nausea, and sleep disturbances (Lyon, 2012), it is reasonable that the goal for individuals engaging in coping behaviours is often to manage the feelings of discomfort and to attenuate the heightened arousal. These coping behaviours include emotion-focused strategies aimed at reducing the feeling of tension (Carver & Connor-Smith, 2010) and problem-focused strategies that are directed toward reducing the magnitude of the stressor itself. This includes behaviours such as planning, making a start on a task, and proactively acquiring resources (Carver & Connor-Smith, 2010). To date, the effect of stress mindset on behavioural outcomes has been examined only in regard to performance-related behaviours. Initially, desire for feedback under stress was found to be influenced by stress mindsets (Crum et al., 2013). While seeking feedback can be considered a form of proactive coping, it may not represent a propensity to use proactive behaviours more broadly when under stress, and it cannot

necessarily be generalised to other active approaches to coping to managing stress. Further, feedback may not be available in all stressful situations and is mostly relevant to performance outcomes. In addition, Casper et al. (2017) found that employees who more strongly endorsed a stress-is-enhancing mindset made more approach coping efforts in anticipation of a high workload, which in turn had favourable implications for performance. These findings indicate that changes in proactive and approach coping behaviours under stress may play a role in the process through which stress mindsets influence performance outcomes. Similar approach-oriented coping styles have been positively associated with physical health outcomes in medical students (Park & Adler, 2003). In addition, a recent meta-analysis (Hagger, Koch, Chatzisarantis, & Orbell, 2017) has indicated that coping strategies, including more proactive problem-focused strategies, predict a range of illness-related psychological and physical health outcomes, including reductions in disease progression, reduced distress, and greater wellbeing. It is expected that the use of a range of proactive coping behaviours when under stress is a key mechanism through which stress mindset influences health and wellbeing outcomes (Keech et al., 2018).

A recent test of the stress beliefs model supported its predictions in a student sample (Keech et al., 2018). Consistent with model predictions proactive coping behaviour mediated the association between stress mindset and both psychological wellbeing and perceived stress. Somatic symptoms also mediated the association between stress mindset and physical and psychological wellbeing, and perceived stress. While the stress beliefs model has been evaluated in a sample of university students, it has not yet been tested among employees in demanding occupational settings such as that experienced by police officers.

A Bayesian Approach to Testing the Stress Beliefs Model

Keech and colleagues' (2018) study provides useful reference data against which estimates can be compared when testing the stress beliefs model in a new population. Recent advances in confirmatory analytic techniques using Bayesian procedures affords researchers

means to test proposed relationships among constructs in a proposed model while simultaneously accounting for existing knowledge of those relations. Specifically, Bayesian path analyses allows researchers to incorporate existing knowledge when testing relations among constructs in model tests which, in turn, provides more precise estimates of the relations (van de Schoot et al., 2014; Zyphur & Oswald, 2015). When specifying relations among constructs in the model, researchers can specify prior values accounting for prior knowledge that are relatively broad and uninformative which returns posterior estimates similar to traditional frequentist approaches (Yuan & MacKinnon, 2009). Conversely, specifying prior values based on previous empirical data is highly informative and, to the extent that the prior values are a good representation of the relations among model constructs in the observed data, will yield estimates that are more precise (van de Schoot et al., 2014).

In the current study, we aim to test the stress beliefs model in a sample of police officers. We will adopt Bayesian path analysis to incorporate existing knowledge among constructs in the stress beliefs model from previous research (Keech et al., 2018). Posterior distributions for each proposed relationship among model constructs will provide updated estimates of the relations within the stress beliefs model. If the priors specified are a good representation of true model effects, the posterior distributions of the estimates of model relations will be more precise. This Bayesian updating approach allows us to use cumulative data from existing and current research to inform further development of the stress beliefs model as it is applied to different stressor environments, contexts, and populations. The posterior distributions can be then used as prior distributions for future tests of the model. The Bayesian approach has also been found to yield more precise parameter estimates compared to conventional frequentist approaches when analysing data from smaller samples and using informative priors (Lee & Song, 2004).

Aims and Hypotheses

The aim of the current study was to predict self-reported measures of psychological wellbeing, physical wellbeing, and perceived stress within the stress beliefs model in a sample

