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A Retrospective Analysis of Paramedic Student Performance Under Simulated Stress

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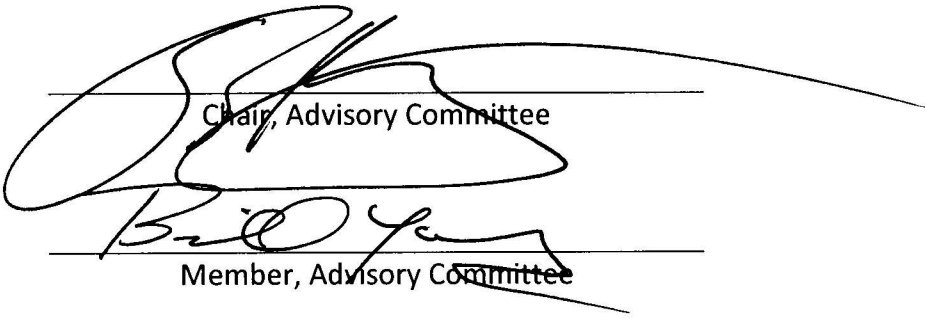

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Date 9 November 2014

A Retrospective Analysis of Paramedic Student Performance During Simulated Stress

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DEDICATION

This thesis is dedicated to my wife Julie for her unwavering love and support.

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ABSTRACT

The paramedic profession is an inherently difficult, dangerous and stressful profession. The paramedic is constantly barraged with acute stressors during the performance of his duties. These stressors have predictable, documented, negative effects on performance. The acute and chronic exposure to stress can negatively impact the safety and the well being of the paramedic. These stressors, if not successfully managed, can also result in negative effects to patients. Despite the overwhelming presence of stress in the paramedic environment, most paramedics receive little or no training to successfully perform under stress. One exception was a program called Trauma Lanes that was held at the National EMS Academy in Lafayette, Louisiana from 2009-2012, as part of the Accelerated Paramedic Education Program. This program, based on a similar model developed by the United States Air Force Pararescue Paramedic Program, trains paramedics to overcome the negative effects of stress using a combination of desensitization and overtraining techniques. A retrospective analysis of student performance scores during Trauma Lanes was performed in order to determine the effectiveness of the program. In addition, a survey was distributed to 71 graduates of the Trauma Lanes program who are now practicing paramedics in Louisiana, Texas and Mississippi in order to obtain additional data on the effectiveness of the program. The results indicated that stress could be effectively replicated in a simulated environment and that student performance is negatively impacted by the simulated stress. Students show significant improvements in performance after 12 simulations and continued improvement through the end of 19 simulations. The research also indicated that more simulations were needed to achieve optimal performance levels. The alumni survey responses indicated that the training received in the Trauma Lanes Program was crucial to prepare for the effects of stress and successfully perform as a paramedic while under stress in real life.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

FIGURE PAGE

CHAPTER 1

Introduction

The paramedic is a crucial component of the healthcare and public safety infrastructure in the United States and most industrialized nations (NAEMT, 2014). When called to action, the paramedic must perform in very hazardous, chaotic and dangerous environments to render care to the sick and injured (Miller, 2013). The paramedic must perform a thorough assessment of the patient and perform life-saving interventions, immediately, without error, or the patient can die. He must effectively lead a team of emergency medical responders to provide the best care for the patient, and in the case of critical patients; he must accomplish this in 10 minutes or less (Bledoe, Porter, & Cherry, 2013; Beebe & Myers, 2012; Chapleau, Burba, Pons, & Page, 2009). Paramedics must do all of this while dealing with numerous distracting issues from upset family members, interfering bystanders, and even first responders who sometimes openly challenge the decisions of the paramedic. The paramedic must also deal with the realization that sometimes despite all of his efforts, the patient will die (Beebe & Myers, 2012; Bledoe, Porter, & Cherry, 2013; Chapleau, Burba, Pons, & Page, 2009). These significant, immediate, and acute stressors that are experienced by the paramedic, are significantly higher levels of stress than levels found in other medical personnel (Hammer, Mathews, Johnson, & Lyons, 1986; Cydulka, Emerman, Shade, & Kubincanek, 1997).

These facts make Paramedicine arguably one of the most stressful of professions (Fishkin & Fox, 1994). The effects of stress and human performance are well documented (Driskell & Salas, 1996) and the paramedic is susceptible to these effects (Cydulka, Lyons, Moy, Shay, Hammer, & Mathews, 1989; Van der Ploeg & Kleber, 2003). These stressors have an immediate effect on the paramedic (Dutton, Smolensky, Leach, Lorimor, & Hsi, 1978; Cydulka, Emerman, Shade, & Kubincanek, 1997; Van der Ploeg & Kleber, 2003), and if not controlled, they can prevent the paramedic from successfully maintaining situational awareness, managing the dynamics of the situation, recalling important medical and tactical knowledge, properly assessing the patient, and performing complex psychomotor skills when time is critical.

Given the fact that stress is a significant obstacle to paramedic performance that is present on a daily basis; one would surmise that paramedic education programs would devote a considerable amount of time to educating the future paramedic on the effects of stress, and teach them how to effectively overcome these effects in the heat of the moment. However, this is not the case. The current National Education Standards for Paramedic education discuss acute stressors or how they affect the paramedic very little (National Highway Traffic Safety Administration, 2007). Very few paramedic programs have developed simulations designed specifically with the purpose of eliciting the physiological and psychological effects of stress in a student, and then requiring the student to perform patient care while experiencing those effects. A paramedic student's first experience with performance stressors may not come until his

clinical rotations, and even then, the type of stressful experience varies greatly from student to student, and the stress is always lessened by the fact that student knows that there will always be an experienced paramedic preceptor to step in if needed.

