

# The Effectiveness of Technology-Enhanced Relaxation Techniques for Military Medical Warriors

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**ABSTRACT** Combat zones can be very stressful for those in the area. Even in the battlefield, military medical personnel are expected to save others, while also staying alive. In this study, half of a sample of deployed military medical warriors (total  $n = 60$ ) participated in technology-assisted relaxation training. Learning relaxation skills with a video clip of virtual reality relaxing scenes showed a statistically significant impact on the anxiety levels of the Experimental Group.

## INTRODUCTION

Anxiety disorders are the most common type of mental disorder in the United States. More than one in four individuals in the United States suffer from an anxiety disorder, costing the country about 50 billion dollars a year.<sup>1-3</sup> Military warriors are not the exception. Warfighters tend to report experiencing stressors such as uncertainty, long work hours, sleep deprivation, information overload, the risk of death/disease, and exposure to horrific injuries and dead bodies.<sup>4,5</sup> Furthermore, many stressors experienced during deployment and deactivation processes, such as deactivation uncertainty, workload, and organizational constraints, are negatively correlated with psychological well-being and positively correlated with turnover intentions.<sup>6</sup>

Although doing their mission, military medical warriors are also expected to stay alive in the battlefield. Many times, these warfighters work with a high casualty flow and limited resources. In fact, a study on deployed medical warriors revealed problems related with leadership and readiness.<sup>7</sup> Stress management techniques (SMT) seem to be useful to help alleviate negative psychophysiological reactions to anxiety, tension, or stress.<sup>8</sup> However, the military population tends to be a “manly” institution. That is, not only is it mainly composed of males but it is also a patriarchal subculture. Warfighters are expected to be tough when facing adversity (e.g., enemy at war) and drive on with the mission. Therefore, SMTs might be perceived as “soft tools” by this type of work

culture.<sup>9</sup> Therefore, the purpose of this study is to test the efficacy of technology-assisted relaxation techniques for military medical warriors.

## Military Stress and Relaxation Techniques

Behavioral researchers have reported that about 18% of Warfighters returning from Iraq and 11% returning from Afghanistan ( $n = 6, 201$ ) screen positive on stress-related measures.<sup>10</sup> In fact, research also suggests that one in 10 U.S. Iraq veterans typically suffer from some type of stress disorder.<sup>11</sup> One study found that stress and depression were the two main reasons why 10% of Warfighters ( $n = 5,671$ ) were medically evacuated from theater in 2003.<sup>12</sup> Nevertheless, whether acute or chronic, psychological stress can affect Warfighters' cognitive performance, putting them in a very vulnerable position while on the battlefield.<sup>13</sup>

Military warriors are submitted to tremendous stressors when deployed in warzones<sup>14</sup> and, generally speaking, all stressors elicit a physiological response or strain within the body.<sup>15</sup> These include increased blood pressure, dilated pupils, elevated heart rate, increased sweat production, muscle tension, and shallow breathing. Chronic activation of stress response systems, such as the sympathetic adrenomedullary system, may also lead to physiological and psychological difficulties.<sup>16</sup> Stress can additionally influence mood, motivation-level, and life outlook.

SMT techniques such as progressive muscle relaxation (PMR) and Controlled Breathing (CB) have proven to be effective to manage anxiety and to mitigate acute stress reactions.<sup>8</sup> PMR is designed to help individuals tense and then relax their muscles in a progressive manner (head to toe or toe to head).<sup>17</sup> The rationale behind PMR is that individuals direct their mental tension toward their large muscle groups. Once the muscles relax then the other components of the relaxation response will naturally follow. CB is a relaxation technique that helps guide individuals to properly use their diaphragms while breathing to attain deeper, more relaxing breaths.<sup>18</sup> This technique can last from seconds to minutes. CB's rationale is that when individuals are anxious, they tend

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to breathe shallower, using their upper chest muscles (instead of their lower chest muscles or diaphragm). The contraction of these muscles can restrict blood vessels in that area, which raises their blood pressure. Individuals are typically asked to inhale through their nose for a few seconds (e.g., 5), hold momentarily (for approximately 2 seconds), and then exhale slowly through their mouth. For example, rhythm formulas that involve breathing at six breaths per minute induce favorable psychological and physiological effects.

