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Virtual Reality Therapy: The New War on Preventing Combat-Related PTSD

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In this research, I review the experimental literature and conduct a separate study concerning virtual reality and combat-related post-traumatic stress disorder (PTSD). The purpose of this study is to investigate how virtual reality exposure therapy (VRET) prevents combat-related PTSD on 100 participants ranging in ages from 18-25 years old. A training program known, as Quantum 3D and SGI Origin 3400 will guide participants through combat-related scenarios pre-exposing them to combat environments. The participants will be randomly selected from both branches, the Marines and the Army. Half of soldiers will be randomly assigned to a 60-minute, 16-weeks, and twice a week VRET program that will result in eliminating combat-related PTSD symptoms in military personnel. This treatment will include a therapist using the Quantum 3D application; the participant will vividly imagine sights, smells, and sounds of the battlefield. The other half will receive military control using SGI 3400, outfitted with a steering wheel, gas pedal, and a brake pedal. All participants will be medically cleared from any pre-existing psychological issue(s) and must be their first time being deployed. I hypothesized virtual reality exposure therapy will prevent combat-related PTSD in active duty service members.

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There are many challenges and issues in identifying, diagnosing, and treating Post-Traumatic Stress Disorder (PTSD) in children and adolescents. Much of the literature on PTSD focuses on children and adolescents that have been exposed to a one-time traumatic event, in particular, a school shooting or a natural disaster. However, many people diagnosed with PTSD have been exposed to multiple traumatic events that cause chronic traumas such as community violence, physical injury, maltreatment, and physical or sexual abuse (Carrion, Weems, Ray & Reiss, 2002).

Certainly, chronic exposure to trauma has implications on a person's well-being consisting of cognitive, physiological, social, emotional, and behavioral areas (for review, see Carrion et al., 2002). In situations of chronic trauma, the environment in which the trauma occurs can arouse a feeling of danger, even when the actual traumatic event is not present (Kaysen, Resick, & Wise, 2003). Recent research on PTSD has focused on the large number of returning soldiers from the Iraq/Afghanistan wars, who are reporting symptoms that are congruent with the diagnosis of PTSD. Spira, Pyne, Wiederhold, Wiedhold, Graap and Rizzo, (2006), examined the impact and complexity of combat-related PTSD in military personnel and their responses to ongoing and or multiple traumas.

Combat-related PTSD symptoms date back to the mid-1800s. A physician who treated men who had been in combat in the U.S. American Civil War identified PTSD as "DaCosta Syndrome" (Saigh & Bremner, 1999). In the early 1900s, PTSD was referred to as "shell shock" due to the large number of soldiers demonstrating similar symptoms since their return from war (Saigh & Bremner, 1999). Later

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in 1952, PTSD was recognized as a psychiatric syndrome and was called "gross stress reaction" in the DSM-III. However, it was not until DSM-III-R that the current classification of PTSD was created (Saigh & Bremner, 1999). In addition, the DSM-IV-TR made modifications that have attempted to compensate for the difference in symptoms present in children, adults, and military personnel. The current criterion focuses on re-experiencing, avoidance, and hyperarousal; however, even these broad categories of criteria may manifest themselves differently in each person, particularly, in older people (Saigh & Bremner, 1999).

Today PTSD is considered a severe anxiety disorder that develops following exposure to extreme psychological trauma for instance, witnessing death or injury, physical assault, combat, sexual assault, accidents, and natural disasters (Butcher, Mineka & Hooley, 2010). PTSD can cause many symptoms, particularly numbness, hopelessness, nightmares, insomnia, anger, flashbacks, shame, and hallucinations. These symptoms can be grouped into three categories: re-experiencing symptoms, which include flashbacks; physical symptoms, bad dreams, or frightening thoughts; and avoidance symptoms that include staying away from places, events, or objects that are reminders of the experience. In addition, hyperarousal symptoms include being easily startled, having difficulty sleeping, and or having angry outbursts (Butcher et al. 2010).