One notable exception to this is the United States military. The military has long recognized the importance of incorporating stress into the education curriculum. Numerous movies including *Band of Brothers, Heartbreak Ridge*, and *An Officer and a Gentleman*, detail the trials of military training with the proverbial drill sergeant providing endless stress for the student in the form of constant yelling, physically demanding obstacles and pushing the recruits to the point of exhaustion; while simultaneously demanding even more of them until they rise from their agony and overcome the many challenges.

In particular the United States Air Force (USAF) Pararescue Combat Rescue Officer Paramedic Program at Kirtland Air Force Base, in Albuquerque, New Mexico incorporates stress as an important part of their paramedic training. The school takes Pararescue trainees with no medical training and certifies them as Nationally Registered Paramedics in an accelerated 7-month format. The school has developed a program called Trauma Lanes. This program runs paramedic students through a grueling training of eight simulations per day for 5.5 days. These simulations are designed to challenge the student's medical knowledge, psychomotor skills performance, and their ability to both lead a medical team and follow the orders of a team leader. They are also

constantly challenged and stressed by an instructor, non-stop, with a variety of techniques designed to fluster, distract, irritate and rattle the students.

This program creates significant positive results in the weeklong time period as the student's progress from initially performing very poorly to excelling at a high performance level by the end of the 5.5 days. In essence, the Trauma Lanes program teaches the students how to overcome the physiological and psychological consequences of stress and successfully perform under pressure in a simulated environment.

The author, a former EMS instructor at the USAF Paramedic School and recognized by the USAF for his ability to effectively teach Trauma Lanes (Valenti, 2007), joined the faculty of the National EMS Academy in Lafayette, Louisiana in 2009. Recognizing the benefits of the Trauma Lanes program during his tenure with Pararescue trainees, he designed an abridged 2.5 day program as part the Trauma Management course curriculum for the accelerated paramedic program. This version of Trauma Lanes embodied the same style of stress with minor adaptations, in a shorter timeframe. This program became popular with students at the National EMS Academy, and testimonials from graduates of the program indicated the importance of Trauma Lanes in preparing them for real-life conditions. Graduates repeatedly stated that Trauma Lanes prepared them for the reality of what they faced on the street.

The negative effects of stress on human performance are well documented in the literature. The ability to train subjects to perform under stress is also documented.

However, there is little information in the available literature as to whether paramedics or paramedic students can be trained to overcome the effects of stress and successfully perform their duty. This research project will attempt evaluate the effectiveness of the Trauma Lanes Program by performing a retrospective analysis of the program in order to answer the following questions:

1. Can stress that impacts student performance be effectively replicated in the paramedic simulations performed during Trauma Lanes?
2. Can paramedic students be trained to overcome the effects of stress with the techniques of desensitization and overtraining, as utilized by the Trauma Lanes Program?
3. Can the students overcome the effects of stress to meet specific, defined competency metrics during the Trauma Lanes Program?
4. How effective was the training provided in the Trauma Lanes Program to the practicing paramedic in real life?

The research consisted of two parts. Part I analyzed the performance scores of students who participated in the Trauma Lanes Program for evidence. Part II analyzed the results of a survey sent to all graduates of the Trauma Lanes program to obtain information about their perceptions of the program.

CHAPTER 2

Review of Literature

Stress

There are many definitions for stress. They include the following:

- *a physical, chemical, or emotional factor that causes bodily or mental tension and may be a factor in disease causation (Merriam Webster , 2014).*
- *a state resulting from a stress; especially: one of bodily or mental tension resulting from factors that tend to alter an existent equilibrium (Merriam Webster , 2014).*
- *a demand that exceeds the capacity of the organism to respond (Orasanu & Backer, 1996).*
- *the subjective feeling of anxiety in response to a stressor, often in conjunction with the physiological indicators such as heart rate or blood pressure (Orasanu & Backer, 1996).*

Categories of stressors.

Orasanu and Backer (1996), in discussing stress in military performance, categorized stressors in two categories: physical/environmental or psychological.

- **Physical/environmental stressors.** These include sleep deprivation, fatigue, noise, temperature, crowding, isolation, or any stressors that can have an effect on all subjects in a physical space. They are assumed to have primary and direct physiological effects.

- **Psychological stressors.** Psychological stressors are broken down into three categories:

    - those that signal danger or threat of physical or psychological harm

    - those that represent limitation of cognitive or physical capacity to meet a demand, such as high information load, workload, lack of control over a situation, ambiguity, and time pressure

    - those that include social factors, which reflect interactions with another person, either in a personal sphere such as with family or friends, or in a job context, such as with platoon or squadron members or with leaders.

Ivancevich and Matteson (1980) categorize organizational stress into four classes: stressors that derive from the physical, from the individual, from the group and from organizational conditions.

Physical stressors. Physical stressors meet two criteria: 1, they require that an employee adapt in order to maintain homeostasis; and 2, result in direct physical impact on the operator.

Individual stressors. Individual stressors occur as a result of functions required in the process of individual performance. They include stressors that are directly related to the role that the person plays in the organization or the tasks the individual must perform within the organization. These include role ambiguity, role conflict and work overload.

Group level stressors. Group level stressors are defined as conditions that create stress within the individual due to some group influence. These include crowding and competition.