Both these techniques have numerous medical and psychological applications as they can help reduce generalized autonomic arousal and positively alter cognitive states (e.g., distraction from pain). CB can not only help relieve anxiety but also improve circulation, concentration, and digestion. Furthermore, both of these techniques can either be applied separately or together. For example, the CB technique can be easily incorporated into the PMR process by asking individuals to tense muscles while inhaling and releasing the body tension while exhaling. Previous applications have been shown useful in reducing anxiety disorders,<sup>18</sup> depression,<sup>19</sup> acute pain,<sup>20</sup> and insomnia.<sup>21</sup> Other SMT, such as Transcendental Meditation, have also been documented to be effective with military personnel.<sup>22</sup>

### **Technologically Relaxing Guided Imagery and Virtual Reality**

Humans typically process information through images. Fortunately, this can be a very cost and time-effective way for clinicians and patients to discuss stressors. However, not everyone finds this is an easy task. Therefore, to establish a relaxing atmosphere, many individuals are using the help of guided imagery. Guided imagery, as the name suggests, can take place with the help of narration on a description of a relaxing image or scenario.<sup>23,24</sup> Because the narration of a scenario is limited to the imagination, with the advances in technology, Virtual Reality (VR) or zones have been very helpful to providers during their therapy sessions.<sup>25–27</sup> VR allows individuals to become active participants within an artificial computer-generated environment in which participants often report feeling immersed in the virtual world.<sup>28</sup>

The Army has recently released the “Field Manual 7.0: Training for Full Spectrum Operations” which corroborates technology and gaming as a tool.<sup>29</sup> There are a few existing videogames and VR research tools where participants can navigate, shoot, etc.<sup>30,31</sup> VR researchers are further developing and testing more technological environments or “zones” to help their practice. For example, VR-graded exposure therapy has been used to treat combat-related post-traumatic stress disorder (PTSD).<sup>32</sup> That said, there is still a lack of “games/videos” that individuals can use for relaxation. Because of the positive impact of relaxation techniques on health and recent technology advances, guided relaxation tools (e.g., VR) might be promising as tools to help the military workforce at home or abroad (e.g., deployment).

Some benefits of the efficacy of using virtual zones instead of real life zones are that these scenarios can: (a) be paced according to the individual and (b) launched via laptops (e.g., “deployable”). In fact, VR researchers have been successful when including both inoculation and stress moderators (i.e., PMR and CB) in their research designs.<sup>33</sup> Another recent study showed that VR may be more effective than bibliotherapy without any therapist contact.<sup>34</sup> In a study with military flight medics ( $n = 63$ ), researchers reported that post-hostility levels were higher in the group exposed to a VR condition when compared with participants who were in the Coping Training group.<sup>35</sup> This finding suggested more effective inoculation via VR, hypothesized to lead to more resilience if inoculated with SMT.

The main objective of the present clinical research protocol was to evaluate the effectiveness and receptiveness of immersive relaxation training with military medical warriors. Specifically, it was designed to study the effects of technology-enhanced relaxation techniques (i.e., PMR and CB) on participants’ stress levels.

The hypotheses in this study were the following:

Hypothesis 1: There will be lower post-relaxation training STAI-State anxiety scores in the Experimental Group (EG) than in the Control Group (CG).

Hypothesis 2: Anxiety scores during a stressful task will be lower in the EG than in the CG.

## **METHODS**

### **Participants**

The sample in this study ( $n = 60$ ) was composed of members of three Forward Surgical Teams (FST). These FSTs are typically composed of approximately 20 specialized medical professionals who are expected to take care of the wounded in very austere situations lacking medical support. The data collection took place during their medical predeployment 2-weeks training at the Ryder Trauma Center in Florida, United States. During the first day of training, MS (Principal Investigator [PI]) explained to every member of the FST the purpose of the study. Those volunteering to participate signed an informed consent. As a result of the fast-paced training schedule, that same day, volunteers were randomly assigned to the EG or the CG. Because the temperature is related/correlated to anxiety levels, only volunteers who showed a body temperature between 98.2 and 98.6°F were admitted in the study. Furthermore, only participants who attained low to none PTSD symptoms (less than “4” and “5” scores in each item) on the PTSD Checklist–Military Version (PCL-M)<sup>36</sup> were admitted in the study. The PCL-M is a widely used self-administered checklist with 17 items assessing trauma-related stress symptoms (i.e. “Feeling jumpy or startled?” and “Feeling as if your future will somehow be cut short?”). The response options range from “Not at All” to “Extremely” (1–5) with higher numbers indicating greater stress. The typical administration time took about 5 to 7 minutes.