of police officers. The specific predictions in the model are summarised in Table 1 and illustrated in Figure 1. We propose that stress mindset will predict greater engagement in proactive behaviours when under stress (P₁), such as planning to meet demands, proactivity toward meeting demands, and avoiding procrastination. It is anticipated that stress mindset will predict perceived general somatic symptoms (P₂). We also expect that proactive behaviour will predict greater psychological wellbeing (P₃), lower perceived stress (P₄), and greater physical wellbeing (P₅) (Hagger, Koch, et al., 2017; Park & Adler, 2003). We expect that perceived general somatic symptoms will predict lower psychological wellbeing (P₆), greater perceived stress (P₇), and lower physical wellbeing (P₈). It is also anticipated that stress mindset will predict higher psychological wellbeing (P₉), lower perceived stress (P₁₀), and higher physical wellbeing (P₁₁) directly. Based on prior research that has found stress mindset to predict proactive forms of coping (Casper et al., 2017; Crum et al., 2013), and research that has found proactive forms of coping to predict positive health and wellbeing outcomes (Hagger et al., 2017; Park & Adler, 2003), we also expect that stress mindset will indirectly predict greater psychological wellbeing (P₁₂), lower perceived stress (P₁₃), and greater physical wellbeing (P₁₄), mediated by proactive behaviour. In addition, stress mindset and stress beliefs have been found to predict physiological responses to stress and perceptions of the somatic symptoms associated with the stress responses (Crum et al., 2013; Fischer et al., 2016; Laferton et al., 2018), and these responses have been directly associated with negative health and wellbeing outcomes (Almadi, et al., 2013; Dhabhar, 2014; Johnston, 2002). Therefore, consistent with Keech et al. (2018) we anticipate that stress mindset will predict greater psychological wellbeing (P₁₅), lower perceived stress (P₁₆), and greater physical wellbeing (P₁₇) mediated by perceived general somatic symptoms.

Materials and Methods

Participants and Procedure

Participants were police officers ($N = 134$; 90 male, 42 female, 2 undisclosed) ranging in

age from 25 to 59 years ($M = 43.22$, $SD = 8.29$) recruited from one police district in Queensland, Australia via an email notice sent to their work account. All operational police officers were eligible to participate, and no incentives were provided for participation. The majority (84%) of participants were born in Australia and were in a married/de facto relationship (78%). The sample was sufficiently heterogenous in terms of rank, and years of service ranged from 1 to 41 ($M = 16.72$, $SD = 9.73$).

The Griffith University Human Research Ethics Committee (reference: 2017/574) and Queensland Police Service Research Committee (DOC17/1298258) approved the study. Prior to participating, police officers were provided with details of study requirements and provided informed consent. The current study adopted a cross-sectional correlational design, with participants completing study measures between March and May 2018 in an online survey hosted by the Qualtrics[®] survey software. All 1,134 police officers in the approved police district were invited to participate, representing a response rate of 12%.

Measures

Item wording and response scales are presented in the Appendix to this paper. Revelle's ω was calculated using the *userfriendlyscience* (Peters, 2018) package in *R* (R Core Team, 2019) as an indicator of reliability for each scale (McNeish, 2018; Revelle, 2009).

Stress mindset. Consistent with Keech et al. (2018), stress mindset was measured using the Stress Control Mindset Measure (SCMM; Keech, Orbell, Hagger, O'Callaghan, & Hamilton, 2019), which measures stress mindset in the context of performance and productivity, learning and growth, health and vitality, and in general. Participants were presented with a series of statements about the consequences of experiencing stress (e.g., "Stress can be used to enhance my performance and productivity"), with responses provided on six-point scales (1 = *strongly disagree* to 6 = *strongly agree*). The SCMM exhibited adequate reliability in the current study, $\omega = .95$ and validity information for this measure is presented in Keech et al. (2019). To compute scores on the SCMM, items assessing a stress-is-debilitating mindset are reverse

coded, and then a mean score for all items is calculated for each individual. The possible range of overall computed scores is from 1 to 6, with higher scores indicating greater endorsement of the mindset that stress can be enhancing. Results of a confirmatory factor analysis (CFA) of the SCMM in the current sample indicate that the factor structure is consistent with previous validation of the scale and that the factor loadings are adequate. The CFA results are presented in the Appendix to this paper.

Proactive behaviour. Proactive behaviour was measured using a six-item proactive under stress scale (Keech et al., 2018). Participants indicated the extent to which they engaged in planning, were proactive, and avoided procrastination, as strategies to cope with stress (e.g., “In the last month, how often did you engage in planning your time to cope with stress?”) in the last month with responses provided on five-point scales (1 = *never* to 5 = *very often*). The scale exhibited adequate reliability in the current study, $\omega = .82$. Analyses conducted by Keech et al. (2018) indicated that the proactive under stress scale exhibited factorial validity and was related to constructs known to be related to proactive coping such as perceived stress and psychological wellbeing.

Perceived general somatic symptoms. The State-Trait Inventory for Cognitive and Somatic Anxiety – *Trait Version* (STICSA-T) somatic subscale (11 items) was used as a proxy measure for perceived chronic elevation in sympathetic nervous system activation (Ree, French, MacLeod, & Locke, 2008; Ree, MacLeod, French, & Locke, 2000). Participants were asked to indicate the extent to which they generally experience a variety of somatic symptoms (e.g., my breathing is fast and shallow). Responses were provided on 4-point scales (1 = *almost never* to 4 = *almost always*). The STICSA-T is a validated scale that has been associated with cortisol in prior research (Giles et al., 2015). The scale exhibited adequate reliability in the current study, $\omega = .93$.

