Human Factors and Simulation, Vol. 30, 2022, 76–83
https://doi.org/10.54941/ahfe1001494

Toward Understanding Development of Team Resilience during Stress Exposure Training

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ABSTRACT

The demand for understanding stress resilience in Soldiers has continued unabated for decades. In this paper we applied the Bowers et al. (2017) team resilience model to test hypotheses about whether U.S. Army squads participating in a three-day Stress Exposure Training would respond with resilient stress reactions, positive team and learning climate attitudes, and learning outcomes. Anxiety, depression, hostility, sensation seeking, and positive affect showed mild to strong indications of resilient "bounce back" after scenario based training, and positive team attitudes emerged early in training and remained high. Soldiers that reported higher team cohesion and learning climate scored higher on a post-training knowledge test. These findings indicate that individual and team resilience are emergent states and multiple measures of individual and team attitudes and behaviors are critical for diagnosing team development over time. Recommendations for future research are discussed.

Keywords: Stress exposure training, Team resilience, Team development

INTRODUCTION

Starting in 2013, the U.S. Army began a vigorous campaign to implement Soldier support programs and research efforts to develop stress resilience (U.S. Department of the Army, 2013). To address the problem, the Squad Overmatch (SOvM) research program conducted a field experiment to test whether Stress Exposure Training (SET) would improve Soldier and squad skills in tactical combat casualty care (TC3), stress management, advanced situation awareness, teamwork, and conducting team self-correction during the after action reviews (AARs) (Johnston et al., 2019). In the SET condition, four Army squads were given classroom instruction along with simulation and live training exercises. Because they were intact squads, it was expected that SET with repeated post-training AARs would result in lower stress reactions, improved team attitudes, and better team performance than the four control condition squads that participated in just one day of standard tactical training. Johnston et al. (2019) compared the two conditions on measures collected before, during, and after the final two exercises and the SET squads

performed significantly better on TC3 tasks, and increased knowledge emergence as measured by observed advanced situation awareness and teamwork behaviors. Patton et al. (2018) found that Soldiers in both conditions reported about the same levels of sensation seeking and dysphoria (a combined measure of anxiety, depression, hostility) during the two scenarios, but reactions were within the range of moderate stress levels. Likewise, a decrease in cognitive workload was reported in both conditions. In this paper we further explore resilience development in the stress exposure trained squads by studying the individual and team constructs that were repeatedly collected during the three-day training.

Recently, researchers have proposed that team resilience is a complex, multi-level, dynamic construct that is influenced by and mediates both individual and team behaviors (Bowers et al., 2017; Raetze et al., 2021; Stoverink et al., 2020). Bowers et al. (2017) developed a dynamic feedback model that specified individual, team and organizational inputs and processes, emergent team resilience states such as team cohesion and efficacy, and behavioral outcomes as positive indicators of team resilience. Emergent team states result from team interaction processes under stress that in turn represent a second order emergent factor of team resilience that influences individual, team and organizational outcomes. Emergence of team states is "a dynamic process engaged in during the face of significant adversity resulting in positive adaptation" (p. 9). Using the Bowers et al. model as a guide, Table 1 presents individual, team, and organizational inputs, processes, emergent states and outcomes implemented in the SOvM study. Except for the individual processes (which were implemented as training strategies), all constructs were either self-reported or observed measures.

We hypothesized that: stress reactions would "bounce back" between training scenarios (1); cognitive workload would decrease over time (2); adaptive coping would be negatively related and maladaptive coping would be positively related to reported stress levels (3); lower reported stress levels measured later in training (emergent resilience) would be positively related to learning (4); positive team attitudes and shared situation awareness would increase across scenarios (5); adaptive coping would be positively related and maladaptive coping would be negatively related to team attitudes (6); organizational resilience as measured by AAR climate (i.e., a supportive environment) would increase over time (7); and more positive team attitudes and AAR climate measured later in training would be related to learning (8). Implications of these findings for developing team training for resilience along with future research recommendations are discussed.

