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Virtual Healing: Designing Reality

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The Usefulness of Virtual Reality Stress Inoculation Training for Military Medical Females: A Pilot Study

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Abstract: Warfighters face stressors such as sleep deprivation, information overload, exposure to injuries/dead bodies, and anxiety for the welfare of fellow Warfighters and family left behind. Consequently, we are continuously losing Warfighters due to psychological stress. Researchers have recently reported that approximately 18% of Warfighters returning from Iraq and 11% returning from Afghanistan (n = 6, 201) screened positive for Post Traumatic Stress Disorder (PTSD). PTSD is a debilitating condition resulting from experiencing trauma, characterized by continuous memories of the traumatic experience. Military medical personnel are not immune to stress since they have a challenging and demanding dual role — that of a Warfighter and a first responder. In fact, it has been reported that many first responders report serious psychological distress, including PTSD. Even though many researchers are studying Warfighters’ stress, there is still a gap in the literature on studies with support personnel (i.e., medics) and females. During a recent interview, a researcher reported finding no statistically significant PTSD symptoms difference between males (11%, n = 300) and females (12%, n = 50) in a sample of Warfighters holding violence-prone support jobs (i.e., medics). However, other researchers had previously reported that approximately 20% of females and 8% of males who had been exposed to traumatic events did develop PTSD symptoms. Furthermore, some researchers suggest that females might be less likely to be exposed to adverse stressful events but more likely to develop PTSD if exposed. Thus, an overall increased prevalence of PTSD in females (10% vs. 5% in males) can be accounted for by a significantly greater vulnerability to develop PTSD after exposure. Females also seem to have a longer course of illness than males with a median time to remission being 35 months for females compared to 9 months for males. The purpose of this study is not to identify which gender is more prone to PTSD. However, given the premise that males typically grow-up being exposed to more stressful situations than females (i.e., teasing each other, playing rough sports), and the lack of studies on female Warfighters (especially, in the medical field), we propose to test the effectiveness of Stress Inoculation Training (SIT) for female military medical personnel. SIT proposes that repeated exposure in stressful, but controlled conditions (i.e., via virtual reality) enables individuals to gradually adapt to stressors and learn how to cope. By conducting virtual reality SIT, or “VR-SIT”, the stressors can be applied systematically and paced appropriately for each individual. Our VR-SIT pilot study is currently underway and preliminary findings will be presented at the 2006 CyberTherapy Conference in Canada.

INTRODUCTION

Warfighters face a myriad of stressors when deployed to the battlefield, such as sleep deprivation, information overload, exposure to injuries/dead bodies, and anxiety for the welfare of fellow Warfighters and family left behind (Lukey, Stetz, & Romano, 2005). Hoge et al. (2004) reported that approximately 18% of Warfighters returning from Iraq and 11% returning from Afghanistan (n = 6, 201) screened positive on stress-related measures (i.e., Post Traumatic Stress Disorder (PTSD)). They also reported that 1 in 10 U.S. Iraq veterans suffer some type of stress disorder (Hoge, Auchterloni, & Milliken, 2006). Additionally, Stetz et al. (2006) found that in 2003, 7% (21 out of 282) of medical evacuations in Operation Enduring Freedom and 6% (365 out of 5,389) of those in Operation Iraqi Freedom were due to psychiatric illness. Stetz et al. (2006) also reported that 21% of those evacuated had prior psychiatric histories before deploying to the theater of operations. Most prior histories were either related to stress
PTSD is a psychiatric disorder that follows traumatic events. It can occur after exposure to extreme traumatic stressors during combat deployment such as coming under fire, suffering injuries that require medical attention, seeing casualties (Nisenbaum, Barrett, Reyes, & Reeves, 2000), or handling human remains (McCarroll, Ursano, & Fullerton, 1993). To be considered PTSD, symptoms must be present for more than one month (to rule out Acute Stress Disorder), and the disturbance must cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. Major symptoms of PTSD consist of a persistent reexperience of the traumatic event, avoidance of stimuli associated with the trauma, numbing of general responsiveness, and increased arousal (i.e., difficulty sleeping, anger, irritability). Danckwerts and Leathem's (2003) PTSD review shows that the severity of PTSD symptomatology is influenced by the extent or gravity of the actual exposure to the stressful event (e.g., the sudden unexpected death of a loved one carries a risk of 14% for triggering PTSD, while combat, bombing, or mass violence has a risk factor as high as 20–40%). Individuals with PTSD report symptoms related to cognitive impairment such as an inability to think, concentrate, or make decisions. They may appear easily distracted or complain of memory difficulties (Amer. Psych. Assoc., 2002).