After completion of the study, seven participants were excluded because of outlier data.

### Procedures

“Dream Island” is a relaxation VR tool developed using the Utility 2.5 Pro VR toolkit with embedded guiding narratives.<sup>25,26</sup> For this study, researchers used three 7-minute video clips (Fig. 1) with embedded English narratives guiding PMR and CB.

After the screening session (temperature and stress symptoms), a total of 60 participants ended up in the study (30 in the EG and 30 in the CG). During the first day of data collection, the PI explained both relaxation techniques (PMR and CB) and provided written instructions to follow (including not to discuss the experiment with participants from the other condition). On three consecutive mornings, the EG sat in front of a screen (as in a movie theater). PI controlled both the mouse and the keyboard while presenting one VR environment, per day. With each immersion, participants in the EG were guided through calming scenes and relaxing images (e.g., slow waves on a shore) while practicing techniques. Audio narratives embedded in the VR environment guided the practice and timing of the 7-minute relaxing videos. On each of the three evenings while participants were involved in the study, they were expected to practice the SMT techniques by watching on a portable play station videos of the VR environment presented in the morning. The EG was also asked to fill out a log form regarding their experience in watching the video clip and practicing the techniques on their own.

The participants also engaged in two “stressful” hands-on tasks (surgery) to document the generalization of the SMT. Participants were subjected to the first stressful task (simulation of medical procedures performed in the context of mass casualty) before the first SMT session and to the second stress-



FIGURE 1. Screenshot of One of the Dream Island Relaxing Zones.

ful task (hospital training in a situation that went uncontrolled due to different schedule rotations) after the post-program assessment session.

After the third and final VR relaxation session, the research team also conducted a focus group session with both groups to discuss their impressions.

### Measures

A first set of questionnaires were administered at the beginning of the study to collect descriptive data and baseline anxiety levels. A measure of anxiety was also administered afterward to document its effectiveness. The same anxiety measure was also administered after the two “stressful” situations (which occurred before and after implementing the technology-assisted relaxation training).

#### State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI)<sup>37</sup> is a self-report assessment device, which includes separate measures of state and trait anxiety. State anxiety is operationally described as the complex emotional reaction that fluctuates over time as a function of stressors. Trait anxiety captures personality characteristics that are relatively stable within individuals over time. This tool contains 20 items measuring state anxiety and 20 items measuring trait anxiety. Items are rated on a scale ranging from “not at all” to “very much so.” Although the STAI-Trait section was administered, it was not analyzed, as the level of trait anxiety is not likely to be significantly affected by a few relaxation sessions. Thus, only the STAI-State scores were analyzed in the study.

#### Université du Québec en Outaouais Presence Questionnaire

The Université du Québec en Outaouais Presence Questionnaire (UQO-PQ)<sup>38</sup> consists of four items measuring how absorbed individuals become during exposure sessions. Two items are positively worded and assess the feeling of being present in the virtual environment and the perceived realism of the virtual environment (e.g., “To what extent did you have the impression of being present in the virtual environment?”). Two items are negatively worded (reverse scoring) to assess the extent participants were aware the virtual environment was artificially created and the extent they felt they were physically present in the assessment room. Items are rated in a scale using a percentage between 0% and 100%, where 0% refers to “not at all” and 100% refers to “totally.” The UQO-PQ was administered only to participants in EG.

#### Focus Group Questionnaire

Participants were asked to document in a log their perceptions on the usefulness of this study (e.g., relaxation techniques) to substantiate the discussions in the focus group.

