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A better understanding of factors influencing human responses to acute stress is needed to enhance prevention and treatment of stress-related disorders. In the current study, the authors examined predictors of acute stress symptoms during intense military training in 35 men. In univariate and multivariate models, perceived stress, passive coping, and emotion-focused coping during daily living predicted acute stress symptoms in response to realistic survival training, whereas active coping and problem-focused coping did not. Baseline stress levels and coping styles, both of which may be modifiable, appear to play a fundamental role in the human response to acute uncontrollable stress. Additional research is needed to better elucidate the relative and interactive contributions of behavioral predictors of acute stress.

A central premise of leading theories of human stress is that the stress response results from a complex interaction of the human with his or her environment (Lazarus, 2000; Szalma, 2008). As Szalma (2008) asserted, adopting an "individual differences" perspective enhances our understanding of the "person" element of this interaction and can, therefore, contribute to a better appreciation of its complexity. Importantly, the person component is thought to be multidimensional—comprising cognitive appraisal (i.e., evaluation of what is happening and its personal significance), motivational (i.e., disposition to attain a particular goal), as well as physiological elements (Selye, 1976). Finally, Lazarus (2000) asserts that, although emotional reactions possess their own action tendencies and associated physiological specificity, they can be concealed or overridden by the process of coping. For instance, whereas the action tendency for fear is avoidance or escape, it may be inhibited or modified by counterphobic conditioning. Building

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from this general theoretical framework, a diverse literature exploring stress responses in high-performance settings is found in the sport sciences (Jones, 1990), military psychology (Eid & Morgan, 2006; Morgan, Hazlett, et al., 2001; Morgan et al., 2004; Morgan, Wang, et al., 2001), and elsewhere. Ultimately, a more complete understanding of the person–environment model of human stress is needed to prompt the development of individualized, evidence-based strategies to mitigate stress and enhance resilience of those exposed to extreme circumstances.

With respect to the military environment, a growing body of literature examines multidimensional stress responses during Survival, Evasion, Resistance, and Escape (SERE) training (Eid & Morgan, 2006; Morgan, Hazlett, et al., 2001; Morgan et al., 2004; Morgan, Wang, et al., 2001), a harsh and realistic course where service members at high risk of capture are taught to survive, evade enemy captors, and resist during a stressful mock captivity scenario. Morgan, Hazlett, et al. (2001), for instance, revealed that 96% of Army soldiers undergoing military survival training reported peritraumatic dissociative symptoms (PDS; i.e., perceptual disconnectedness) and that general troops who endorsed symptoms of dissociation at baseline were also more likely to dissociate under stress. Furthermore, self-reported peritraumatic symptoms were significantly lower in elite Special Forces personnel compared with less-elite soldiers, and scores were significantly higher in individuals who had experienced a perceived threat to life in the past (Morgan, Hazlett, et al., 2001). In addition, Eid and Morgan (2006) linked a subscale of a hardiness measure (i.e., the tendency to view life stressors as a challenge) to fewer peritraumatic symptoms during a stressful captivity challenge ($r = -.36$).

Surprisingly limited research has investigated the relationship of baseline perceived stress to acute stress responses in the military sector. In one recent study, Engelhard and van den Hout (2007) demonstrated positive relationships between (retrospectively recalled) major stressors and PTSD symptoms experienced 5 months after deployment to Iraq in 383 Dutch army soldiers. Interestingly, the strength of association between minor stressors and PTSD symptoms dropped substantially after statistical control for neuroticism. Similarly, coping is another psychosocial variable that has been shown to influence stress responses across a variety of nonmilitary populations (Bryant & Harvey, 1995; Jehel, Duchet, Paterniti, Consoli, & Guelfi, 2001; Ullman, Filipas, Townsend, & Starzynski, 2007; Willebrand, Andersson, & Ekselius, 2004). In particular, emotion-oriented (Jehel et al., 2001) and avoidant coping styles (Bryant & Harvey, 1995; Ullman et al., 2007) are positively associated with PTSD, whereas task-oriented coping (Jehel et al., 2001) and coping by self-control (Willebrand et al., 2004) may buffer against PTSD. Little is known, however, of the influence of coping in the military environment. Given that coping styles and perceived stress may be modifiable characteristics, it is of clinical and operational importance to study their influence on stress responses in this unique at-risk population.

Taken together, the previously reviewed literature supports the notion that the human stress response is a complex function of the person–environment interaction. This, in turn, implies that relatively stable individual characteristics (i.e., traits) may influence "state" behavioral responses to specific environmental circumstances. In the present study, we consider perceived stress and coping styles as relatively stable characteristics that may influence the human response to intense stress. With this in mind, the purpose of the current study was to prospectively investigate behavioral predictors of acute stress symptoms in response to military survival training. It was hypothesized that perceived stress as well as passive and emotion-focused coping styles reported prior to survival training would associate with higher acute stress symptoms in response to survival training. By contrast, it was expected that active and problem-focused coping styles would predict lower acute stress symptoms.