As noted, PTSD develops differently from person to person. While the symptoms of PTSD most commonly develop in the hours or days following the traumatic event, it can sometimes take weeks, months, or even years before they appear (Butcher et al., 2010). As noted by Saigh and Bremner (1999) throughout history, PTSD has had many names including railway spine, stress syndrome, shell shock, battle fatigue, and traumatic war neurosis. Moreover, about 5.2 million adults suffer from PTSD during a given year ("WebMD"); 7-8% of people in the U.S. will have PTSD at some point in their lives ("WebMD"). In fact, it is estimated that 30% of returning veterans of the Iraq and Afghanistan wars have experienced PTSD (Hoge, Castro, Messer, McGurk, Cotting, & Koffman, 2004). For instance, Kashdan, Young, and McKnight (2012) estimated that 300,000 U.S. soldiers would return from Iraq and Afghanistan suffering from PTSD, although few would receive treatment.

Today, there are effective treatments available for PTSD. PTSD therapy can help a person regain a sense of control over their life. For this reason, with successful PTSD treatments, they can also feel better about themselves and learn ways to cope if any symptoms arise. PTSD treatment often includes both medication and psychotherapy (Butcher et al., 2010). Combining these treatments can help improve a person's symptoms and teach them skills to cope with the traumatic event. The types of medications used for PTSD are antipsychotics, antidepressants, anti-anxiety medications, and a hypertension drug called Prazosin (Butcher et al., 2010). Antipsychotics in some cases may be prescribed in short courses to relieve severe anxiety and related problems, such as difficulty sleeping or emotional outbursts.

Antidepressant medications include selective serotonin reuptake inhibitors (SSRIs), such as sertraline (Zoloft) and paroxetine (Paxil) that relieve symptoms of depression, anxiety, insomnia, and concentration. Anti-anxiety medications improve feelings of anxiety and stress. Specifically, a drug called Prazosin is commonly used to control symptoms of insomnia or recurrent nightmares (Butcher et al., 2010). In fact, Prazosin for years has been used in the treatment of hypertension; moreover, it blocks the brain's response to an adrenaline-like brain chemical called norepinephrine. Even though this drug is not specifically approved for the treatment of PTSD, Prazosin may reduce or suppress nightmares in many people with PTSD ("WebMD").

Some types of psychotherapy treatments used in PTSD include cognitive therapy, eye movement desensitization and reprocessing (EMDR) and exposure therapy. Cognitive therapy is "talk therapy" that focuses on thinking by addressing cognitive patterns that are keeping a PTSD patient stuck in negative or inaccurate ways of perceiving normal situations ("WebMD"). In addition, eye movement desensitization and reprocessing (EMDR) therapy is often combined with exposure therapy ("WebMD"). Both therapies use a series of guided eye movements that help patients' process traumatic memories (Stein et al., 2012).

Among the many approaches that have been used to treat PTSD, exposure therapy appears to have the best-documented therapeutic efficacy (Stein et al., 2012). Exposure therapy is considered a behavioral treatment for PTSD; it targets behaviors that people engage in and most often avoid in response to situations or thoughts and memories that are viewed as frightening or anxiety-provoking ("WebMD"). In fact, avoidance of reminders of the trauma is inherent in PTSD and is one of the prime symptoms of the disorder. For example, a soldier may begin to avoid July 4 because of the loud "bangs" and "popping" noises in fear of flashbacks. If not addressed, avoidance behavior can become extreme and interfere with a person's quality of life. Furthermore, avoidance can also make PTSD symptoms stick around longer or even become worse (Stein et al., 2012). As a person avoids certain situations, thoughts, or emotions, they do not have the opportunity to learn that these situations may not be quite as dangerous or threatening as they seem. To address this problem, researchers have recently turned to the use of Virtual Reality (VR) to deliver exposure therapy by

immersing clients in simulations of trauma-relevant environments that allow for precise control of stimulus conditions.