Data Analysis

One squad did not participate in the final training scenario M3, therefore, we maximized sample size for interpreting the findings by eliminating participant data related to M3. A GLM repeated measures analysis test of within-subjects contrasts (e.g., linear, quadratic, and cubic) was used to test hypotheses 1, 2, 5 and 7. A GLM repeated measures analysis for a test of within-subjects effects with a Greenhouse-Geiser adjustment was used to test hypotheses 3, 4,

Table 1. Individual, team, and organizational inputs, processes, emergent states and outcomes in the Squad Overmatch study.

Inputs	Processes	Emergent States	Outcomes
Individual			
• Perceived ways of coping • Trait-based perceived stress • Perceived skill levels • Tested knowledge	• Stress management • Controlled breathing methods • Social support • Mental simulation • Mindfulness	• Perceived arousal • Perceived cognitive workload	• Perceived skill levels • Tested knowledge
Team and *Organizational			
	• Observed advanced situation awareness • Observed teamwork • Observed TC3 • Observed team-self correction	• Perceived team efficacy • Perceived team cohesion • Perceived quality of team processes • Perceived quality of team performance • Perceived shared situation awareness • *Perceived AAR climate	

and 6. To test hypothesis 8 the pre-training self-reported skill assessment and knowledge subtests were included as covariates in a GLM repeated measures analysis for a test of within-subjects effects.

METHODS

Participants

Refer to Johnston et al. (2019) and Patton et al. (2018) for a complete description of the study methods. Volunteer affidavits were obtained from all participants in accordance with Institutional Review Board requirements 32 CFR 219 and DoDI 3216.02. A total of 35 Soldiers (four intact squads supplemented with an Army medic) from two Army companies undergoing pre-deployment training participated in the SET study condition. Study pre-requisites for participation was the requirement that squads were experts in performing collective tactical tasks together, and had some first responder training. Johnston et al. (2019) confirmed that Soldiers in the SET condition had served an average of about 6 months, with a range of 23 months, in their current position, and the majority of them reported some familiarity with others in their squad and had combat casualty care training.

Training, Procedures, and Measures

Each squad in the SET condition participated in classroom instruction, two team simulation training scenarios (B1 and B2), and three live training exercises (M1, M2, M3) over a three-and-a-half-day period. All squads received training in sessions separated from the other squads. Subject matter experts taught Soldiers how to implement TC3 with their embedded medic, and how advanced situation awareness, stress management and teamwork enhanced TC3. Then squads focused on developing and applying skills during the five, increasingly stressful event-based scenarios. Scenario stressors included improvised explosive devices, a suicide vest explosion, sniper shootings, and Soldier and civilian injuries. Instructors encouraged Soldiers to use team self-correction during AARs to identify skill areas needing improvement and set performance goals for the next scenario. During the live exercises, Soldiers wore their own gear used in outdoor combat training and employed weapons rendered nonlethal with laser engagement technology.

As reported in Patton et al. (2018), the Revised Ways of Coping Checklist (RWCCL) was collected from Soldiers at the beginning of the study to assess their tendencies to use adaptive (Problem Focused Coping and Seeking Social Support) and maladaptive (Avoidance, Wishful Thinking, and Blaming Others) coping behaviors. The Multiple Affect Adjective Checklist-Revised (MAACL-R) assessed trait and state arousal levels (Anxiety, Depression, Hostility, Sensation Seeking, and Positive Affect). At the beginning of the study Soldiers assessed how "they generally feel" (trait), then their arousal state was assessed before each scenario ("how you feel right now") and immediately after each scenario ("how you felt during the scenario").

As described in Johnston et al. (2019) and Patton et al. (2018), after each scenario Soldiers completed Likert-type scales indicating the degree to which: (1) mental effort (Cognitive Workload) was needed to identify, understand, predict and achieve mission objectives; (2) their team was able to identify, understand, predict and achieve mission objectives (Shared Situation Awareness); (3) Team Cohesion and Team Efficacy was experienced; and (4) how their squad had accomplished its tasks via Teamwork Process Actions and Team Performance. After each AAR Soldiers completed word pair choices rating various characteristics of the AAR Climate. Prior to the start and then after the end of training, Soldiers completed a 58-item multiple choice test comprised of the five knowledge-area subtests and a self-report survey rating their skill levels (i.e., beginner, advanced beginner, proficient, and expert) on the five areas.