METHOD

Participants

The participants in this study included 35 healthy, male, active-duty Navy personnel (M age = 21.7 years, $SD = 2.1$). Those who volunteered to participate and reported no history of head trauma or PTSD were scheduled for an in-person meeting to review the details of the study and provide written informed consent. All participants were subjected to medical and psychological screening prior to enrollment in survival training. This protocol was approved by the Naval Health Research Center Institutional Review Board.

SERE training is described in earlier reports (Taylor, Sausen, Mujica-Parodi, et al., 2007; Taylor, Sausen, Potterat, et al., 2007) and some portions of the curriculum are classified. Briefly, United States military members at high risk of capture are required to attend this course, which includes a period of mock captivity. After an initial phase of classroom-based didactic training, students were taken to a field training site where they received applied training in survival, evasion, resistance, and escape techniques. Training tasks include evasion from a simulated enemy and upon eventual capture, students must practice resistance to various forms of simulated exploitation in stressful, mock captivity-related training challenges. Because SERE training is designed, in part, to simulate a captivity experience, it offers a unique medium in which to prospectively study the effects of highly realistic mock-captivity stress on human functioning.

Measures

Approximately 3 weeks prior to attending survival training, participants completed the Perceived Stress Scale-10 (Cohen & Williamson, 1988) and the Ways of Coping Scale (Folkman & Lazarus, 1988). During survival training, the Clinician-Administered Dissociative States Scale (Bremner et al., 1998) was

administered to participants immediately after a high-intensity, mock captivity-related challenge. Finally, participants completed the Impact of Event Scale-Revised (Weiss & Marmar, 1997) 24 hours after the conclusion of survival training, with respect to the same high-intensity stressor encountered during mock-captivity.

The Perceived Stress Scale-10 (PSS-10) is a 10-item questionnaire examining the role of nonspecific appraised stress that people have experienced during the last month. This scale has been used widely in a broad cross-section of the population. Examples of items include "How often have you been upset because of something that happened unexpectedly?" and "How often have you felt nervous and 'stressed'?" All items are scored with a 5-point Likert scale ranging from 0 (*never*) to 4 (*very often*), with a possible total score of 40. The mean perceived stress score was 21.9 ($SD = 5.9$), and Cronbach's alpha reliability in the current sample was .88.

The 66-item Ways of Coping Questionnaire assesses thoughts and actions that individuals use to cope with the stressful encounters of everyday living. The respondent is asked to briefly describe a specific stressful encounter that has occurred in the past month, and then answer a series of questions about how he coped with the situation. Examples of items include "I was inspired to do something creative about the problem," and "I accepted the situation, since nothing could be done." Items are rated on a 5-point Likert scale from 0 (*does not apply or not used*) to 4 (*used a great deal*). In our study, four subscales were initially calculated, including active coping ($M = 29.8$, $SD = 11.3$, maximum possible score = 125, $\alpha = .82$), passive coping ($M = 24.2$, $SD = 11.4$, maximum possible score = 125, $\alpha = .85$), emotion-focused coping ($M = 31.9$, $SD = 15.5$, maximum possible score = 160, $\alpha = .89$), and problem-focused coping ($M = 22.2$, $SD = 7.5$, maximum possible score = 90, $\alpha = .70$). The Ways of Coping Questionnaire was administered only to a subset of the larger sample ($n = 24$).

The 19 self-report items from the Clinician-Administered Dissociative States Scale (CADSS; Bremner et al., 1998) were used to assess the frequency and intensity of state symptoms of dissociation during survival training. Specifically, participants completed the scale directly after the high-stress, mock captivity challenge and were asked to respond to each question specifically with respect to this event. Although the CADSS includes additional items used for clinical observation of the participant, the set of 19 self-report items is a valid, reliable, and independent indicator of dissociative state symptoms (Morgan et al., 2004; Taylor, Sausen, Potterat, et al., 2007). This scale is designed to assess how perceptually connected or disconnected an individual is relative to his or her environment. Examples of items include "Did you feel as if you were watching the situation as an observer or spectator?", and "Did you space out or in some way lose track of what is going on?" The self-report items are rated on a Likert scale of 0 (*not at all*) to 4 (*extremely*), with a possible total score of 76. The mean CADSS score was 25.6 ($SD = 13.1$), which is similar to previous observations of general infantry personnel in the military survival training context (Morgan, Hazlett, et al., 2001). Cronbach's alpha reliability for the CADSS in the present study was .88.