Psychological wellbeing. Psychological wellbeing was measured using the 14-item Warwick-Edinburgh Mental Well-being Scale (WEMWBS; Tennant et al., 2007). Participants

indicated the extent to which they experience wellbeing states (e.g., “I’ve been feeling good about myself”), with responses on five-point scales (1 = *none of the time* to 5 = *all of the time*). The measure has been widely used in large national studies in the UK and Australia (Casey, 2014; Stewart-Brown et al., 2009), and in studies of police officers (Rotenberg, Harrison, & Reeves, 2016). The scale exhibited adequate reliability in the current study, $\omega = .97$.

Perceived stress. Perceived stress was measured using the 10-item Perceived Stress Scale (PSS-10), which measures the extent to which life situations over the last month are perceived as stressful (Cohen & Williamson, 1988). Participants responded (e.g., “In the last month, how often have you felt you were on top of things?”) on five-point Likert scales (0 = *never* to 4 = *very often*). Prior research has found PSS-10 scores to be positively associated with physiological indicators of the stress response such as cortisol, suppressed immune function, and increased biological markers of aging (Cohen & Janicki-Deverts, 2012). The scale exhibited adequate reliability in the current study, $\omega = .92$.

Physical wellbeing. Perceived physical wellbeing was measured on a single item from the US CDC Healthy Days (HRQOL-14) measure (Centers for Disease Control and Prevention., 2000): “Would you say that in general your health is...” with responses provided on a five-point scale (1 = *excellent* to 5 = *poor*). The measure has demonstrated acceptable criterion validity with the SF-36 (Newschaffer, 1998).

Amount of stress. Amount of stress was included as a covariate in the analyses and was measured on a single item (“Overall, how much stress do you have in your life right now?”) with responses provided on a 7-point Likert scale (1 = *no stress* to 7 = *an extreme amount of stress*). This measure was previously used by Crum et al. (2013) in the first study into stress mindset and displayed the same strength of relationship with the Stress Mindset Measure as the social readjustment rating scale (Holmes & Rahe, 1967).

Data Analysis

Bayesian path analysis using Mplus version 7.4 (Muthén & Muthén, 2015) was

employed to estimate the effects within the stress beliefs model. Proposed direct and indirect effects within the model are presented in Figure 2 and Table 3 and were set as free parameters. Full specification of the settings of the Bayesian path analysis implemented in Mplus are provided in the footnote¹. Variables in the model were manifest variables computed by calculating the mean or sum of scale items (see Table 2 for details). Amount of stress was controlled for by allowing it to predict all other variables in the model. We estimated two models. Model 1 was estimated using Mplus default ‘flat’ non-informative prior values for model parameters. In this configuration each parameter was assigned a prior based on a normal distribution with a mean of zero and a variance of infinity (Mplus uses a variance of 10^{10} to ‘approximate’ infinity). Bayesian model estimation using default priors returns similar estimates to frequentist estimation methods such as maximum-likelihood (Yuan & MacKinnon, 2009). Model 2 was estimated using informative prior values for key parameters in the stress beliefs model empirically derived from prior research testing the stress beliefs model (Keech et al., 2018). While Keech et al. (2018) tested the model in a different population who experience different types of stressors, this is the only prior study to test the model and therefore is the most logical information on which to base prior values. Mean perceived stress scores in the sample of students in Keech et al. (2018) and in the current study were also very similar between the studies (although slightly higher in the student sample) and while the type of stressor exposure may differ, both samples represent high-stress groups when compared to norms for the

¹ Bayesian path analysis using Mplus version 7.4 (Muthén & Muthén, 2015) was employed to estimate the effects within the stress beliefs model. Models were estimated using a Markov Chain Monte Carlo (MCMC) simulation which used Gibbs’ algorithms (Muthén & Asparouhov, 2012). We requested 200,000 iterations to estimate model paths with Gelman and Rubin (1992) criterion used with a strict potential scale reduction value of 1.01 to determine convergence of the Bayesian estimates. To further verify convergence, models were estimated a second time using with an increased number of iterations fixed at a factor of two (400,000) of the original number of iterations (Muthén & Asparouhov, 2012). In Bayesian path analysis, for each relationship in a proposed model, two components are specified: (a) The prior distributions of model parameters (‘priors’) provide a plausible range of values for estimating each parameter; and, (b) the observed sampling distribution of each parameter based on the newly collected data (Muthén & Asparouhov, 2012). These distributions are then combined using Bayes theorem, producing posterior distributions for model parameters (Depaoli, Rus, Clifton, van de Schoot, & Tiemensma, 2017; van de Schoot et al., 2014; Zyphur & Oswald, 2015).

perceived stress scale (Cohen & Williamson, 1988). See Table 3 for prior values and associated variance estimates.