VR programs or also known as "Virtual Iraq" allow a patient suffering from PTSD to re-enter the setting in which they experienced trauma. VR can be generally defined as "a way for humans to visualize, manipulate, and interact with computers and extremely complex data" (Sato, Clifford, Silverman, & Davies, 2009). This advanced form of human-computer interaction is achieved via the integration of computers, real-time graphics, visual displays, body tracking sensors, and specialized interface devices that serve to immerse a participant in a computer-generated simulated world that changes in a natural way with head and body motion (Sato et al., 2009). The goal of VR is to help reduce a person's fear and anxiety with the ultimate goal of eliminating avoidance behavior and increasing the quality of life. This is done by actively confronting the issue(s) a person fears most. For exposure therapy to be effective, it is very important that a person confront a situation that closely maps onto what they fear most (Sato et al., 2009).

However, this may not always be possible for the person with PTSD. As of 1991, stressful events of war fighting environments have increased the risks of PTSD in active service members (Rizzo, Parsons, Lange, Kenny, Buckwalter, Rothbaum, & Reger, 2011). As noted, a veteran who developed PTSD because of combat exposure would not be able to confront a combat situation again. In addition, it would be unsafe to do so. This is where VR technology is beneficial (Stetz, Folen, & Yamanuha. 2011). VR technology in the military uses applications known as Quantum 3D and SGI Origin 3400. Individuals are immersed in a computer-generated virtual environment, either with a head-mounted display device or with entry into a computer-automated room where images are present all around them (Rothbaum, Hodges, Ready, Graap, & Alarcon, 2001). VR is an artificial environment that is created with software and presented to the user in such a way; the user suspends belief and accepts it as a real environment (Rothbaum et al., 2001). On a computer, VR is primarily experienced through two of the five senses: sight and sound. The simplest form of VR is a 3-D image that can be explored interactively at a personal computer, usually by manipulating keys or the mouse so the content of the image moves in some direction. Efforts that are more sophisticated involve such approaches as wrap-around display screens, actual rooms augmented with wearable computers, and haptics devices that let the participant feel the display images. This environment can be programmed to help the person directly confront feared situations or locations that may not be safe to encounter in real life (Rothbaum et al., 2001).

In addition, a couple of studies have tested how useful Virtual Reality Exposure Therapy (VRET) may be for PTSD patients' (Glantz, Rizzo, & Graap, 2003). Godleski et al., (2008) found that advancements in technology permits tools for enhancing clinical practices and support for further research in VRET. Technology is used in treatments for PTSD to simulate combat environments (Godleski et al., 2008). Flight simulators are used to simulate the pilot's field. The simulator sits on top of either an electronic motion base or a hydraulic lift system that reacts to user input and events within the simulation. As the pilot steers the aircraft, the module he sits in twists and tilts, giving the user haptic feedback. The applications are designed to address combat related stress, resilience-training, and PTSD treatment (Godleski et al., 2008).

In addition, on the ground and in the water simulators are important parts of the military's strategy (with PTSD or outside of PTSD). In fact, simulators are a key part of the Future Combat System (FCS) the foundation of the armed forces' future (Godleski et al., 2008). The FCS consists of a networked battle command system, advanced vehicles, and weapons platforms. Computer scientists designed FCS simulators to link together in a network, facilitating complex training missions involving multiple participants acting in various roles (Godleski et al., 2008). The FCS simulators include three computer monitors and a pair of joystick controllers attached to a console. The modules can simulate several different ground vehicles, including non-line-of-sight mortar vehicles, reconnaissance vehicles or an infantry carrier vehicle. (Godleski et al., 2008). The Army uses several specific devices to train soldiers to drive specialized vehicles like tanks or the heavily armored Stryker vehicle. They not only accurately recreate the handling and feel of the vehicle they represent, but also can replicate just about any environment imaginable. Trainees can learn how the real vehicle handles in treacherous weather conditions or difficult terrain (Godleski et al., 2008).