Organizational stressors. Organizational stressors derive from the general climate and working conditions of the organization. These include occupational stress, shift work, and continuous work.

Acute Stressors. Acute stressors are defined as stressors that are sudden, novel, unexpected, and of short duration. They include but are not limited to personal threats, time constraint, noise, and task overload (Driskell & Salas, 1991).

Stress and human performance.

Physiological responses to stress.

Stress Response. The stress response, also known as the fight or flight response, is a condition arising in response to a terrifying or traumatic event. It is now recognized as the first stage of the general adaption syndrome that regulates stress responses among vertebrates and other organisms (Bledsoe, Porter, & Cherry, 2013).

- The stress response begins in the amygdala of the brain, which triggers a response in the hypothalamus. This in turn, activates the pituitary gland, which releases the adrenocorticotropic hormone (ACTH).
- The adrenal glands are activated at the same time and release adrenaline (epinephrine) and noradrenaline (norepinephrine).
- The release of these chemical messengers result in the production of the hormone cortisol. This hormone increases blood pressure, blood glucose levels and suppresses the immune system.
- These actions are triggered to create a boost of energy, which can be used for immediate response to the perceived threat by the body.
- The release of adrenaline and noradrenaline also prepares the body for immediate muscular reaction. Those reactions include the following:
    - Increased heart rate
    - Increased rate of breathing
    - Decrease in digestion

- Vasoconstriction
- Release of glucose and fat sources for use
- Vasodilation of muscular blood vessels
- Pupil dilation
- Relaxation of the bladder
- Loss of peripheral vision (tunnel vision)
- Auditory exclusion (tunnel hearing)
- Shaking
- Disinhibition of spinal reflexes

The net result of these biological changes result in the following:

- Increased blood flow to the muscles by diverting flow from other parts of the body
- Increased blood pressure, heart rate and blood sugar to supply the body with extra energy
- Increased ability for blood to clot in the event of an injury
- Increased muscle tension to provide the body with extra speed and strength

In essence, these physiological changes help the body either fight the threat or take flight from it. (Bledsoe, Porter, & Cherry, 2013).

Perceptual Distortions. The stress response can also produce perceptual distortions. Perceptual distortions are commonly described as a lack of agreement

between the way a stimulus is commonly perceived and the way an individual perceives it under given conditions. These distortions are often experienced by public safety professionals in the commission of their duty and can negatively affect their ability to perform those critical duties. A study published by the National Institute of Justice surveyed 113 law enforcement officers who were required to shoot someone in the line of duty. The study demonstrated that over 95 percent of the officers experienced some form perceptual distortion during the incident. Table 1 lists those distortions below:

Table 1. Perceptual Distortions of Law Enforcement Officers Who Shot Someone In the Line of Duty

Distortion	At any time	Prior to firing	Upon firing
Tunnel vision	51%	31%	27%
Heightened visual detail	56%	37%	35%
Both visual distortions	15%	10%	11%
Auditory blunting	82%	42%	70%
Auditory acuity	20%	10%	5%
Both aural distortions	9%	0%	9%
Slow motion	56%	43%	40%
Fast motion	23%	12%	17%
Both time distortions	2%	0%	2%
Other	13%	6%	9%
Total	**95%**	**88%**	**94%**

Source: Klinger, D. (2006, January). *Police Responses to Officer-Involved Shootings.* Retrieved May 9, 2014, from www.nij.gov: http://nij.gov/journals/253/pages/responses.aspx

Effects of stress on performance. Salas, Driskell, and Hughes (1996) state that the "deleterious effects of stress on performance are profound and pervasive." The effects of stress are unique to the individual. Those effects include the following:

Physiological changes. Stress may result in physiological changes such as increased heartbeat, labored breathing and trembling (Rachman, 1983).

Emotional Reactions. Stress may result in emotional reactions such as fear, anxiety, frustration and a loss of motivation *(Salas, Driskell, & Hughes, 1996)*.

Cognitive Effects.

Problem solving degradation. Several studies have documented that stress results in problem solving degradation (Yamamoto, 1984; Smart & Vertinsky, 1977; Glass & Singer, 1972).

Attentional tunneling. Attentional tunneling is used to describe the process by which the scope or breadth of a person's focus will narrow under stress (Hockey, 1986). This can have significant negative consequences. Analysis of cockpit voice recordings at times of high stress prior to accidents found evidence of severe breakdowns in the pilot's ability to handle multiple tasks or issues (Helmreich, 1986). Sometimes; however, it can be of benefit, as one study found that noise stress improved focus of attention of the relevant issues and reduced distractions from irrelevant ones (Houston, 1969).

Working memory loss. Several stressors result in working memory loss including noise, danger and anxiety (Hockey, 1986; Mandler, 1979; Berkum, 1964). This has been attributed to a reduced working memory capacity.

Long-term memory. Stress has little or no effect on long-term memory of pilots (Wickens & Flach, 1988). Studies of soldiers under stress demonstrated that more-

skilled soldiers performed better than less-skilled soldiers at the same task (Berkum, 1964); but, stress restricts the retrieval of long-term information to habits that are well learned or overlearned (Eysenck, 1976).

Shifts in processing strategy. Individuals under stress regularly shift their strategic thinking priority from accuracy to speed as the most important result (Wickens C. D., 1996). This shift in priority results is less accuracy, increased errors, and more false alarms (Hockey, 1986; Wickens & Flach, 1988). When a person under stress gives commands they tend to be simpler, less effective and lead to more tactical errors than commands given by non-stressed individuals (Domer & Pfeifer, 1993).