We employed two forms of posterior predictive checking of the fit of the Bayesian model based on chi-square comparison of the proposed model across replications in the simulation (Muthén & Asparouhov, 2012). First, the 95% confidence intervals of the chi-square value including zero and having a negative lower bound value are indicators of satisfactory fit. Second, the posterior predictive p -value (PPP) should be greater than .05 and ideally approach .50 for a well-fitting model. With regard to the assessment of model paths, the associated credible interval (CrI) should not include zero when there is a true effect. The Yuan and MacKinnon (2009) method of estimating indirect effects in Bayesian models was also employed. It was anticipated that if prior distributions were a good representation of the observed data, the path model adopting informative priors would yield more precise model estimates, indicated by narrowed credible intervals around each parameter (van de Schoot et al., 2014). Changes in precision between models will be gauged by examining changes in the width of the credible intervals between the model adopting flat priors and the model adopting informative priors. While there were missing data on some demographic variables, there were no missing data on the analysed variables. Consistent with prior research (Keech et al., 2018) the proactive behaviour and perceived somatic symptoms, and the perceived stress, and psychological wellbeing and physical wellbeing constructs were set to covary.

Results

The Bayesian path analyses with flat priors (PPP = .46, 95% CI [-22.21, 25.90]) and empirical informative priors (PPP = .36, 95% CI [-19.23, 29.25])² exhibited good fit with the data and the models converged appropriately. Consistent with simulations by Muthén and

² Note that confidence intervals about PPP values are not expected to narrow in the model with informative priors as is the expectation for credible intervals about specific parameters. This is because credible intervals reflect precision of model parameters (Yuan & MacKinnon, 2009), whereas the PPP and respective confidence intervals are an indicator of the difference in the f statistic for real and observed data (Muthén & Asparouhov, 2012).

Asparouhov (2012), the PPP value was lower in the model with informative priors. Standardised parameter estimates and 95% CrI's for the structural relations among the variables in the stress beliefs model are presented in Table 3 for each model. Both models yielded the same inferences (except for P₁₀ and P₁₁ which were not supported in Model 1); however, Model 2 (informative priors) yielded more precise estimates as indicated by narrowed credible intervals and is reported below. Please also see Figure 2 for a graphical representation of Model 2. Stress mindset directly predicted proactive behaviour positively (P₁) and perceived somatic symptoms negatively (P₂), as anticipated. Proactive behaviour directly predicted psychological wellbeing positively (P₃) and perceived stress negatively (P₄), as anticipated. In contrast with predictions, proactive behaviour did not directly predict physical wellbeing (P₅). Perceived somatic symptoms directly predicted psychological wellbeing (P₆) and physical wellbeing negatively (P₈), and perceived stress positively (P₇), as anticipated. In line with expectations, stress mindset directly predicted psychological wellbeing positively (P₉), perceived stress negatively (P₁₀), and physical wellbeing positively (P₁₁).

Turning to the predicted indirect effects, as anticipated, stress mindset indirectly predicted psychological wellbeing positively through proactive behaviour (P₁₂). Further, stress mindset predicted perceived stress negatively through proactive behaviour (P₁₃) as anticipated. However, stress mindset did not indirectly predict physical wellbeing (P₁₄) through proactive behaviour, indicating a lack of support for this prediction. As anticipated, stress mindset indirectly predicted psychological wellbeing positively (P₁₅), physical wellbeing positively (P₁₇), and perceived stress negatively (P₁₆) through perceived somatic symptoms.

The path coefficients presented are standardised effects and can be interpreted in the same way as standardised regression coefficients. Standardised regression coefficients are reported in Figure 2 to provide an estimate of the effect size of each path relative to other paths in the model. Overall, Model 2 explains 48%, 45%, and 34% of the variance in psychological wellbeing, perceived stress, and physical wellbeing, respectively.”

Discussion

The aim of the current study was to test the stress beliefs model in a sample of police officers, replicating and extending research by Keech et al. (2018), and using a Bayesian analytic technique to provide updated estimates of model parameters. Overall, the role of the behavioural and physiological mechanisms through which stress mindset predicts physical wellbeing, psychological wellbeing, and perceived stress, when controlling for amount of stress, were supported. All effects were consistent with Keech et al. (2018), with the exception that in the current study the direct effect of stress mindset on psychological wellbeing was supported upon entering the mediators, and this was not the case in the prior study by Keech et al. (2018). The mediation pathways in the current study provide further support for the mechanisms in the stress beliefs model and support that these mechanisms are applicable in police officers, a group that experiences a high level of potentially uncontrollable stressors (Chopko et al., 2015). Additionally, Model 2 that used empirical informative priors drawn from Keech et al. (2018) displayed narrowed credible intervals compared to Model 1, which did not consider this prior information. This indicates that Model 2 estimates were more precise and that the prior values were a good representation of the relations among model constructs in the observed data (van de Schoot et al., 2014).