Water vehicle simulators are used for the Navy. Submarine simulators are different from other military-vehicle simulators. There are no windows to the outside world on board a sub, so there is not a need for lifelike graphics (Godleski et al., 2008). Submarine simulators instead must provide realistic instrument readings as the crew navigates through the simulation. Some submarine simulators are stationary, which can detract from a user's sense of immersion. Others, however, are mounted on a set of pneumatic arms that can tilt the module, allowing it to physically simulate a diving or surfacing maneuver (Godleski et al., 2008). Another impressive naval application of virtual environments is the virtual bridge. The navigation, seamanship, and ship-handling trainer (NSST) accurately replicates the bridge of a large Navy

ship. The simulator has dozens of computer monitors, some that serve as the bridge's windows, and some that serve as ship monitors (Godleski et al., 2008).

Navy bridge teams can train together through various scenarios, building teamwork and ship-handling skills in the process. Another application of virtual environments in the military is battlefield visualization. Battlefield visualization is vital when determining combat strategies in real time. It is also a key element in the training regimen of commanding officers. It helps commanders assess their options before making decisions that could put soldiers in harm's way (Godleski et al., 2008). As the military's enthusiasm for VR training continues to grow, the military's new plan is to make VR programs to identify and treat combat-related PTSD (Rees & Haythornthwaite, 2004). For example, researchers have found that VRET resulted in significant reductions in PTSD symptoms for military service members after an average of just seven treatment sessions. Moreover, researchers' report 62% of patients who tried VRET presented a clinically meaningful, reliable change in PTSD symptoms (Rothbaum et al., 2001). During the VRET treatment, the soldier repeatedly revisits the memory, and by using the imagination, they safely access emotions related to the original traumatic experience. In other words, revisiting the memory while safely emotionally engaged reduces anxiety, and allows the engagement process to be comfortably repeated (Rothbaum et al., 2001).

Although the studies dealing with PTSD focus on identifying, diagnosing, and treating PTSD symptoms; however, studies have not used pre-combat exposure to threatening stimuli? Some studies suggest that early intervention with people who have suffered a trauma may reduce some of the symptoms of PTSD or prevent it all together (Zohar, Sonnino, Juven-Wetzler, & Cohen, 2009). After a trauma, certain medical issues can be improved or even prevented if intervention occurs within a particular window of opportunity (Zohar et al., 2009). This window of time has been given the euphemism as "the golden hour(s)," as intervention in that time is particularly effective. Several examples of this are well-established. For example, after a thrombotic cerebular vascular accident, there is a 3-hour window from the onset in which clot-busting drugs can be administered to relieve the thrombosis. In a heart attack, reperfusion of the infarct-related artery in the first hour significantly reduces mortality rates (Zohar et al., 2009). The principle is that immediate intervention is given in order to prevent or decrease the impending (usually devastating) issue of those events, which often trigger a chain of pathological processes. If the right intervention is given during the window of opportunity, it might dramatically improve the outcome. Many prevention efforts seek to reduce the likelihood of PTSD among individuals who have recently been exposed to traumatic stress could apply these findings by developing early-intervention models that target processes associated with PTSD (Zohar et al., 2009). Although PTSD is clearly precipitated by trauma exposure, differences in exposure do not fully determine either the development of or recovery from PTSD. In recent years, there has been an interest in identifying biological and clinical risk factors that increase the likelihood PTSD will develop following a traumatic event (Zohar et al., 2009). These have ranged from genetic to environmental factors, and have included both pre-existing traits, characteristics of the traumatic event, and aspects of the victim's peri- and post-traumatic response. Correspondingly, factors with the potential to reduce the risk have been identified and the concept of "resilience factors" has been proposed (Zohar et al., 2009). Although little is known about predictive factors of PTSD and the immediate response to the trauma, the symptoms that were found to be associated with higher frequency of PTSD include, among others, a significant panic-like response, pronounced distress, dissociative response, and past history of anxiety or depression (Zohar et al., 2009). Those symptoms may reflect the intensity or severity of the current experience, a pre-existing individual trait, or sensitization from prior trauma exposure (Zohar et al., 2009).