Decision making. Decisions have been shown to break down under stress (Wickens C. D., 1996). Specifically, subjects were shown to think about decisions longer when placed under a threat of potential electrical shock for an incorrect answer (Cowen, 1952). There were some positive results noted as well regarding decision-making abilities. Individuals under stress tend to make less risky decisions and have an increased receptivity to judgments and solutions proposed by others (Ben Zur & Breznitz, 1981; Driskell & Salas, 1991).

Effects of specific stressors on complex performance. Orasanu and Backer (1996) have summarized the effects of various specific stressors on complex performance. They are listed in Table 2:

Table 2. Effects of Specific Stressors On Complex Performance

Stressor	Effects
Danger or threat	• Subjective anxiety • Freezing • Escape from situation • Reduced motivation
Loss of control	• Subjective anxiety • Freezing • Escape from situation • Reduced motivation
Sleep deprivation during continuous or sustained operations	• Effects seen with 18-24 hours of sleep deprivation • Long and boring tasks most vulnerable • Attention lapses • Perceptual focus narrows • Timing accuracy decreases • Complex psychomotor skills degrade • Loss of discrimination about task priorities
Workload	• Speed up processing
Time pressure	• Limited information scanning • Focus on limited information • Focus on selected information • Working memory disrupted • Decision strategies shift • Restricted number of team members participate in decision process
Information load	• Restricted information search • Less information used in decisions • Greater risk taking
Noise – Continuous	• Disrupts continuous attention • Increases attention selectivity • Disrupts memory component of complex tasks
Noise - Variable	• May increase alertness
Heat – Long duration	• Cognitive confusion • Impaired attention memory and judgment • Piloting skills disrupted
Cold	• Slowing of responses • Loss of manipulative ability (hands) • Little effect on cognitive tasks
Altitude	• Impaired concentration and acquisition of new information

Source: Orasanu, J., & Backer, P. (1996). Stress and Military Performance. In J. E. Driskell, & E. Salas (Eds.), *Stress and Human Performance.* Mahwah, NJ, USA: Lawrence Erlbaum Associates.

The Paramedic Profession

Overview. The paramedic is an allied health provider that acts as a clinician and advanced life support provider. In order to be credentialed as a paramedic, students must first get their Emergency Medical Technician (EMT) certification and then attend 18-24 months of advanced medical training at the undergraduate level. The total didactic and clinical time spent in training is approximately 1000-1300 hours. The students are also required to have competencies in basic health sciences and academic skills (Commision on Accreditation of Allied Health Education Programs, 2005). Upon completion, the paramedic receives a technical certificate, associate, or bachelors degree (Consortium of Academic Programs in EMS, 2014).

The paramedic is certified to perform numerous advanced life support skills. Several of these advanced medical skills, if done incorrectly, can cause serious permanent injury or death to the patient. These advanced skills include but are not limited to the following (National Highway Traffic Safety Administration, 2007):

- Advanced airway management, including:
    - Endotracheal intubation
    - Rapid sequence induction with paralytic agents

    - Surgical cricothyrotomy
    - Thoracic needle decompression
    - Ventilator set up and management
- Nasogastric tube insertion
- Intravenous cannulation
- Intraosseous cannulation
- Intravenous medication administration
- 12 and 15 lead ECG analysis
- Defibrillation
- Cardioversion
- Cardiac pacing
- Foley catheter placement
- Blood transfusion maintenance
- Imminent delivery childbirth
- Critical care transport

The paramedic is the primary clinician and advanced medical provider in the United States for prehospital medical care and public safety emergencies. They also work as allied health professionals in hospitals and in medical transportation. They regularly work with Law Enforcement, Fire-Rescue, and Emergency Communications to provide public safety services on a daily basis.

The paramedic profession, as part of public safety, is an inherently dangerous one, with fatality rates that are two and a half times higher than the average worker, injury and illness rates that are six times the national average, and transportation related injuries that are 30 times higher than the national average (Maguire, EMS Occupational Risks, 2009; Maguire, Hunting, & Levick, Occupational Fatalities and Emergency Medical Services: A Hidden Crisis, 2002).

Stress and the paramedic profession. As an allied health discipline that focuses on emergency medicine, the paramedic has the enormous responsibility of making life and death decisions, independently, and in a time-critical environment. He must successfully lead a team of medical and rescue providers, under pressure, to do what is best for the patient. He must perform complex psychomotor life-saving medical interventions immediately and correctly without error. He is expected to have the patient assessed from head to toe and all immediate life threats identified within 90 seconds. He is then expected to have those life threatening conditions managed, the patient packaged for transport and en route to the hospital within 10 minutes (Bledoe, Porter, & Cherry, 2013; Beebe & Myers, 2012; Chapleau, Burba, Pons, & Page, 2009; National Highway Traffic Safety Administration, 2007). Failure to accomplish all of these tasks can result in serious permanent injury or death to the patient.

These facts alone would place Paramedicine as one of the most stressful of the medical professions; but, the paramedic is also an integral part of public safety. Unlike other medical professionals who operate in a secure, climate controlled facility with an

abundance of security personnel, physicians, nurses, and allied health professionals to assist; the paramedic operates in the field, with only his partner to truly rely on, and with any additional help varying in both number and training level depending on what municipality or region the emergency presents itself. The paramedic must be able to successfully lead and coordinate care for the patient with other public safety professionals with whom he may or may not know or have a rapport.