RESULTS

Individual Resilience

All correlations are reported as Pearson *r*. Trait-based arousal measures on the MAACL-R were found to be significant covariates of their respective state arousal measures and were included as covariates in the GLM analyses. Figure 1 shows arousal measures spiking during scenarios and then returning closer to their baseline assessment. Hypotheses 1 and 2 were supported

with a significant quadratic trend for Anxiety ($F(1,32) = 10.89$, p=.002), Hostility (F (1,33) = 13.55, p = .001), and Sensation Seeking ($F(1,33)$ = 8.75, p = .006); cubic trend for Depression ($F(1,33) = 4.15$, p = .05) and Cognitive Workload ($F(1,33) = 5.34$, p = .027), and linear trend for Positive Affect ($F(1,33) = 4.30$, p = .05). Patton (2013) found that, when compared to normative values on the MAACL-R, mean scores such as those in Figure 1 are in the low to moderate range of arousal levels; values above 65 indicate very high arousal (e.g., U.S. Army recruits) and values below 55 are normal arousal (e.g., end of a regular work day). Patton (2013) also reported that Soldiers do not usually express anxiety while performing duties in which they are well trained; Depression and Hostility usually increase when the task or the systems being used do not perform as anticipated or if they lose control over events; Positive Affect tends to be lower in military populations in general and usually indicates task engagement; and Sensation Seeking (compared to civilians) elevates when performing the duties for which Soldiers are trained, especially if it involves firing a weapon. Cognitive Workload ratings supported these findings, with Soldiers rating scenario B1 as somewhat easy ($M = 1.90$, $S.E. = .10$), and then rating the remaining scenarios as very easy (B2: $M = 1.57$, $S.E. = .08$; M1: $M = 1.63$, $S.E. = .09$; M2: $M = 1.56$, $S.E. = .09$). Soldiers reporting higher Cognitive Workload during B1 also reported greater Anxiety ($r = .53$, $p = .001$) and Hostility (r= .43, $p = .01$), and lower Sensation Seeking (r = -.41, p = .015), and higher Hostility levels during B2 ($r = .44$, $p = .008$) and M2 ($r = .45$, $p = .007$).

Hypothesis 3 was partially supported with the finding that Problem Focused Coping was a significant covariate of Anxiety ($F(4.33,138.48) = 2.87$, $p < .05$). Soldiers reporting higher levels of Problem Focused Coping had lower levels of Anxiety during B1 (r = -0.47, p = .005), B2 ($r = -0.59$, $p < .000$) and M1 ($r = -0.40$, $p < .02$), indicating they were probably using effective coping behaviors when they were needed. Hypothesis 4 was not supported.

Team Resilience

Hypothesis 5 was partially supported with a cubic trend for Team Cohesion ($F(1,31) = 21.42$ p = .000) and Team Action Processes ($F(1,31) = 10.04$, p =.003), and a quadratic trend for Team Performance ($F(1,31) = 8.33$, p =.007) and Shared Situation awareness ($F(1,33) = 7.52$, p = .01). Figure 2 shows Team Cohesion, Team Action Processes, and Team Performance started low after the first scenario (B1) and then increased to remain at higher levels following the next three scenarios. Soldiers reported high levels of Team Efficacy throughout the training. Ratings of Shared Situation Awareness supported these findings, with perceptions of the squad's ability to maintain Shared Situation Awareness starting high during the first scenario (B1: $M = 3.10$, $S.E. = .70$), then increasing to even higher levels during the remaining scenarios (B2: $M = 3.36$, $S.E. = .47$; M1: $M = 3.45$, $S.E. = .56$; M2: $M = 3.43$, $S.E. = .50$).