In addition to deployment and battlefield stress, Warfighters experience job-related stressors such as work overload, time demands, uncertainty, and poor leadership that can decompensate in sub-clinical emotional states of anxiety and fear. For example, under conditions of high workload, individuals tend to experience anxiety because of an inability to cope with work requirements (Bliese & Stetz, in press) and individual performance declines. Unpredictability at work has also been shown to lead to low performance. Warfighters tend to report higher performance and well-being when predictability/certainty at work is high (Fleming, O’Keefe, & Baum, 1991). Organizational constraints (i.e., lack of equipment) have also been associated with lower satisfaction (Spector & Jex, 1998; Stetz, Stetz, & Castro, in press), lower well-being, and decreased reenlistment intentions.

VIRTUAL REALITY’S ROLE IN STRESS DETECTION, MEASUREMENT, TREATMENT, AND PREVENTION

There are many ways to measure stress. For example, researchers can administer paper-and-pencil or computerized surveys, such as the Clinician-Administered PTSD Scale, to determine individuals’ psychological states. Stress can also be measured via physiological apparatuses that capture stress markers such as breathing rate, heart rate, and skin temperature. Luckily, some battlefield stressors can be treated with non-invasive measures. For example, sleep loss, a typical byproduct of the quick tempo in the battlefield, can be monitored using a wrist-mounted actigraph and treated with hypnotics, phase delay light therapy, or strategic naps. Increased physical activity is also recommended for everyone aiming to feel better. Leduc, Caldwell, and Ruyak (2000) found that while the alerting effects of exercise were short lived, short but vigorous bouts of exercise placed during the circadian ebbs actually helped the participants "get over the hump." However, treating extreme stress (i.e., PTSD) is not that easy. Research shows that only 44% of those individuals who enter psychotherapy "significantly improve" (Bradley, Greene, Russ, et al., 2005). Psychological debriefing (PD), designed to mitigate acute distress and prevent long-term psychopathology, is undergoing intense scrutiny. Some critics question its efficacy (McNally, Bryant, & Ehlers, 2003), while others claim it may increase the risk of developing long-term psychological symptoms following traumatic events (McFarlane, 1986). Critical incident stress debriefing (CISD) is also used to help Warfighters manage stress upon returning home or immediately after a traumatic exposure, but has received mixed empirical support (Kavanagh, 2006). While most recipients of psychological debriefings report feeling better or that the debriefing was helpful, there is not a clear or robust relationship to either mitigation of psychological symptoms or functional outcomes. Ironically, this approach is currently used extensively in the military, law enforcement, fire fighting, emergency rescue, and airline industries. Drugs, or antidepressant medi-
cations (i.e. selective serotonin reuptake inhibitors), rarely yield better than a 40% reduction in the Clinician-Administered PTSD Scale scores, and most patients will still meet criteria for PTSD at the end of their treatment trial (Hamner, Robert, & Frueh, 2004).