Results of the EG and the CG on the STAI-State anxiety were analyzed with an analysis of variance (ANCOVA) comparing post-treatment scores while controlling for pretreatment

scores as covariable. Partial eta-squared were used to document the effect size of the difference between the groups. The same approach was used to assess the impact of the stressful task.

**RESULTS**

Most of the sample ( $n = 60$ ) was composed of Caucasian (70%), males (66%), under the age of 35 (51%), who were married (66%), and with at least one child at home (55%). They were mainly officers (62%), in active duty status (74%) who had been previously deployed (51%), and were getting ready for another deployment (62%). Eighty-six percent of them stated having previous experience with VR/games. No significant differences were found between groups for the sample characteristics (Table I). The average PCL-M total scores was 66.98 (SD = 9.52). Results of the UQO-PQ showed that participants who participated in immersive relaxation training reported feeling slightly present in the VR environments during the relaxation training (mean of 27.52 during session 1, 26.08 during session 2, and 25.53 during session 3).

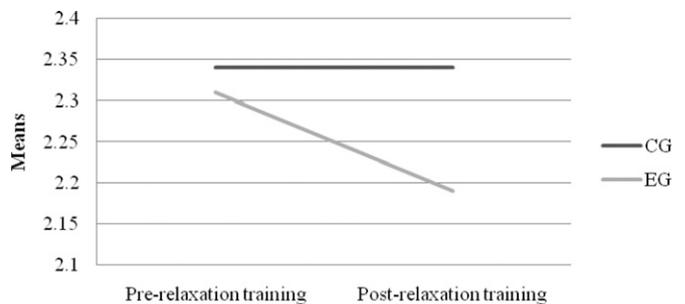
The post-technology-assisted relaxation training STAI-State anxiety scores for both groups were compared while controlling for pre-program anxiety levels (Table II and Fig. 2). Results of this ANCOVA revealed that participants in the EG were sig-

nificantly less anxious post-program compared to those in the CG ( $F[1,40] = 5.77, p < .021$ , partial eta-squared = .13).

To determine if the EG was better at coping with stress during a stressful task than those in the CG, STAI-State anxiety scores after the first stressful task were compared to a second stressful task performed after relaxation training (Table III and Fig. 3). Results of an ANCOVA on scores after task two while controlling for task one anxiety levels revealed no significant difference ( $F[1,48] = .04, p = .84$ , ns, partial eta-squared = 0.001). It is noteworthy that STAI-State anxiety scores after the stressful tasks were similar to pre-program levels, suggesting that the task was probably not stressful.

**TABLE II.** STAI-State Anxiety Scores Before and After Relaxation Training

	Prerelaxation Training		Postrelaxation Training	
	Mean	SD	Mean	SD
Control	2.34	0.23	2.34	0.21
Experimental	2.31	0.21	2.19	0.21



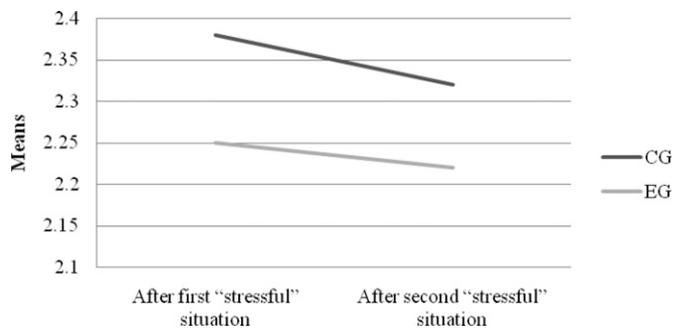
**FIGURE 2.** STAI-State anxiety scores before and after relaxation training.