Hypothesis 6 was supported; with a mix of coping strategies related to team attitudes during the simulation-based exercises early in training. Problem Focused Coping was a significant covariate of team attitudes (Team

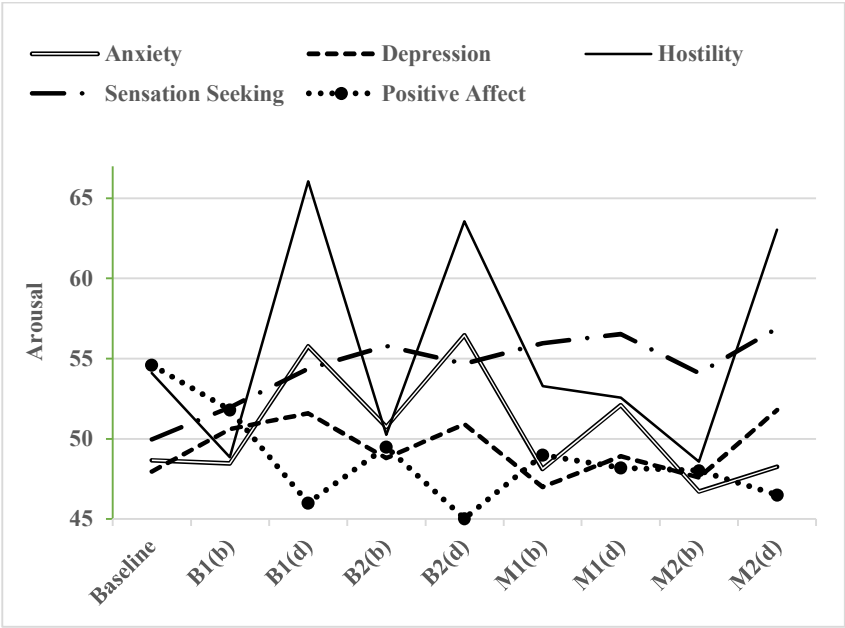

Figure 1: Patterns of Soldier Self-Reported Arousal Levels at Baseline, Before (b), and During (d) Training Scenarios.

Cohesion: (F(2.46, 73.87) = 5.792, p = .003; Team Action Processes: (F (1.90,56.96) = 5.529, p = .007; and Team Performance: (F(2.03,60.79) = 5.946, p = .004). Higher levels of Problem Focused Coping were related to greater Team Cohesion (B1: r = .56, p = .000; B2: r = .43 p = .007), Team Action Processes (B1: r = .40, p = .011; B2: r = .44, p = .006), and Team Performance (B1: r = .45, p = .005). Avoidance (F(2.44, 73.26) = 3.35, p = .032) was a significant covariate of Team Cohesion, with lower levels of Avoidance related to higher levels of Cohesion (B1: r = -.59, p < .000; B2: r = −0.59, p = .013). Wishful Thinking was a significant covariate with Team Performance (F(1.91, 57.23) = 3.14, p = .053), with lower Wishful Thinking related to higher levels of reported Team Performance (B1: r = −0.43, p = .007; B2: r = −.30, p = .05). Blaming Others was found to be a significant covariate of Team Action Processes (F(1.65,49.54 = 3.84, p = .036) and Team Performance (F(1.96,58.81) = 3.80, p = .029), but no significant correlations were found.

Hypothesis 7 was supported with a finding of a significant linear trend in Soldier AAR climate ratings (F(3, 35) = 17.81, p < .000). As with the team attitudes, AAR climate ratings started low following B1 (M = 44.81, $S.E.$ = 1.22) and then increased to higher levels after B2 (M = 47.47, $S.E.$ = 1.23), M1 (M = 47.86, $S.E.$ = 1.14) and M2 (M = 49.58, $S.E.$ = 1.08).