Contrary to expectations, but consistent with Keech et al. (2018), the indirect effect of stress mindset on physical wellbeing via proactive behaviour was not supported. A potential explanation for this lack of effect across two studies are that the relative importance of the mechanisms in the stress beliefs model may vary across outcomes. That is, stress mindset may predict physical health through physiological responses but not through behavioural responses. A further explanation is that physical health may be more slowly influenced by behavioural responses than psychological states such as psychological wellbeing and perceived stress, and therefore effects may not have been captured by the cross-sectional design. Together, this finding provides foundational information that can be used to inform further refinement of the

stress beliefs model, which can be evaluated using longitudinal research designs such as experience sampling (Bolger & Laurenceau, 2013).

Implications of the Current Findings

The current research makes some important theoretical contributions and also highlights areas for further investigation. First, the current study provides further support for the predictions within the stress beliefs model and provides updated estimates for these predictions. Specifically, the current research provides further evidence to support that stress mindsets are associated with the coping behaviours used when under stress and the experience of physiological stress symptoms, and that these mechanisms in turn predict stress-related health and wellbeing outcomes. This evidence was identified in a substantive non-student sample of workers that frequently experience occupation-related stress. The paper also further highlights the importance of understanding peoples' subjective cognitive models of stress in determining their wellbeing when experiencing stress.

Consistent with Keech et al. (2018), we did not observe an indirect effect of stress mindset on physical wellbeing through proactive behaviour under stress. Together, these findings suggest that for different stress-related outcomes, there may be differences in the extent to which, if at all, a particular mechanism is involved in the process by which stress mindset influences outcomes. Differences in the relative importance of particular constructs and mechanisms in predicting outcomes has also been observed in widely-used models such as the theory of planned behaviour (McEachan, Conner, Taylor, & Lawton, 2011). Given that this finding that has now been observed in two studies, it suggests that the stress beliefs model may need to be revised to consider that different mechanisms may be responsible for the effect of stress mindset on different outcomes consistent with the nomological validity approach to modelling (Hagger, Gucciardi, & Chatzisarantis, 2017). Examining this process with a greater range of stress-related outcomes and using a longitudinal autoregressive design to reduce any potential bias in estimates (Maxwell, Cole, & Mitchell, 2011) would be a valuable direction for

future research to clarify this question and to support revision of the model. A range of stress-related outcomes that could be investigated in future research include affective responses to stress, physiological indicators of stress, objective measures of physical health such as medical diagnoses or sick leave, and occupational outcomes such as turnover intentions and work performance.

The current study also supports translation of the stress beliefs model to understanding how stress mindsets influence stress-related outcomes in police officers and therefore has practical implications for stress management in this occupation. Together with further research, current findings can provide the foundation for future interventions aiming to aid police officers in stress management. For example, research could examine potential benefits of intervening upon mechanisms from the stress beliefs model in addition to manipulating stress mindset. This could be implemented by imparting skills for proactive coping strategies that may be used when experiencing stress. Research could then evaluate whether those who receive a stress mindset manipulation employ the proactive coping strategies more frequently when under stress than a control group who only received the coping strategy training.

Consistent with prior research (Crum et al., 2017; Crum et al., 2013), Keech et al. (2019) revealed that stress mindset measured by the SCMM is distinct from stressor appraisals. Kilby and Sherman (2016) also found that stress mindset displayed a moderate correlation with challenge appraisal and no correlation with threat appraisal following a mathematics stressor task. Together, these findings suggest that stress mindset and stressor appraisals are distinct constructs in the stress process. While the stress beliefs model maps key mechanisms through which stress mindset is associated with important wellbeing outcomes, the question still remains regarding how the effects of stress mindset on stress-related outcomes can be integrated with the dominant theoretical approach to understanding stress—the transactional model (Lazarus & Folkman, 1984). For example, it is not yet known whether stress mindset leads to more challenge and less threat appraisals, or whether stress mindset has an effect later in the temporal

sequence, after a cognitive appraisal has been made. Future research should therefore apply experimental methods to establish the temporal sequence in this process and to facilitate theoretical integration.

Strengths and Limitations

The current study has several strengths that enhance understanding of how stress mindsets influence health and wellbeing outcomes. First, the study examined the role of stress mindsets in determining physical and psychological wellbeing, and perceived stress in a hard to reach population given the operational environment in which police officers work. This is particularly important due increased exposure to critical incidents in high-pressure work environments (Nielsen et al., 2011), such as regular operational exposure to danger, physical harm, and violence (Chopko et al., 2015). Second, the study used a Bayesian analytic technique which provided updated estimates of the predictions within the stress beliefs model and provides further information to inform the focal points of further research that can inform interventions aimed encouraging more adaptive responses to stress among police officers and members of other occupational groups experiencing significant potentially uncontrollable stressors.

It is important to also consider the results of the current study in light of some limitations. While there are strong theoretical arguments for the direction of effects in the stress beliefs model, temporal precedence cannot be established empirically using a cross-sectional design. Cross-sectional tests of mediation can still make a useful contribution to the evaluation of conceptual models, particularly for foundational research when theory in a particular area is lacking (Gaynor & Davila, 2017); and in the case of the current study, this design was used due to constraints in recruiting from this population. Given that sequential designs generally do not improve the accuracy of estimates in tests of mediation relative to cross-sectional designs (Mitchell & Maxwell, 2013), it is recommended that future tests of the stress beliefs model employ full longitudinal designs to estimate autoregressive growth models (Maxwell et al.,

2011). This will help to empirically establish temporal precedence among model constructs and will ensure that the most accurate estimates of model parameters are estimated.