In the present study, I will examine the effect of VRET and the impact it has on soldiers prior to deployment. VRET will be used to expose soldiers to combat environments prior to deployment. As a result, this may prevent soldiers from developing PTSD. Through the use of VRET, soldiers will experience their future traumatic experience(s) in a safe environment with the goal of reducing anxiety and panic-like response. As noted earlier, VRET is designed to introduce soldiers to the combat scene through immersive drills, enabling them to experience the locations they are assigned to fight in through realistic VR environment (Rothbaum et al., 2001). This content analysis design is safe, yet a realistic scene they can practice and rehearse future missions through individual or team-based exercises that develop their combat skills, resilience, exposure to traumatic events, and understand the physical and human terrain (Rothbaum et al., 2001).

With this application, warfighters are not solely looking at a simulation on a computer screen from a distance, but they become a fundamental part of the scene. This application can help soldiers prevent painful memories or events by probing them to vividly imagine sights, smells, and sounds of the battlefield (Rothbaum et al., 2001). Although little is known about predictive factors of PTSD, pre-exposure to combat environments will be examined to prevent panic-like response, pronounced distress, dissociative response, anxiety, or depression. In the present paper, the role VRE therapy plays in combating PTSD in active military personnel is investigated. It is hypothesized that VRET will prevent combat-related PTSD in active duty service members. Recent research has designed applications for service members that identify and treat PTSD; this research will examine the effect of VRET and PTSD prior to deployment to further our understanding of the influence VRET plays in preventing PTSD.

PROPOSED METHOD

Population and Sample

This study will randomly sample 100 participants either male or female ranging in ages from 18-25 years old. Participants from this study will be from both infantries, the Marines and the Army. In addition, this must be the participants first time of deployment and must have been cleared of any pre-existing psychological issues. The stress of VRET may precipitate an increase of the symptoms from being subjected to stressful conditions; this could interfere with the participant's ability to benefit from pre-exposure therapy. In addition, they are already subjected to psychological issues and this would decrease the validity of the study. A random sample is used because the research cannot obtain data from every single service members due to age and deployment factors. As a result, this smaller portion is randomly selected to represent the entire group as a whole and is a representative of the larger population.

Study Design

An experimental design will be used to explore whether pre-expose to combat environments will reduce combat-related PTSD. Half of soldiers will be randomly assigned to a 60-minute, 7 weeks, and twice a week VRET program that will result in eliminating combat-related PTSD symptoms in military personnel. The randomly assigned will work with therapist using the Quantum 3D application. The other half of soldiers will be controlled and assigned to a 60-minute, 7 weeks, and twice a week VRET program that will result in eliminating combat-related PTSD symptoms in military personnel. Specifically, this study will employ an analysis that will focus on primary outcome measures: service members pre-exposed to virtual reality combat environments prior to deployment and secondary outcome measures prevention in combat-related PTSD following immediately post-treatment six-months to one year after return. This design may reduce the severity and symptoms of PTSD if service members are pre-exposed to combat environments.

Clinical Scale

Participants will be recruited for this trial as part of a larger study on the prevention of PTSD prior to deployment via VRET. Recruitment efforts include referrals from specialist, corporals, and staff sergeants and clinicians. The trials will be using Quantum 3D and SGI Origin 3400 applications ("Quantum 3D: Technology," 2001), which are interactive computer-generated environment simulations. Behavioral health providers can use this uniquely tailored application to expose the participant into the environment and experience combat for the first time before actual deployment. This is a 60-minute, 16-week, twice a week program.