The field is also a very dangerous place where the paramedic must deal with considerable stressors that are unknown to most other health professionals. These stressors are present the minute the paramedic responds to the emergency. They include, but are not limited to, the following (Miller, 2013; Bledoe, Porter, & Cherry, 2013; IFSTA, 2008; Van der Ploeg & Kleber, 2003):

- The increased stress of driving at higher speeds and navigating through red light intersections.
- The possibility of being seriously injured or killed by speeding or inattentive drivers on the roadway.
- The immediate dangers of the scene itself, including various hazards such as downed power lines, hazardous materials, fires, falling debris, and hazardous atmospheres.
- Violent, emotionally unstable or mentally unstable individuals who would harm or kill the paramedic if given the chance.
- Being confronted with dead or dying people.

- Being confronted with a dead child.
- Being confronted with a sexually abused child.
- Controlling angry or extremely upset bystanders and/or family members who have just experienced a traumatic event and often demand unrealistic expectations of the paramedic.
- The peer pressure that comes from other public safety professionals who insist their priorities or treatment plan takes precedence, even if those plans may be dangerous to the patient or others.
- Immediately gaining rapport and being seen as the leader by all persons involved at the scene of the emergency.
- The burden of leadership and the consequences of decisions made under pressure.
- The fatigue and lack of sleep that comes with working 12, 24 or 48 hour shifts.
- The fatigue that comes with working overtime, whether mandatory to fill shortages or simply to meet personal financial needs.
- The fatigue that comes with lifting heavy patients throughout the day, working in rough terrain, and bending into awkward positions to gain access to and move the patient.
- Maintaining a constant and heightened situational awareness throughout a dangerous, chaotic and life-threatening situation.
- Bringing order to chaos.

Training for Effective Performance Under Stress

Developing an effective training program that prepares individuals for the stressors of a particular profession, situation, or task is essential, yet very difficult to accomplish. Orasanu and Backer (1996) state that the effects of various stressors on cognitively complex performance has shown the following:

- The presence of certain stressors leads to decrements in performance, in addition to physiological and affective reactions.
- Different stressors have different effects: there is no such thing as a universal "stress reaction" that affects all people identically and equally.
- There are significant variations in the effects on stress on different individuals.
- Various tasks are differently vulnerable to different stressors.

Developing an education program that accounts for these complex issues of various stressors and their individual effects; both on the individual, and in how they disrupt performance, is very difficult. Programs that do attempt to prepare individuals for the stressors of the mission will use one or more of the following methods to help the individual reduce and overcome stress:

Stress Inoculation Training (SIT). SIT consists of an educational, rehearsal and application stage. In the educational stage, the students are taught about different ways that individuals respond to different types of stress. In the rehearsal stage, students learn one of a number of stress management techniques that will work best for

their specific situation. In the application stage, the students apply the techniques they have learned, first in a simulated environment and then in the actual stressful environment (Orasanu & Backer, 1996).

Skill training. Skill training attempts to relax or reduce the individual stress response by increasing the durability or automaticity of the skill itself (Orasanu & Backer, 1996). For effective performance, the skill must be performed under operational conditions similar to those found in the real environment. Normal task training without stressors does not necessarily improve skill quality when the skill is eventually performed under actual conditions (Zakay & Wooler, 1984). It is also believed that skills training mitigates the effects of stress by producing an overlearned behavior. This has the benefit of making well-rehearsed skills automatic and thus requiring less attention by the individual. This overlearned behavior is commonly referred to as "*muscle memory*." The skills also become less prone to degradation under stressful conditions. This increases confidence and the individual's sense of control, which in turn reduces effects of stress on the individual (Zajonc, 1965; Driskell & Salas, 1991).

However, there are limits to skills training. Driskill, Willis and Cooper (1992) found that the benefits of 100% and 150% overtraining were reduced by 50% after 19 days. In certain situations, the stress may be significant enough that degradation in performance occurs even after high levels of skills training (Stepanov & Stetanov, 1979).

Crew Resource Management Training (CRM). CRM training applies to any action that requires coordinated action by teams of highly trained professionals who must function under dynamic high workload conditions (Orasanu & Backer, 1996). CRM training is based on social psychology. Team building is the cornerstone of crew coordination and an emphasis is placed on building a sense of mutual trust, respect and responsibility for the crew's performance. Communication is a central tenant of CRM, and sharing information about problems that develop, intentions to address those problems, and who will perform various roles and tasks is essential (Orasanu & Backer, 1996; Kanki & Palmer, 1993). CRM training is credited with saving many lives when a DC-10 lost all flight controls at 33,000 feet. The flight crew practiced CRM training and were able to work together to bring in the airplane for a controlled crash landing (NTSB, 1990).

Comparison of training utility. Orasanu and Backer (1996) have summarized the various training approaches below in Table 3. The table lists specific stressors and rates the effectiveness of each type of training:

Table 3. Comparison of Training Utility

	Training Approaches		
Stressor	**Stress Inoculation Training**	**Skill Training**	**CRM Team Training**
Danger/threat/loss of control	xxx	xx	x
Sleep deprivation – continuous operations		x	xx

Table 3. (Continued)

Stressor	Training Approaches		
	Stress Inoculation Training	**Skill Training**	**CRM Team Training**
Sleep deprivation – sustained operations		x	xx
Workload	x	xx	xx
Time pressure	x	xx	xx
Noise		x	x
Heat			
Cold			x
Altitude			x

Source: Orasanu, J., & Backer, P. (1996). Stress and Military Performance. In J. E. Driskell, & E. Salas (Eds.), *Stress and Human Performance.* Mahwah, NJ, USA: Lawrence Erlbaum Associates.