Hypothesis 8 was partially supported with a finding that when measured after M2, higher levels of Team Cohesion (F(1,31) = 6.820, p = .014) (r = .464, p = .007) and AAR Climate (F(1,34) = 8.602, p = .006) (r = .545, p = .001) were related to higher scores on the TC3 knowledge post-test. None

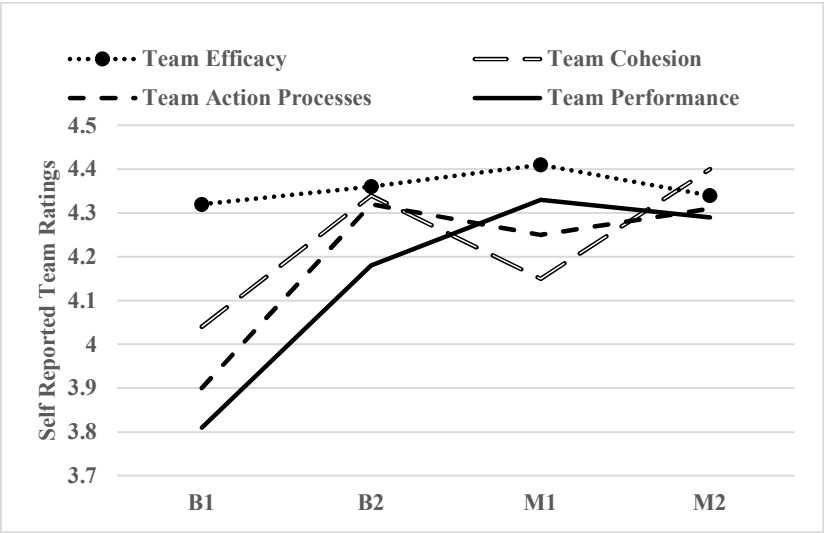

Figure 2: Patterns of soldier team attitudes after each scenario.

of the measures following M2 were covariates of the self-reported skill levels evaluated after training.

DISCUSSION AND RECOMMENDATIONS

Findings support the Bowers et al. (2017) team resilience theory. Trait-based arousal is related to emergence of perceived arousal. Positive coping strategies (e.g., greater problem focused, and less wishful thinking and avoidance) may reduce anxiety and bolster team attitudes early in training. Patterns of Soldier arousal levels "bounced back" to lower levels; which likely indicated Soldier task engagement. The high level of team efficacy indicated Soldiers felt their squads could adequately perform TC3 training, and the rapid increase in the other team attitudes and organizational support immediately after the first scenario were further positive indicators of confidence in their teams. Lastly, emergent team and organizational attitudes likely influenced learning TC3 skills. Johnston et al. (2019) discussed study limitations and reported minimal threats to internal and external validity: study design and measures had been validated and used in previous research, participant experience and training were similar in both conditions, objective learning tests and observer checklists were used to compare learning and performance, both experimental and control groups were equivalent on demographic characteristics, and any external training participants had outside the study during the same time was unrelated to SET.

These findings along with the comparative results reported by Johnston et al. (2019) and Patton et al. (2018) support the Bowers et al. proposition that resilience training such as SET that focuses on improving individual and team resilience processes will enable emergence of individual, team and organizational resilience and influence learning outcomes. Future research

should strive to study resilience with research designs that account for emergent cognitions, attitudes and behaviors. Research on teams should identify best instructional strategies for team resilience depending on where they are in their team development path, and improve the quality and availability of measures for complex team dynamics to better capture how teams develop (Johnston et al., 2018). Finally, researchers should study how these types of data can inform human behavior representation models that can help identify and predict soldier behavior in a variety of scenarios.

DISCLAIMER AND ACKNOWLEDGEMENT

This work was funded by the US Army Medical Research and Materiel Command Joint Program Command-1 (MRMC JPC1). The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the U.S. Government. The U.S. Government is authorized to reproduce and distribute reprints for Government purposes notwithstanding any copyright notation herein. This document is approved for public release.

For their significant contributions to this research effort the authors acknowledge Henry (Hank) Phillips, Laura Milham, Dawn Riddle, Lisa Townsend, Arwen DeCostanza, Katherine Cox, Sean Fitzhugh, Robert Wolf, and Paul Butler.

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