It is often said, “An ounce of prevention is worth a pound of cure.” This saying rings true with regard to stress casualties. The Department of Defense (DoD) is earnestly looking for ways to prevent and treat Warfighters’ mental health problems like PTSD. DoD asks all units to complete health questionnaires before (DD Form 2795) and after (DD Form 2796) deployments. However, both of these surveys only ask a few questions concerning mental health. Furthermore, most questions are asked upon redeployment back home. Therefore, there is limited pre-deployment screening effect. Moreover, units do not tend to follow the same process as prescribed by DoD (Centers for Disease Control). Stress Inoculation [exposure] Training (SIT) is a prevention strategy that aims to mitigate the negative effects of psychological stressors in healthy individuals. Its foundation dates back to Wolpe’s work on cognitive/behavioral stress-coping training in the early 1970’s. The cognitive-behavioral preventive approach, which is central to SIT, has been implemented in military, medical, and other settings. SIT attempts to immunize an individual from reacting negatively to stress exposure (Abramson, Metalsky, & Alloy, 1989). The individual and the stressful condition must be identified a priori (Adams, 2005). Gradual and repeated stress exposure desensitizes individuals to stimuli that may impede performance and produce psychological trauma (Wiederhold, Bullinger, & Wiederhold, 2006), decreasing the probability of future negative responses (Driskell & Johnston, 1998). That is, through successive approximations, individuals build a sense of expectancy that is integrated into positive cognitive appraisal, providing a greater sense of mastery and...
confidence or “self-efficacy.” The rationale for stress-reduction is based on the premise that the availability of information or pre-exposure to the stress reduces the novelty of stressful tasks. SIT, therefore, increases the likelihood of a positive expectation and greater sense of predictability and control with a consequent reduction in both physiological and emotional reactivity.

Saunders et al. (1996) offer the following findings regarding the effectiveness of SIT (Abramson, Metalsky, & Alloy, 1989): the greater the number of training sessions the better (Adams, 2005); there is no difference in effect for laboratory and field (not necessarily battlefield) interventions; SIT is more effective for state anxiety if used with small groups while more effective for performance anxiety if used with larger groups; and finally, (Banderet & Russo, 2005) SIT programs using imagery components are more effective at reducing performance anxiety than those that do not use imagery, unless the latter uses behavioral practice in coping. Meichenbaum (1985) states that SIT’s success is also dependent upon employing stress-coping training-features and instructional design. Adaptive coping strategies and their associated appraisals could act as a moderating buffer against stress-induced impairment. Coping skills, such as combat breathing, can first be taught in a safe environment. After the basic skill is taught, the individual can be asked to perform the skill in a more vivid environment. Vividness is an important component of the SIT approach and it must be controlled, allowing individuals to gradually adapt to stressors and learn how to cope.

With recent advances in virtual reality (VR), the technology leads itself quite well to be used in SIT. Stressors can be systematically added and vividness can be increased as the individual habituates. Military personnel can train in virtual environments (i.e., an Iraqi village, a shoot house, or a ship) where simulations can be viewed on desktops, laptops, through a head-mounted display, or as a one- or three-wall CAVE projection system. The training is then transferred to real-world exercises in structures designed specifically for tactical training. VR-SIT is consistent with a current emphasis on embedding training in Warfighters’ systems. There is some evidence that SIT can reduce PTSD. A group of 106 male British soldiers preparing for a 6-month tour of duty in Bosnia received a combination of pre-deployment stress training and PD. The study demonstrated a drastically reduced incidence of PTSD and other psychopathology, approximately 10 times less than figures reported from other military samples (Deahl, Srinivasan, Jones, et al., 2000). Saunders et al. (1996) conducted a meta-analysis of SIT studies to determine the effect of such training on subjective (anxiety) and objective (performance) measures. They found a strong overall effect for SIT to reduce performance anxiety (anxiety resulting from engaging in a task). They also found a moderate effect for reducing state anxiety (anxiety that is not necessarily task-related) and increasing performance. Their results are similar to Driskell and Johnston, (1998) who studied over-learning. Stahl (2004) notes that both SIT and stress management approaches have been studied extensively, and overall, these two appear to have a positive effect on subjective measures of stress and anxiety prior to and during performance.

