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Terrifying Our Soldiers: Stimulant- Induced PTSD in the Armed Forces

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An article published in April of 2012 in the *New York Times* by Dr. Richard Friedman, Director or Psychopharmacology the Weill Cornell Medical College, found that annual spending by the Department of Defense (DOD) on stimulant medication – i.e., Adderal, Ritalin, Modafinil, etc. – increased from $7.5 million in 2001 to $39 million in 2010 (Friedman, 2012). Friedman also cited that, in the past five years, there has been a thousand-fold increase (3,000 to 32,000) in the number of Ritalin and Adderal prescriptions written for active duty service members. During this same time frame, an alarming increase has occurred in the number of American soldiers returning from the Middle East suffering from PTSD. Seal and colleagues (2009) used national Veterans Affairs data and found that the rate of PTSD in Operation Iraqi Freedom (Iraq) and Operation Enduring Freedom (Afghanistan) veterans rose from 0.2 to 21.8 percent between 2002-2008.

In his article entitled *Why Are We Drugging Our Soldiers,* Friedman raises an important question: does the increased use of stimulant medication by US Armed Forces correlate with an increase in the prevalence of PTSD in soldiers returning from the Middle East? The practice of providing stimulants to soldiers is not new. Soldiers on 'long-range patrols' during the Vietnam War were provided stimulants to maintain mental acuity and stave off fatigue (Krystal, 2012). The US Army approved the use of Adderal by troops and the US Air Force approved the use Modafinil and Adderal by pilots for fatigue management (Kelley et al, 2010). In fact, members of the US Armed Forces are required by military law to take a medication to improve military performance if ordered to do so by a commanding officer (Moreno, 2006). The significant increase in stimulant spending by the US Department of Defense and the increase in the number of Adderal and Ritalin prescriptions by military physicians provide evidence for significant use of stimulants in the US Armed Forces.

Post-traumatic stress disorder (PTSD) is an anxiety disorder that usually occurs after a person witnesses a traumatic event in which the threat of injury or death was present (DSM-IV-TR). According to the DSM-IV-TR: diagnostic criteria for PTSD include a history of exposure to a traumatic event resulting in symptoms from each of three following clusters: intrusive

recollections, avoidant/numbing symptoms, and hyper-arousal symptoms. A fifth criterion concerns duration of symptoms and a sixth assesses functioning.

While much debate exists over how to correctly diagnose and treat the disorder, the effect it has on sufferers, family and caregivers is undeniable. Members of the US Armed forces are at a higher risk than the general population of being afflicted with PTSD due to the traumatic reality of their profession. A recent review of the epidemiology of PTSD found that the prevalence of PTSD in the US civilian population is estimated to be at five to six percent, while the prevalence in the US armed forces is approximately 11% (Richardson et al, 2010).

The formation of emotional memories and information derived from such memories is vital for the survival of any organism and has evident evolutionary significance (Maren, 1999). For example, an individual's ability to pair aversive stimuli with a particular situation, also known as fear conditioning, allows him or her a greater chance to avoid that situation and thus enhances chances of survival. Understanding fear conditioning is useful in explaining the occurrence of PTSD symptoms; simply put, PTSD occurs when the fear conditioning reaction becomes overactive.

In mammals, fear conditioning is controlled by the amygdala, a limbic system structure located in the medial temporal lobe. The neurotransmitter norepinephrine (NE), released during emotional situations (via stimulation of the ß-adrenergic system by stress hormones), is partly responsible for the enhancement of emotionally stimulating memories occurring in the amygdala (Cahill, 1994; Buchanan & Lovallo, 2001; McCaugh & Roozendaal, 2002). Emotionally significant events induce the release of stress hormones such as cortisol and adrenaline, which activate the amygdala. The amygdala facilitates the hippocampal memory consolidation of the event, resulting in a situation-dependent enhancement in episodic memory (McGaugh & Roozendaal, 2002; Phelps, 2004). These emotionally encoded memories are extremely resilient. While most of us cannot remember what we had for dinner a week ago, the car accident we got into when we were ten years old may be a vivid memory that we can recall minute details of many years later.