A further limitation was the use of a self-report measures. This relied on participants retrospectively recalling their behaviour, as well as their psychological and physiological states. Given potential issues associated with this type of recall in stress and coping research (Duvenage et al., 2018), further research is required to link the constructs within the stress beliefs model with more objective indicators of the stress response, such as physiological and neuroendocrine markers. Given the relatively small sample size used in the current study, future research should also seek to replicate current findings for the stress beliefs model in larger samples of police officers to test. The generalisability of the study should also be viewed in light of the sampling approach. Specifically, participants self-enrolled in the study and were not randomly sampled, approximately 69% of the sample was male, and the extent to which the sample is representative of the broader population of police officers in terms of sex, age, or exposure to adverse situations could not be verified.

Conclusion

The current study evaluated the stress beliefs model in a sample from an occupational group experiencing high levels of potentially unavoidable stressors—police officers. The study demonstrated that the model translates to another sample beyond the university student sample it was initially evaluated in and provides updated estimates of the effects within the model, maintaining that proactive behaviour under stress and perceived general somatic symptoms are mechanisms through which stress mindset influences health and wellbeing outcomes. Specifically, stress mindset directly predicted proactive behaviour, perceived somatic symptoms, psychological wellbeing, physical wellbeing, and perceived stress. Stress mindset also predicted psychological wellbeing and perceived stress indirectly through proactive behaviour; and, psychological wellbeing, physical wellbeing, and perceived stress indirectly through perceived somatic symptoms. Understanding the mechanisms through which stress

mindsets influence these outcomes is important for providing the foundations of future research aimed at maximising intervention effects and evaluating intervention effectiveness. The current study extends the work of Keech et al. (2018) mapping these mechanisms and filling this knowledge gap. The study provides the foundation for future experimental research aimed establishing causal links between the variables within the stress beliefs model and intervening upon these processes to promote adaptive responses to stress in police officers.

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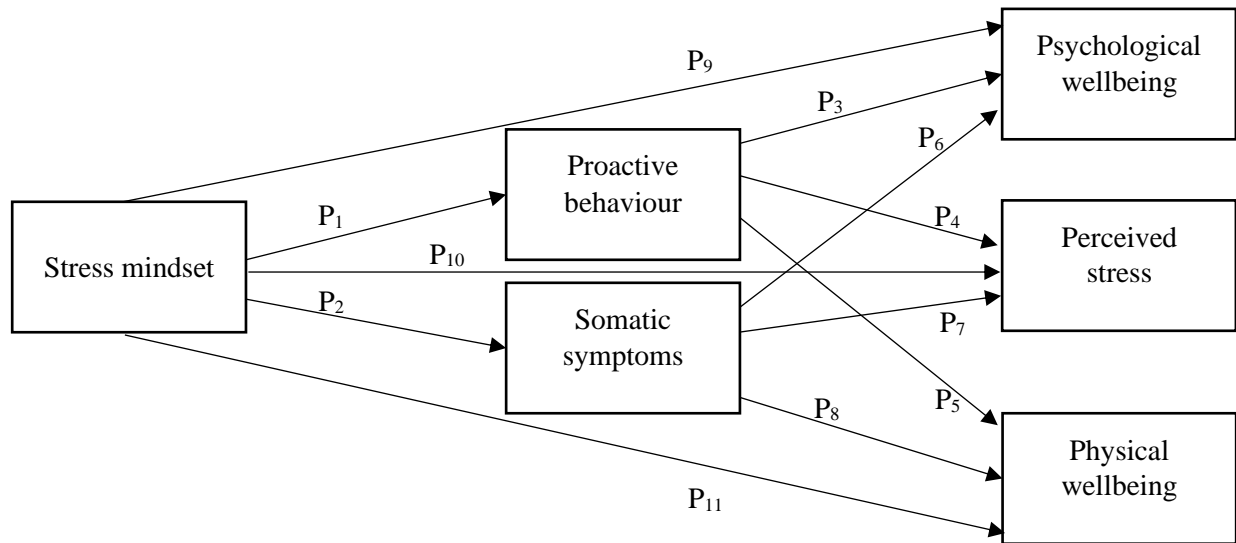


Figure 1. The hypothesised stress beliefs model.