VR applications are designed to resemble a small or large middle-eastern city. For example, cities, outlying villages, and desert convoy scenes. The choice options are combined with real therapist input via a "Wizard of Oz" clinical interface. This allows for creation of user experience that is specifically customized to the needs of the participant's during the experiment. This is a necessary component because the therapist needs to modulate the participant's anxiety levels, which is expected during exposure therapy. The software is designed so that participants can be teleported to specific scenario settings based on a determination as to which environments most closely match the patient's session, individual or grouped. Three general types of scenes are available: city streets, urban areas, and desert.

All scenario settings are adjustable for time of day or night, weather conditions and lighting illumination. There will be two city scenarios. The first city setting has the appearance of an isolated low populated street comprised of old buildings, dilapidated apartments, warehouses, a mosque, and factories. The second city setting has comparable street characteristics and buildings, but is more highly populated and has more traffic activity, a marketplace, monuments, and alleys with insurgents. In addition, a small rural village consists of comparable characteristics as a larger city, but is isolated. It will also contain more vegetation and have a view of a desert landscape in the distance.

For the desert road scenario, this consists of paved and dirt roadways that will connect the city and village scenarios. The view from the road consists of desert scenery and sand dunes with occasional areas of

vegetation, battle wreckage, debris, and virtual human figure(s). The scenario supports the perception of travel within a convoy or as a lone vehicle. VRET allow the participant to enter and navigate through building interiors, some of the city and village scenario buildings. These interiors will have the option of being vacant or inhabited by various numbers and types of virtual human characters. Participants will also be exposed to various checkpoints.

For both applications, individual and grouped sessions, participants will wear a head-mounted display while the therapist orchestrates the relevant stimuli: helicopters overhead, smells, gunfire, or even a Muslim call to prayer. The Quantum 3D will be used during individual sessions because it is designed with a stand-up platform that incorporates vibrations. The vibrations will represent gunfire, rumbling of a Humvee, helicopter, and tanks. The SGI Origin 3400 applications will be used for the grouped session because it is outfitted with a steering wheel, gas pedal, and a brake pedal. The SGI Origin 3400 allows participants to adjust their view from the perspective of being either inside of the cab of a HUMVEE, tank or other moving vehicles or from a more exposed position in a gun turret above the roof of the vehicle.
This will give direct control over the level of anxiety produced for the participant as well as the participants overall comfort level with the VRET. VRET is designed to re-create a stimulus to a real-world driving experience in a combat zone. During each VRET session, the participant will be able to determine his or her own course, for example, whether to enter a side street. The subjective units of distress (SUDS) scale (range: 0–100) will be used to record levels of anxiety the participant may experience during the exposure process ("Subjective units of," 2001).

The Treatment Program

VRET will be conducted using a Quantum 3D and SGI Origin 3400. The two computer-generated simulations will be administered in eight individual sessions and eight grouped sessions. The first two sessions will include psychoeducation about the symptoms of PTSD and the purpose of VRET, relaxation training, anxiety-producing situations, and familiarization with the VR simulator using unbiased scenarios that will be 60 minutes long. In the remaining 14 sessions, this will be divided evenly so both sessions, individual and grouped have an unbiased amount of sessions. Participants will be instructed on how to engage in VRET therapy. In this protocol, relaxation training is included to address defensive behaviors, anxiety, and resilience that have been observed in this population.