The Impact of Event Scale-Revised (IESR) is a self-report measure designed to assess current subjective distress for any specific life event. It has three subscales comprising 22 items: avoidance (IESR-Avoid; mean of eight items measuring the extent to which the respondent avoids situations that remind him or her of the stressful or traumatic event), intrusion (IESR-Intrusion; mean of eight items assessing the extent to which one experiences intrusive thoughts), and hyperarousal (IESR-Arousal; mean of six items measuring anger, irritability, heightened startle response, and hyperarousal). The total impact of event score (IESR-Total) is the mean of all 22 items. In the current study, respondents completed the IESR 24 hours after the conclusion of survival training. The directions were modified to ask the participant to indicate how distressing each difficulty has been with respect to the high-intensity stressor encountered during mock-captivity on a scale of 0 (*not at all*) to 4 (*extremely*). Adequate reliability and predictive validity have been shown for this scale (Weiss & Marmar, 1997), and Cronbach's alpha reliabilities in the present sample were .78, .83, and .78 for IESR-Arousal, IESR-Avoid, and IESR-Intrusion, respectively. Cronbach's alpha reliability for IESR-Total was .92, and the mean IESR-Total score was .94 ($SD = .61$).

Because PDS scores and IESR-Total scores were related ($r = .53$, $p < .01$), these variables were combined to form a single endpoint, termed Acute Stress Symptom Index (ASSI). Specifically, total CADSS scores and IESR-Total scores were first z-transformed, and the two z-scores were summed to yield the composite ASSI score. CADSS and IESR-Total scores related similarly to ASSI ($r = .87$, $p < .001$ and $r = .88$, $p < .001$, respectively).

Data Analysis

Data were analyzed using SPSS software Version 15 (SPSS, Inc., 2006). First, characteristics of the distributions for all independent and dependent variables were examined to ensure that assumptions of normality were met, i.e., skewness between −1 and 1, skewness/standard error <2.5, and approximate equivalency of mean/median/mode, as recommended by Leech, Barrett, and Morgan (2004). Descriptive analyses were conducted (see Table 1). Next, zero-order (Pearson) correlations were performed to reveal univariate relationships between each of the independent variables and the dependent variable and to select candidate predictors for multiple regression analyses (Table 2). Subsequently, a multiple regression analysis was conducted to prospectively examine markers of acute stress symptoms. All hypothesis tests were two-sided with $p < .05$.

RESULTS

Characteristics of the sample are shown in Table 1. Upon review, the distributions of all independent and dependent variables met

Table 1. Participant Characteristics

Characteristic	*N* (%)	*M*	*SD*	Range
Age (years)	35	21.7	2.1	19.0–30.0
Body mass index (kg/m^2)	35	24.5	1.7	20.8–27.8
Years of military service	33	1.7	0.8	1.0–5.0
Education				
High school graduate	26 (74.3%)			
College graduate	9 (25.7%)			
Ethnicity				
Caucasian	32 (91.4%)			
Hispanic	1 (2.9%)			
African American	0 (0.0%)			
Asian American	1 (2.9%)			
Pacific Islander	0 (0.0%)			
American Indian	0 (0.0%)			
Other	1 (2.9%)			
Military occupational specialty				
Aviation warfare candidate	29 (82.9%)			
SEAL officer candidates	6 (17.1%)			
Perceived stress	32	21.9	5.9	12.0–36.0
Coping styles				
Active coping	24	29.8	11.3	6.0–54.0
Problem-focused coping	24	22.2	7.5	4.0–38.0
Passive coping	24	24.2	11.4	3.0–48.0
Emotion-focused coping	24	31.9	15.5	6.0–64.0
Dissociation	35	25.6	13.1	5.0–60.0
Impact of Event Scale scores				
Total	32	.94	.61	0.0–2.1
Arousal	32	.92	.76	0.0–2.7
Avoidance	32	.79	.65	0.0–2.1
Intrusion	32	1.1	.62	0.0–2.4

Note. Two participants did not report number of years of military service, three did not complete the Perceived Stress Scale, and three did not complete the Impact of Event Scale-Revised.

criteria for normality. The subset of participants that completed the Ways of Coping Scale was indistinguishable demographically from the larger sample of 35 and did not differ with respect to any of the independent variables or the dependent variable.