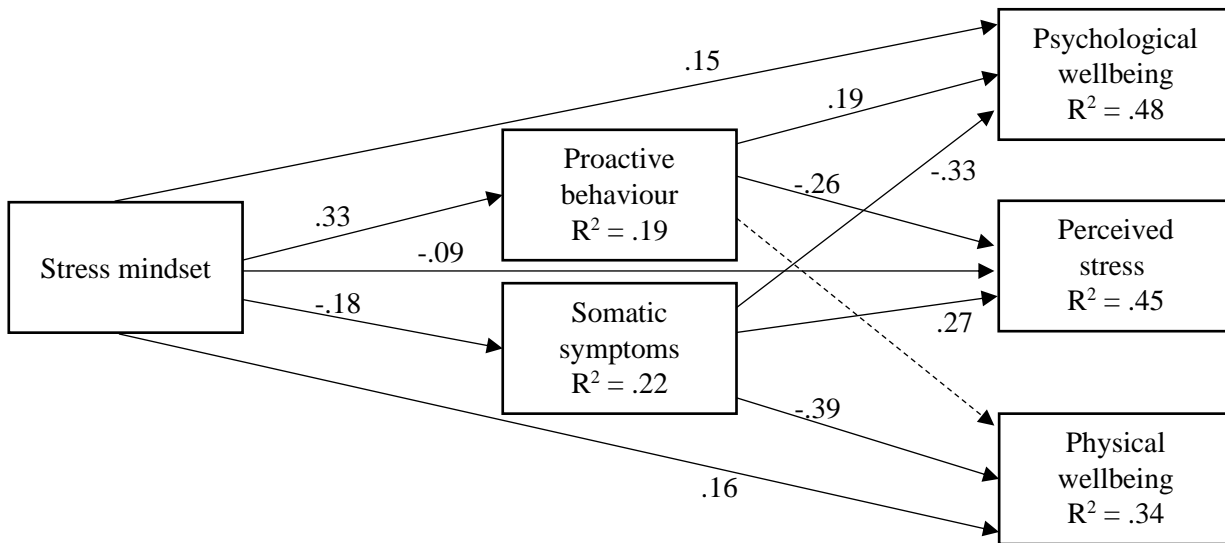


Figure 2. Standardised path coefficients for Bayesian path model of predicted relations between stress mindset and three stress-related outcomes, mediated by proactive behaviour under stress and perceived general somatic symptoms.

Note. Broken lines between constructs indicate effects estimated in the model that yielded credible intervals which encompassed zero. Credible intervals for all estimates presented in the figure do not encompass zero. Estimates presented are drawn from model adopting informative priors. Effects of variables controlled for in the model are not included in the diagram for clarity: amount of stress \rightarrow stress mindset, $\beta = -.22$, 95% CrI [-.37, -.06]; amount of stress \rightarrow proactive behaviour, $\beta = -.21$, 95% CrI [-.35, -.05]; amount of stress \rightarrow perceived general somatic symptoms, $\beta = .395$, 95% CrI [.25, .52]; amount of stress \rightarrow psychological wellbeing, $\beta = -.29$, 95% CrI [-.40, -.17]; amount of stress \rightarrow perceived stress, $\beta = .30$, 95% CrI [.17, .41]; amount of stress \rightarrow physical wellbeing, $\beta = -.13$, 95% CrI [-.28, .03].

Table 1

Summary of predicted direct and indirect effects in the proposed stress beliefs model

Prediction	Independent variable → Dependent variable	Prediction ^a
Direct		
P ₁	Stress mindset → Proactive behaviour	Effect (+)
P ₂	Stress mindset → Perceived somatic symptoms	Effect (-)
P ₃	Proactive behaviour → Psychological wellbeing	Effect (+)
P ₄	Proactive behaviour → Perceived stress	Effect (-)
P ₅	Proactive behaviour → Physical wellbeing	Effect (+)
P ₆	Perceived somatic symptoms → Psychological wellbeing	Effect (-)
P ₇	Perceived somatic symptoms → Perceived stress	Effect (+)
P ₈	Perceived somatic symptoms → Physical wellbeing	Effect (-)
P ₉	Stress mindset → Psychological wellbeing	Effect (+)
P ₁₀	Stress mindset → Perceived stress	Effect (-)
P ₁₁	Stress mindset → Physical wellbeing	Effect (+)
Indirect effects via Proactive Behaviour		
P ₁₂	Stress mindset → Psychological wellbeing	Effect (+)
P ₁₃	Stress mindset → Perceived stress	Effect (-)
P ₁₄	Stress mindset → Physical wellbeing	Effect (+)
Indirect effects via Perceived Somatic Symptoms		
P ₁₅	Stress mindset → Psychological wellbeing	Effect (+)
P ₁₆	Stress mindset → Perceived stress	Effect (-)
P ₁₇	Stress mindset → Physical wellbeing	Effect (+)

^aDenotes whether the hypothesis specifies a positive (+) effect, a negative (-) effect, or no effect.