The first seven sessions will meet twice a week; the participants will use Quantum 3D. Participants will be placed in individual sessions that will last 60 minutes long. A trained therapist will be present for each session and will instruct and encourage the participant to use relaxation techniques as a distraction from exposure. They will then record the participant's exposure process, relaxation skills, and a rating of anxiety using the subjective units of distress. Each participant will be subjected to the same scenario and therapist during the seven weeks. For the first half-hour, the participant will be exposed to VR driving situation until their anxiety had reduced by 50%, if anxiety is present. In the last half-hour, the participant will be exposed to VR walking situations. The participant will be exposed to the same VR scenario in the first half-hour except they will be on foot. During the last seven weeks, the participants will use the SGI Origin 3400. This exposure treatment will meet twice a week for 60 minutes.
The participants will follow the same guidelines as the individual sessions. However, the participants will be grouped. The groups will consist of four participants. Depending on the specific exposure situation, for the first-half hour the participants' would take turns, one participant would be the driver, another will be the passenger, and the last two participants will be passengers in a Humvee, tank, or other vehicles while the therapist guides the exposure process. During the last half-hour, the participants will be subjected with a patrol of virtual soldiers. Once the 16-week sessions are completed, the participants will follow up with a therapist six months to one year after they have completed their deployment tour in order to see if how effective VRET is in preventing PTSD.

CONCLUDING REMARKS

Significance

War is perhaps one of the most challenging situations that a human being can experience. The demands of a combat environment place enormous stress on military personnel. Such stressful experiences that commonly occur in war fighting environments have produced a significant number of cases related to combat-related PTSD. This study will contribute to the expanding knowledge of combat-related PTSD. Pre-exposure may significantly reduce PTSD; and doing so could reduce health care costs. As of September 2004, there were over 13,524 Gulf War Veterans receiving compensation for PTSD from the Department of Veterans Affairs (VA Fact Sheet, 2004). The military could benefit economically by preventing or reducing the turnover rate of soldiers with PTSD. This would decrease the direct cost of benefit compensation and medical care by 60% (VA Fact Sheet, 2004). Finally, VRET training may benefit the participants

both, soldiers and therapist. This VRET approach is not designed to be an automated treatment procedure that could be administered in a "self-help" design. The management of guiding and training soldiers' relaxation and resilience skills through VRET combat related scenarios while providing treatment options is not possible under an automated procedure. This proposal will most likely extend therapeutic benefits when administered within the setting of proper care through a thoughtful professional obligation. This proposal could offer ways to address these aims.

Limitations

There are three limitations to this study. The study will be limited in terms of generalizability. Military personnel who range in certain ages, multiple deployments, medical issues, and certain infantries' will be excluded from this experiment. First, military personnel who are above the age of 26 cannot participate due to age stipulations. Most military personnel who are above the ages of 26 have been deployed many times throughout their career. Second, military personnel who have been deployed multiple times have a higher chance of pre-existing medical issues. Military personnel with current or a history of mania, schizophrenia, PTSD or any mental illness would be excluded. Finally, the applications being used for this study is designed for land simulations. The Navy and Air force will be excluded because this study is currently not designed to accommodate air and water.

REFERENCES

Butcher, J., Mineka, S., & Hooley, J. (2010). Abnormal psychology. Allyn and Bacon.

Carrion, V., Weems, C., Ray, R. & Reiss, A. (2002). Toward an empirical definition of PTSD: The phenomenology of PTSD symptom's in youth. *American Academy of Child and Adolescent Psychiatry, 41*(2): 166-173.

Factsheet, V.A. 2004. Retrieved from www.1.va.gov/opa/fact/ptsd.asp

Glantz, K., Rizzo, A.A. & Graap, K. (2003). Virtual reality for psychotherapy: Current reality and future possibilities. *Psychotherapy: Theory, Research, Practice, Training, 40,* 55–67.

Godleski, L., Nieves, J., Darkins, A., & Lehmann, L. (2008). VA telemental health: Suicide assessment. *Behavioral Sciences & The Law, 26*(3), 271-286. doi:10.1002/bsl.811

Hoge, C.W., Castro, C.A., Messer, S.C., McGurk, D., Cotting, D.I. & Koffman, R.L. (2004). Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *NE J. Medicine, 351*(1):13-22.