BATTLEFIELD STRESS, VR, AND PERSONAL CHARACTERISTICS

Even though battlefields are very stressful, some Warfighters decompensate more than others. For example, Killgore, Stetz, and others (2006) compared Soldiers who had been deployed (to either OEF or OIF) with those who had not been deployed. They found that (in consonance with theories of stress reaction, repression, and somatic amplification) combat-experienced Soldiers reported limited affective complaints, but greater somatic complaints than Soldiers without combat experience. Also, in regards to gender, during a recent interview by Elias (2005), a researcher reported finding no statistically significant PTSD symptoms difference between males (11%, n = 300) and females (12%, n = 50) in a sample of Warfighters holding violence-prone support jobs (medics, mechanics, and drivers). Interestingly, Foa et al. (1999) had previously reported that approximately 20% of females and 8% of males who had been exposed to traumatic events did develop PTSD symptoms. Some researchers suggest that females might be less likely to be exposed to adverse stressful events but more
likely to develop PTSD, if exposed. Thus, an overall greater prevalence of PTSD in females (10% vs. 5% in males; Kessler et al., 1995) can be accounted for by a significantly greater vulnerability to develop PTSD after exposure. Females also seem to have a longer course of illness than males with a median time to remission being 35 months for females compared to 9 months for males (Breslau, Davis, Andreski, & Peterson, 1997). It is widely known that in the developmental stages of childhood, male children are often encouraged not to show their feelings, while females are encouraged to do the opposite. It is possible that women may not be experiencing PTSD more often than men, they are just more likely to come forward and seek help. Moreover, animal models show no difference in stress reactions between sexes. Incidentally, Campbell and Elison (2005), claim their studies on coping reported that Long-Evans’ rats, when exposed to stressful situations, showed no significant difference between genders. Specifically, they found that the main difference between genders was that female rats had higher recovery cortisol levels than males.

Participant’s characteristics are also important factors to consider when analyzing stress data in VR studies. MacCluskie (1998) suggests that eye movement desensitization and reprocessing may elicit differential treatment effects based on client variables that have yet to be identified. Furthermore, Cheung (2002-2003) found from a study of male and female reactions to stress in a VR setting that there is no significant difference in subjective symptoms rating and blood flow measurements between the sexes. It was found, however, that data suggested that females may be more inclined to admit discomfort, as indicated by their responses to a survey of motion sickness history prior to the experiment. Park and Hu (1999) also found that while women reported a higher incidence of motion sickness history, the severity of symptoms of motion sickness while viewing a rotating optokinetic drum were not significantly different. Klosterhalfen et al. (2005) suggest that susceptibility to motion sickness is affected by not only gender but also ethnic origin. Also, Grantcharov et al. (2003) compared the impact of hand-dominance, gender, and experience with computer games on performance in virtual reality laparoscopy. They found that men usually completed the tasks in less time than women, but there was no statistical difference between the genders in the number of errors and unnecessary movements. They also found that subjects with a right hand dominance made fewer errors, fewer unnecessary movements, and had an overall trend of better results in terms of time and errors overall. Subjects who reported use of computer games made fewer errors than nonusers. Finally, age is another important demographical variable to consider. Schultz and Schultz (2003) studied the affects of age on stress levels as they relate to overall performance and found that age did not directly affect stress levels of the subjects during an evaluation. Montoya et al. (2003) studied the characteristics of drug users who were diagnosed with PTSD. They studied age, race, gender, and income as the independent variables and found that people with a higher income were more likely to develop PTSD. Additionally, they found that young females were in a higher risk of PTSD than older females.

CONCLUSION

The above review shows that there is some research suggesting demographical differences when studying stress and using VR. The purpose of the present paper is to share with readers that The United States Army Aeromedical Research Laboratory (USAARL) is conducting a pilot study on genders’ vulnerability to stress, and “VR-SIT” usefulness. Given the premise that males typically grow-up being exposed to more stressful situations than females (Bridge, 1999), and the reported difference when using VR technology (courtesy of the Virtual Reality Medical Center), we predict that females will yield higher stress markers than males. We will capture stress-related data by using the Multiple Affect Adjective Check List-Revised (MAACL-R) survey (courtesy of the Army Research Laboratory (ARL)), a physiological apparatus to capture heart rate, and an amylase test created by the Northwestern University in collaboration with ARL—all measures that provide immediate on-site data. This stress data will be collected before, during, and after the participants navigate VR scenarios. We also predict that females will respond faster to the coping strategies than males, and that males will be looking for those scenarios where they can more actively participate (i.e., shoot the enemy).
REFERENCES


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