**TABLE I.** Demographic Data for Participants at Baseline

Demographic Variables (n = 60)	Frequency	Chi-Square	DF	Asymp. Sig. (2-sided)
Gender				
Male	40	0.21	1	0.65
Female	20			
Age (M = 32.8; SD = 8.74)		31.7	25	0.16
Rank				
Enlisted	24	11.43	11	0.41
Officers	36			
Race				
African American	6	2	4	0.73
Caucasian	43			
Hispanic	6			
Asian	3			
Other	2			
Marital Status				
Married	39	1.96	2	0.38
Single	19			
Divorced	2			
Component				
Active	45	0.09	1	0.77
Reserve	15			
Previous Deployment				
Yes	31	0.07	1	0.8
No	29			
Deploying Soon				
Yes	38	1.99	2	0.37
No	18			
Number of Children				
0	27	4.34	6	0.63
1 or More	33			

**TABLE III.** STAI-State Anxiety Scores After the 2 “Stressful” Situations

	After First “Stressful” Situation		After Second “Stressful” Situation	
	Mean	SD	Mean	SD
Control	2.38	0.14	2.32	0.21
Experimental	2.25	0.23	2.22	0.28



**FIGURE 3.** STAI-State anxiety scores after each stressful task.

During the focus group (after the third and final technology-assisted relaxation training), 79% percent of participants in the EG expressed feeling relaxed or calm. Fifty-three percent seemed to prefer the immersive relaxation training (as compared to standard relaxation training). Most participants appeared to prefer using the videos on their own time. Finally when asked: "Would you use these techniques upon graduation?" about half of those in the EG reported they would, 27% expressed feeling unsure, and only 7% reported that they would not use these techniques after the study. A few participants informally offered suggestions to improve the quality of the training (e.g., longer duration and at different times of the day and increasing the duration of the program).

## DISCUSSION

The mission of military medical warriors is to take care of the wounded in the battlefield. Many times they lack support to perform their mission and sustain their own readiness.<sup>7</sup> Therefore, this study was designed to investigate the receptiveness and effectiveness of immersive relaxation training with military medical warriors. Despite the potential psychological "denial" or "Army Strong" mentality,<sup>8</sup> the sample appreciated the importance of taking control of their minds and bodies.

Participants did not seem to be especially stressed or anxious (per either the PCL-M or the STAI) at the beginning of this study. However, the use of the technology-assisted relaxation training seemed to contribute to lower levels of state anxiety. Therefore, the first hypothesis stating that participants in the EG would be less anxious post-immersive relaxation training as compared to the CG was confirmed. Additional data from the focus group revealed that most of the participants desired to continue using relaxation techniques in the future. Furthermore, 1 year after the data collection, the PI informally visited some of the participants ( $n = 15$ ) deployed in the Middle-East. During this visit, they shared with her that they were still practicing some of the relaxation techniques learned in this study. These results are consistent with existing research supporting the efficacy of the use of VR during relaxation training.<sup>23-26</sup> However, it should be noted that the population utilized in this study only included medical military personnel and thus results may not generalize to other populations.

The "stressful" task was not always associated with high levels of state anxiety in both groups. That is, the first stressful task did not elicit anxiety in either groups and the second stressful task did not elicit anxiety in the CG. Therefore, the second hypothesis stating that anxiety scores during a stressful task would be lower in the EG than in the CG could not be determined. Thus, further studies are needed to evaluate the efficacy of technology-assisted relaxation techniques during stressful tasks that are found to consistently elevate anxiety levels.

There were a few limitations in this study. The participant sample was a result of several aggregated groups. Thus, data collection did not occur all at once. Furthermore,

participants were screened after being assigned to either group. Additionally, information regarding the participant's previous experience with relaxation exercises was not gathered. Therefore, earlier relaxation training experience could have served as a confounding variable. According to the research design, EG participants were expected to practice relaxation techniques at home using a portable play station and a video-version of the same VR scenario watched during the day. Although they were asked to maintain an accurate log of their experiences, there was not a sure way of confirming the accuracy of their logs. Additionally, to avoid cross-contamination, the PI asked members in the EG to avoid discussion about the study with the CG. However, there was no way to ensure this. Finally, the focus group questions consisted only of open-ended questions. Although this allowed participants to freely answer questions (including topics that were of pertinence to them), analyzing data was difficult. That is, many answered in ways that were hard to quantify for this report.

In conclusion, although the technology-assisted relaxation techniques were unable to be evaluated during stressful situations (as the stressful tasks failed to consistently elevate participant anxiety levels), they were successful in reducing overall anxiety levels. Thus, this study highlights the efficacy and benefits of such interventions that are much needed to help medical military personnel cope with stress.

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