Research examining the neurobiology of PTSD uniformly indicates the involvement of catecholamines, specifically those of the central noradrenergic system, in the pathophysiology of the disorder (Krystal et al, 1989). Catecholamines are derived from the amino acid tyrosine and include dopamine, epinephrine and norepinephrine (Purves et al, 2008). While successful psychological treatment has been shown using trauma focused cognitive-behavioral therapy (TFCBT), eye movement desensitization and reprocessing (EMDR), stress management and group TFCBT (Bisson & Andrew, 2007), pharmacological therapies are also widely used. A range of effective treatments, including selective- serotonin/norepinephrine reuptake inhibitors (SSRI/SNRI), anticonvulsants and propranolol, all act on

catecholaminergic systems within the brain (Bandelow et al, 2008).

Stimulants like Adderal, a mix of amphetamine salts, and Ritalin (Brand Name: Methylphenidate), are mainly used to treat attention-deficit disorder (ADD) and attention-deficit hyperactivity disorder (ADHD). Modafinil is used to treat narcolepsy and shift-work sleep disorder. Adderal and Ritalin are both central nervous system (CNS) stimulants that increase the extracellular availability of dopamine and norepinephrine (Sulzer et al, 2005). The mechanism of action of Modafinil has not been thoroughly examined, although preliminary studies have shown that it has similar effects on the dopaminergic and noradrenergic systems as Adderal and Ritalin (Wilens, 2006). Adderal and Ritalin have relatively low therapeutic windows and a high potential for abuse (Russo, 2006).

According to the neurochemical theories of PTSD, it is logical that the increase in norepinephrine caused by the use of stimulants would result in enhanced emotional memory consolidation by the amygdala (Krystal, 1989). The use of these stimulants by soldiers is almost exclusively paired with emotionally stimulating situations, such as prolonged missions into hostile territories. The surge of norepinephrine as a result of the emotional situation is magnified with the administration of stimulants, increasing the likelihood of emotional memories being formed during these stressful time periods. Since emotionally encoded memories are extremely resilient, the accumulation of these ingrained memories can lead to the onslaught of PTSD symptoms. While an infinite number of variables exist that can affect the occurrence of PTSD (a few being genetics, prior illness/medical conditions, and head trauma), evidence suggests that a correlation between PTSD and stimulant medication use could exist.

With this information, one must critically think of the cost-benefit ratio and ethics in this particular situation. Is it worth staving off natural fatigue and temporarily increasing mental acuity in a soldier if he or she may be more likely to develop PTSD and no longer be able to perform the duties required as a member of the US Armed Forces? Is it ethically permissible to force soldiers to take potentially harmful medications based upon the judgment of a commanding officer? No studies have looked at the correlation between concurrent stimulant use and incidents of PTSD in armed forces. In fact, few studies have even looked at the correlation between substance use (both recreational and prescription) and PTSD, and most of these studies were focused on the clinical symptoms of PTSD and its relation to substance use, not preclinical correlates between substance use and PTSD occurrence. It is precisely in this preclinical population where vital preventative research is lacking. One study published in 2002 found that prior stimulant use positively correlated with PTSD symptoms in postoperative trauma survivors with acute injuries (Zatzick et al, 2002). Another study found that in a sample of 8,124 Somalia combatants the chewing of khat leaves (which contain

cathinone, a CNS stimulant similar to amphetamine) correlated to higher instances of PTSD (Odenwald, 2009).

More scientific and ethical thought must be devoted to this issue in order to better understand the impact of combined battlefield and pharmaceutical exposure on soldiers. They face dangers and risks inherent to the job, and they shouldn't have to take anything that could increase the risk of long-term side effects from their vocational duties. A thorough retrospective study of the history of PTSD and stimulant use could help better elucidate the impact that these pharmaceuticals have on the neurochemistry of our soldiers. If the United States Armed Forces is going to continue to prescribe stimulants to their soldiers then it would be prudent of them to employ scientists to the task of uncovering the full effects that these medications can have on their recipients in various situations. Finally, the possible correlative and/or causal relationship focused on in this paper between the use of stimulants and the occurrence of PTSD must be considered in determining whether any future cost-benefit analyses are even ethical.

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