Stress, Paramedicine, and Medical Education

- Girzadas et al. (2009) reported that medical students who performed simulations of difficult airway management scenarios, found that students did experience stress in the form of increased heart rate and self reported stress scores. They also found that the level of stress was the same for all students regardless of their assigned role. Their results indicate that medical students may benefit from simulation scenarios.
- Bong et al. (2010) determined that high fidelity simulation based training of gastroenterology physicians produced elevated stress levels in the form of

increased heart rate and salivary cortisol levels whereas tutorial based interactive education training did not.

- Arora et al. (2009) determined that surgeons are subject to many intra-operative stressors that can impair their performance.
- Cushman et al. (2010) determined that EMS providers attributed the occurrence of errors with pediatric patients to the stress and anxiety produced by a lack of familiarity with pediatric patients, the reluctance to cause pain or harm, and the lack of training and experience in treating pediatric patients.
- Bentley et al. (2012) determined the prevalence of depression, anxiety, and stress among a large cohort of nationally certified EMS professionals. They identified statistically significant demographic and work-life characteristics that predicted depression, anxiety and stress.
- Donnelly (2012) determined that exposure to both chronic and critical incident stressors increase the risk of EMS providers developing a posttraumatic stress reaction. Attention must be paid to both critical incident exposure as well as chronic stress to mitigate the development of posttraumatic stress disorder.
- Goon et al. (2014) determined that simulation training attenuates neural responses related to stress when making clinical decisions that online training does not.

- Sexton (2000) determined that discussing errors and error reporting is difficult because medical staff seem to deny the effect of stress and fatigue on performance.

CHAPTER 3

Research

Trauma Lanes - Overview

Trauma Lanes is the name for the simulation program for paramedic students that were in the accelerated paramedic program at the National EMS Academy (NEMSA) in Lafayette, Louisiana. It was part of the EMT-P 2040 course curriculum. Trauma Lanes was 2 ½ days of intense realistic simulations using patient simulation manikins, actual paramedic equipment, real ambulances, and a simulated emergency room. Upon the completion of Trauma Lanes, the students performed 20 paramedic level trauma simulations and acted as team leader for approximately five of the simulations. All 20 simulations, in aggregate, covered the breadth and depth of paramedic trauma skills and reviewed specific medical emergencies that are compounded by trauma.

Trauma Lanes was held near the end of the paramedic trauma course. This allowed the student to have learned all didactic and psychomotor skills knowledge before performing in the event. Students would also be familiar with performing realistic simulations from previous simulation exercises during their airway, cardiology, medical emergencies and obstetrics/pediatrics courses. Once students completed the trauma course, their didactic training was completed, and only their final field internship and the remainder of their clinical rotations, would remain before graduation.

Trauma Lanes is modeled after the Trauma Lanes Program at the United States Air Force (USAF) Pararescue/Combat Rescue Officer Paramedic Program at Kirtland Air Force Base, New Mexico. The significant differences between the USAF Trauma Lanes and the NEMSA Trauma Lanes Programs are 1., a shortened timeframe from 5.5 days to 2.5 days; 2., modifications in what specific stressors could be used on a civilian versus military population; and 3., the types of specific scenarios chosen. Trauma Lanes is unique in that it was designed not only to hone trauma skills performance with simulation, but it was specifically designed to acclimate the students to the stress response by placing them under constant acute stressors during the simulations.

The objective of Trauma Lanes was to expose the student to the physiological and psychological responses created by the stress response, develop solid critical thinking skills under stress, and help students learn how to overcome the effects of these stressors in order to successfully perform necessary job functions. The program accomplished this through a variety of techniques including:

- desensitization to stressors.
- providing the students with a self-awareness of their own stress response.
- exposing the student to a variety critical patient conditions in a simulated environment.
- overtraining of paramedic skills and development of muscle memory.
- development of critical thinking, problem solving, and prioritization skills under stress.

- developing effective leadership strategies to direct teams under stress.
- integrating paramedic skills into simulations.
- honing specific psychomotor skills for speed and accuracy.
- training under simulated stressful conditions.
- building student confidence.

Trauma Lanes – Design

Students were divided into teams of four or five students. Four students are ideal; but resource limitations sometimes dictated groups of five students. Each team was provided with a complete advanced life support (ALS) equipment set and a working ambulance with stretcher to perform the simulation. Students performed one simulation each hour with each student taking a turn as the team leader. Students were randomly assigned into different teams during each four-hour session.

During each simulation, the group was assigned to an adjunct paramedic instructor who led, facilitated, and evaluated the student's performance during the simulation. The adjunct instructor followed the group the entire time from driving to the simulation location, on scene student performance, transport with the patient, en route patient care, and disposition to the simulated emergency department. The adjunct instructor facilitated the simulation, providing essential information as needed as well as applying stressors to the team; with particular attention to the team leader.

The adjunct instructor then debriefed the entire group on their performance and filled out an evaluation form for the team leader (See Appendix A). The students then cleaned up their equipment, took a short break, and moved to the next simulation station. Students performed one simulation each hour for 20 total simulations in 2.5 days.