Table 2

Observed Pearson Correlations and Descriptive Statistics for Study Variables and Covariates in the Stress Beliefs Model

Variable	1	2	3	4	5	6	7
1. Psychological wellbeing	-						
2. Perceived stress	-.83*** [-.88, -.77]	-					
3. Physical wellbeing	.59*** [.47, .69]	-.47*** [-.59, -.33]	-				
4. Proactive behaviour	.49*** [.35, .61]	-.56*** [-.67, -.43]	.37*** [.21, .51]	-			
5. Perceived general somatic symptoms	-.62*** [-.71, -.50]	.56*** [.43, .67]	-.52*** [-.63, -.38]	-.40*** [-.53, -.25]	-		
6. Stress mindset	.45*** [.30, .58]	-.36*** [-.50, -.20]	.33*** [.17, .47]	.41*** [.26, .54]	-.26** [-.41, -.09]	-	
7. Amount of stress	-.51*** [-.63, -.37]	.50*** [.36, .62]	-.37*** [-.51, -.21]	-.28** [-.43, -.12]	.44*** [.29, .57]	-.23** [-.38, -.06]	-
<i>M</i>	45.82	19.13	3.01	3.08	15.94	2.83	4.22
<i>SD</i>	11.33	7.42	1.03	.63	5.52	.94	1.52
Minimum	14	5	1	1	11	1	1
Maximum	70	40	5	4.67	44	5	7

Note: * $p < .05$. ** $p < .01$. *** $p < .001$. Scale ranges: Psychological wellbeing – responses summed, possible range 14 to 70; Perceived stress – responses summed, possible range 0 to 40; Physical wellbeing – single item, possible range 1 to 5; Proactive behaviour – responses averaged, possible range 1 to 5; Perceived general somatic symptoms – responses summed, possible range 0 to 44; Stress mindset – responses averaged, possible range 1 to 6; Amount of stress – single item, possible range 1 to 7.

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Table 3

Prior values, parameter estimates with 95% credible intervals (CrI) for hypothesised effects within the stress beliefs model

		Informative priors		Model with flat priors Model 1		Model with empirical informative priors Model 2		Diff %
		B	SD	Estimate	95% CrI	Estimate	95% CrI	
Direct								
P ₁	Stress mindset → Proactive behaviour*	.20	.06	.36	[.20, .50]	.33	[.22, .45]	-7.2
P ₂	Stress mindset → Perceived somatic symptoms*	-1.14	.49	-.17	[-.32, -.01]	-.18	[-.29, -.07]	-7.7
P ₃	Proactive behaviour → Psychological wellbeing*	3.58	.79	.17	[.03, .31]	.19	[.12, .26]	-13.3
P ₄	Proactive behaviour → Perceived stress*	-2.49	.43	-.34	[-.47, -.20]	-.26	[-.33, -.19]	-14.2
P ₅	Proactive behaviour → Physical wellbeing	-.77	.56	.12	[-.05, .29]	.08	[-.08, .24]	-1.8
P ₆	Perceived somatic symptoms → Psychological wellbeing*	-.53	.09	-.39	[-.52, -.25]	-.33	[-.41, -.25]	-11.2
P ₇	Perceived somatic symptoms → Perceived stress*	.36	.05	.28	[.13, .42]	.27	[.20, .35]	-13.8
P ₈	Perceived somatic symptoms → Physical wellbeing*	-.21	.06	-.37	[-.52, -.20]	-.39	[-.53, -.23]	-2.1
P ₉	Stress mindset → Psychological wellbeing*	.44	.65	.22	[.09, .35]	.15	[.07, .23]	-10.1
P ₁₀	Stress mindset → Perceived stress*	-.96	.36	-.09	[-.22, .09]	-.09	[-.17, -.01]	-16.0
P ₁₁	Stress mindset → Physical wellbeing*	1.32	.47	.15	[-.00, .30]	.16	[.01, .30]	-1.1
Indirect via Proactive Behaviour								
P ₁₂	Stress mindset → Psychological wellbeing*	-	-	.06	[.01, .12]	.06	[.03, .10]	-4.8
P ₁₃	Stress mindset → Perceived stress*	-	-	-.12	[-.20, -.05]	-.08	[-.13, -.05]	-7.1
P ₁₄	Stress mindset → Physical wellbeing	-	-	.04	[-.02, .11]	.03	[-.03, .08]	-1.8
Indirect via Perceived Somatic Symptoms								
P ₁₅	Stress mindset → Psychological wellbeing*	-	-	.06	[.00, .13]	.06	[.02, .10]	-5.2
P ₁₆	Stress mindset → Perceived stress*	-	-	-.05	[-.10, -.00]	-.05	[-.08, -.02]	-3.5
P ₁₇	Stress mindset → Physical wellbeing*	-	-	.06	[.00, .13]	.07	[.02, .12]	-2.8

Note. ^aDenotes whether the prediction specifies a positive (+) effect, a negative (–) effect, or no effect. *Credible intervals for corresponding estimate in Model 2 do not encompass zero. Prior B values are expressed as unstandardised path coefficients and associated variance estimates are expressed as standard deviations. Model estimates are standardised path coefficients. Diff % represents the difference between credible intervals about model parameters between models. Negative values indicate a narrower credible interval for the parameter in Model 2.