Kaysen, D., Resick, P. & Wise, D. (2003). Living in danger: The impact of chronic abuse, traumatization and the traumatic context on Posttraumatic Stress Disorder. *Trauma and Violence 4*(3): 247-26.

Kashdan, T. B., Young, K. C., & McKnight, P. E. (2012). When is rumination an adaptive mood repair strategy? Day-to-day rhythms of life in combat veterans with and without posttraumatic stress disorder. *Journal of Anxiety Disorders, 26*(7), 762-768. doi:10.1016/j.janxdis.2012.07.004

Kasckow, J. J., Brown, C. C., Morse, J. J., Begley, A. A., Bensasi, S. S., & Reynolds, C. F. (2012). Post-traumatic stress disorder symptoms in emotionally distressed individuals referred for a depression prevention intervention: Relationship to problem-solving skills. *International Journal of Geriatric Psychiatry, 27*(11), 1106-1111. doi:10.1002/gps.2826

Nader, K.O. (2004). Assessing traumatic experiences in children and adolescents: Self-reports of DSM PTSD criteria B-D symptoms. In Wilson, J.P and Keane, T.M. (Eds.) *Assessing Psychological Trauma and PTSD* (pp.513-537). New York: Guilford Press.

Rizzo, A., Parsons, T., Lange, B., Kenny, P., Buckwalter, J., Rothbaum, B., & Reger, G. (2011). Virtual reality goes to war: A brief review of the future of military behavioral healthcare. *Journal of Clinical Psychology in Medical Settings, 18*(2), 176-187. doi:10.1007/s10880-011-9247-2

Rothbaum, B.O., Hodges, L.F., Ready, D., Graap, K., & Alarcon, R.D. (2001). Virtual reality exposure therapy for Vietnam veterans with posttraumatic stress disorder. *Journal of Clinical Psychiatry, 62,* 617-622.

Rothbaum, B.O., & Schwartz, A.C. (2002). Exposure therapy for posttraumatic stress disorder. *American J. of Psychotherapy 56*:59–75.

Saigh, P. A., & Bremner, J. D. (1999). The history of post-traumatic stress disorder. In P. A. Saigh & J. D. Bremner (Eds.) Post-traumatic stress disorder: A comprehensive text (pp. 1-17). Boston: Allyn & Bacon.

Sato, A. F., Clifford, L. M., Silverman, A. H., & Davies, W. (2009). Cognitive-Behavioral interventions via telehealth: Applications to pediatric functional abdominal pain. *Children's Health Care, 38*(1), 1-22. doi:10.1080/02739610802615724

Spira, J., Pyne, P., Wiederhold, B., Wiedhold, M., Graap, K., & Rizzo, A. (2006). Virtual reality
and other experiential therapies for combat-related posttraumatic stress disorder. *Primary Psychiatry, 13*(3),

Stein, N. R., Dickstein, B. D., Schuster, J., Litz, B. T., & Resick, P. A. (2012). Trajectories of Response to Treatment for Posttraumatic Stress Disorder. *Behavior Therapy, 43*(4), 790-800. doi:10.1016/j.beth.2012.04.003

Stetz, M., Folen, R., & Yamanuha, B. (2011). Technology complementing military behavioral health efforts at Tripler Army Medical Center. *Journal of Clinical Psychology In Medical Settings, 18*(2), 188-195. doi:10.1007/s10880-011-9246-3

Subjective units of distress (suds) sacle. The Australian Center for Post Traumatic Mental Health. (2001). Retrieved from www.ptsd.factsforhealth.org

Quantum 3d: Technology for solutions. Visual simulations. (2012). Retrieved from www.quantum3D.com

Webmd. (n.d.). Retrieved from www.webMd.com

Zohar, J., Sonnino, R., Juven-Wetzler, A., & Cohen, H. (2009, January). Can posttraumatic stress disorder be prevented? Retrieved from www.mbldownloads.com

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