Each simulation was carefully designed with specific objectives. The simulation was written and provided to each adjunct instructor to ensure consistency and adherence to the objectives (See Appendix B). Each adjunct instructor was also provided with an EMS simulation evaluation form that the instructor filled out on the team leader's performance during the simulation. The form provides an overall score of 100 points, and an overall Pass/Fail score. In order to pass, the student must score at least a 75% overall score without making any critical errors that would result in an automatic failing grade, regardless of score.

Simulations used During Trauma Lanes.

1. Dislocated Knee
2. Basal Skull Fracture
3. Femur Fracture
4. Humerus Fracture
5. Epidural Hematoma
6. Thoracic Gun Shot Wound
7. Severe Lacerations

8. Electrocution
9. Cervical Spine Injury
10. Thoracic Spine Injury
11. Crush Injury
12. Burns
13. Subdural Hematoma
14. Multi System Trauma
15. Burn with Airway Compromise
16. Pediatric Multi System Trauma
17. Stabbing with Airway Compromise
18. Fall / Anaphylaxis
19. Pericardial Tamponade
20. MVC / Minor Neck Pain

Students were expected to perform just as they would on an actual call. They were expected to wear appropriate personal protective equipment (PPE) that includes eye protection, gloves, footwear with ankle support and long pants. Students had to perform as a team. The team leader was expected to perform an entire patient assessment on a moulaged, simulation manikin. He was expected to direct his team members to provide care to the simulated patient. Although all students are trained in Advanced Life Support (ALS) skills, only the team leader performed the patient

assessment and paramedic level ALS skills. The team members were only allowed to perform Basic Life Support (BLS) skills and only as directed by the team leader.

Verbalization of injuries by the instructor were kept to an absolute minimum and only performed to compensate for the limitations of the simulation manikin. An example would be the instructor verbalizing that the patient is seizing, as the manikin cannot simulate a seizure. The students had to cut clothing and perform an assessment to find all injuries. They had to actually perform all interventions. No verbalization of treatments or interventions was allowed. This was essential for realism, recreating actual simulated scene times and for the student to experience the difficulty of performing these fine psychomotor skills while under stress.

During Trauma Lanes, the lead instructor rotated from group to group. The lead instructor provided supervision during Trauma Lanes to ensure that instructors were supervising the simulations properly, and that adequate safety precautions were being maintained. The lead instructor provided an overall briefing to both adjunct instructors and students at the beginning of the day, and an overall debriefing at the conclusion of the day. The lead instructor briefed the students and instructors on the rules of engagement and important safety rules. The lead instructor also provided additional stressors to the students as he rotated from group to group during the simulations.

Safety is an important concern during Trauma Lanes due to the intense realism, expected student skills degradation under stress, and being outdoors in various climates. Adequate amounts of shade, water and sports drinks were provided for

students. One of the adjunct instructors was assigned medical duty and had a complete advanced life support medical kit and cardiac monitor available for any medical emergencies. One room was designated as a rehab/infirmary room with a bed available for any student who required it. All instructors were licensed paramedics who are skilled at recognizing the signs and symptoms of exhaustion and can perform immediate medical interventions. Students were given 10-minute breaks per hour and a one-hour lunch. All paramedics fell under the medical direction and protocols of Acadian Ambulance. Students were encouraged to eat nutritious food for breakfast and lunch and to hydrate frequently.

Trauma Lanes – Stressors

Trauma Lanes is designed to place the students under continuous acute stressors during the simulation. The focus of these stressors is on the team leader, but all team members will be subjected to acute stressors during the simulations. The following stressors are permitted during the simulations:

Simulation specific stressors.

- Complexity of patient injuries
- Complexity of necessary interventions
- Correct application of critical thinking/prioritization under acute stressors
- Specific situations dictated by the simulation (scene safety, actors)

- Simulation specific distractors (bystanders, crowds, actors)
- High information load
- Time pressure
- Noise – constant
- Noise – acute

Instructor applied stressors.

- Yelling – in general or at a specific student
- Negative feedback / critique on performance
- Random questions that the student must answer
- Requiring students to repeat poorly performed skills
- Constant reminding of time spent on scene
- Showing disappointment in student performance
- Rolling of eyes
- Shaking of head
- Tossing of equipment
- Removing incorrect or poorly applied interventions
- Photographing incorrect or poorly applied interventions
- Blowing horn / siren / or other noise maker at random
- Singing
- Laughing
- Squirting fake blood at manikin or student (as appropriate for simulation)

Peer pressure stressors.

- Successfully leading team during simulation
- Fear of appearing incompetent in front of team members
- Fear of failure in front of team members
- Fear of not being able to perform skills in front of team members
- Fear of disappointing the instructor(s)
- Fear of performing in front of an audience
- Community service – All students in the group must perform mandatory community service hours for the error of a single person for specific errors
    - Scene safety errors
    - Failure to wear proper personal protective equipment (PPE)
    - Leaving any equipment or trash on scene.

Physiological stressors.

- Fatigue – Physical demands of performing eight simulations per day including:
    - Awkward positions
    - Lifting moving simulated patients
    - Performing psychomotor skills
    - Performing under time constraints
- Weather – Students are expected to perform in all climates except lightning or dangerous storms. Students are told to bring rain gear.

- Climate – students must perform simulations outside in various climates. Students are told to dress appropriately for climate.

Prohibited stressors.

- Physical touching of the student by the instructor
- Throwing objects at students
- Other physical stressors by the instructor enacted upon the student
- Cursing or profanity
- Personal insults
- Any other stressor that could be personally insulting or humiliating to the student.

(Stressors must focus on the student's performance not on the student themselves.)