As shown in Table 2, perceived stress, passive coping, and emotion-focused coping were correlated with ASSI, whereas active and problem-focused coping were not. Due to collinearity between passive and emotion-focused coping, two separate multiple

Table 2. Correlation Matrix: Perceived Stress, Coping, and Acute Stress Symptoms

	1	2	3	4	5	6
1. Perceived stress	–	.02	−.16	.00	−.10	.53**
2. Active coping		–	.78**	.94**	.85**	.27
3. Passive coping			–	.68**	.98**	.43*
4. Problem-focused coping				–	.70**	.17
5. Emotion-focused coping					–	.43*
6. Acute stress symptoms						–

* $p < .05$. ** $p < .01$.

regression models were run—one with perceived stress and passive coping as the predictor set, and the second with perceived stress and emotion-focused coping as the predictor set. In the first model, perceived stress ($\beta = .63$, $p < .01$) and passive coping ($\beta = .52$, $p < .01$) accounted for 52.0% of variance in ASSI. Similarly, in the second model, perceived stress ($\beta = .59$, $p < .01$) and emotion-focused coping ($\beta = .48$, $p < .01$) accounted for 48.0% of the variance in ASSI. These analyses were limited to 24 subjects because, as noted earlier, the Ways of Coping Questionnaire was administered only to a subset of the larger sample.

DISCUSSION

In this study, we have shown that higher levels of perceived stress and use of passive and emotion-focused coping styles prior to survival training are associated with higher levels of acute stress symptoms in response to survival training. By contrast, active and problem-focused coping did not relate to the acute stress endpoint.

Our univariate and multivariate analyses indicated that perceived stress, passive coping, and emotion-focused coping are related to acute stress symptoms during survival training. Despite methodological and ecological differences, these findings relative to perceived stress extend previous work that has demonstrated significant relationships between (retrospectively recalled) major stressors and PTSD symptoms experienced after military deployment (Engelhard & van den Hout, 2007), as well as other work demonstrating a link between financial strain and PTSD symptoms in Hurricane Katrina survivors (Chen et al., 2007). Relative to coping styles, the current findings complement a diverse collection of studies suggesting that emotion-oriented (Jehel et al., 2001) and avoidant coping styles (Bryant & Harvey, 1995; Ullman et al., 2007) are positively associated with PTSD. However, we further expected that active and problem-focused coping would associate with lower acute stress symptoms during survival training, but this hypothesis was not supported. We generated this prediction based on a limited literature showing that (conceptually related) task-oriented coping (Jehel et al., 2001) may buffer against PTSD. As noted earlier, however, we examined acute stress symptoms which relate to but certainly are not synonymous with PTSD. More research is needed to clarify the role of task-oriented, problem-focused, and active coping on the human response to acute stress.

This study has limitations. Although we were able to collect prospective data (a study strength), we were only able to assess the psychological impact of stressful events at 24 hours after the conclusion of the stressful captivity phase of survival training. Therefore, we were unable to collect additional information regarding participants' psychological status across a broader spectrum of time. To be clear, in no way did we measure PTSD itself, but rather we observed psychological impact occurring within a relatively short time frame after a stressful event. It is known that PTSD runs a longitudinal course involving a series of transitional states with progressive modification over a substantial period of time (McFarlane, 2000), and may be characterized by delayed onset up to several years (Lim, 1991). Furthermore, only a small percentage of people who experience trauma actually develop PTSD (McFarlane, 2000). In future research, we plan to plot the psychological impact of stressful events across a broader epoch to quantify the response trajectory more comprehensively. Also, the mean impact of event score was less than 1 on a scale of 0–4, thus introducing the possibility of a floor effect. We may have mitigated this limitation to a certain extent by combining this measure with the CADSS to create the Acute Stress Symptom Index. The CADSS demonstrated adequate range and variance. Another limitation is acknowledged in that the ways of coping in this study were measured in response to a pre-survival training, respondent-selected stressful incident during daily living, which were then correlated to acute stress symptoms relative to an acute mock captivity-related stressor during training. Although this is advantageous inasmuch as it permits a prospective analysis, it is also a limitation because the coping styles were not assessed in direct relation to the acute stressor in question. We are currently executing follow-on research in which we ask respondents to describe coping styles that were used during the event of interest, thereby enhancing specificity of measurement.

Leading theories of human stress advance that the stress response is a complex interaction of the person with his or her environment. In the present study, we explored multidimensional aspects of human stress and showed that perceived stress, passive coping and emotion-focused coping may prospectively influence acute stress responses during intense military training. Additional research is needed to better understand behavioral predictors of acute stress reactions. This important line of research will better inform clinical interventions designed to prevent and treat acute stress symptoms.

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We examined predictors of peritraumatic dissociative states (PDS) and quantified the link between PDS and the subsequent psychological impact of stressful events during extreme military stress. A regression model examining biological predictors of dissociative states indicated that sympathetic cardiac modulation during sleep accounted for 9.6% of the variance in PDS. In a second regression model examining behavioral predictors of PDS, perceived stress and coping styles combined to account for 47.2% of the PDS variance. PDS was positively associated with subsequently experienced avoidance ($p < .001$), hyperarousal ($p < .01$), and a total psychological impact of events score ($p < .01$). Sympathetic cardiac modulation, perceived stress, and coping styles are associated with PDS, which, in turn, influences subsequent psychological impact of stressful events.

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