Student's response to stressors.

Student specific…no two students respond in the same manner.

- Anger
- Sarcasm or disrespect to instructor
- Crying
- Laughing
- Freezing
- Loss of motivation
- Quitting / shutting down during simulation

- Attentional tunneling
- Escaping situation / walking off / leaving during simulation
- Problem solving degradation
- Refusal to follow the directions of the instructor

Instructor feedback to student stress responses.

- Student anger – Too angry or threatening: time out for student with private, one on one counseling by instructor on behavior. If necessary, removal of student or progressive discipline per NEMSA student policy.
- Student sarcasm or disrespect to instructor – Additional stressors applied by the instructor, reaffirming instructor's role as leader and focusing on student professionalism.
- Student crying – backing off stressors temporarily and getting student to refocus on simulation ("get back in the game").
- Student laughing - additional stressors and corrective action applied by the instructor, focusing on student professionalism.
- Student freezing - backing off stressors temporarily and getting student to refocus on simulation ("get back in the game").
- Student loss of motivation – additional stressors applied to student, focusing on student professionalism and getting student to reengage in simulation.

- Student quitting / shutting down during simulation - backing off stressors temporarily and getting student to refocus on simulation ("get back in the game").
- Student attentional tunneling – additional stressors are applied to refocus student on priorities in patient care and scene management. Specific errors are pointed out during debriefing and corrections for errors provided during debrief.
- Student escaping situation / walking off / leaving during simulation - backing off stressors temporarily and getting student to refocus on simulation ("get back in the game").
- Student problem solving degradation – applying additional stressors with clues to correct interventions (e.g. "If ***ONLY*** we had a bandage just for this trauma…"). Specific errors are pointed out during debriefing and corrections for errors provided during debrief.
- Student refusal to follow the directions of the instructor – additional stressors are applied by the instructor, reaffirming instructor's role as leader and focusing on student professionalism. Instructor will attempt to refocus student on the simulation. This will be followed post simulation with one on one counseling regarding student attitude and behavior; and if warranted, progressive disciplinary action per NEMSA student policy.

Trauma Lanes – In Action

Session 1: Hours 1-4.

- Simple simulations
- Introduction of students to stress
- Scene times are poor (approximately 14-30 minutes)
- Treatments are often poor or incorrect
- Multiple errors by students at all levels including: incomplete assessments, incorrect assessment or management sequence, incorrect treatment priorities, improper treatments, treatments/skills performed incorrectly, poor clinical decision making, ineffective scene management and numerous other errors.

Session 2: Hours 5-8.

- Complexity of simulations is increased
- Stressors are increased ("tear them down")
- Continuation of multiple errors by students
- Students begin to show small improvements by hour eight

Session 3: Hours 9-12

- Students demonstrate more improvement by hour twelve and reduce the number of errors committed. Patient management and scene management begin to improve.
- Student improvement varies from team to team and is often inconsistent

Session 4: Hours 13-16.

- Stress now focuses on highlighting good performance as well as bad performance ("build them back up")
- Students are given specific plans for improvement
    - Scene times under 10 minutes
    - Honing skills under pressure
    - Advice on how to integrate assessment, management and skills more efficiently.
- Consistent improvement seen in all groups with few exceptions
- Scene times now begin to reach 10 minute goal
- Critical errors in patient care decrease significantly

Session 5: Hours 17-20.

- Final polishing ("removing the dross from the silver")
- Confidence boosting by instructors
- All teams improve greatly
- Student mastery of trauma emergencies
    - Scene times are now 6-9 minutes (approximately 8.5 minutes on average)
    - Identification of all life threatening injuries
    - Correct treatment on scene of all injuries
        - ET intubation

        - Chest decompression
        - Splinting
        - Bleeding control
        - Packaging
        - Rapid transport
    - Correct treatment of all treatments en route
        - IV access
        - Secondary assessment
        - Reassessment
        - Interventions
        - Patient report
    - Succinct and accurate transfer of care to simulated emergency department (ED)
    - Students should be able to perform independently on Paramedic ambulance unit by the conclusion of Trauma Lanes

Methodology

Part I: Student Performance Data. Trauma Lanes was held for a total of seven different paramedic cohorts from 2009-2012. The method for this study is a retrospective analysis of student performance evaluations for last two of the seven, paramedic classes that participated in the Trauma Lanes Program at the National EMS

Academy in 2012. Data for the previous five classes were not available. Each student who was the team leader, and consequently the focus of the simulated stressors, had their performance scored by an adjunct paramedic instructor who was a state licensed and Nationally Registered Paramedic, using a prepared scoring rubric and evaluation form (See Appendix A). The written simulation with expected student actions was provided to the adjunct instructor running the simulation as part of the simulation materials (See Appendix B).

The scores from each of the five, half-day sessions were statistically analyzed in aggregate for overall improvements or deteriorations in three areas. The first area evaluated was the time the student spent on scene. The scene time starts when the lead student makes contact with the simulated patient and ends when the patient and team are in the ambulance and they have physically left the scene. This is an important performance measure in paramedic trauma management, as critically injured patients need to reach a hospital with surgical capabilities and blood products as quickly as possible. The national standard for scene time on a critical trauma patient is 10 minutes or less (NAEMT, 2010). This also gives insight as to the improvement in efficiency by the lead student and the individual student teams.

The second area that was evaluated was the overall numerical score. The student evaluation is scored with a maximum of 100 available points. This is a valuable tool as it can more accurately reflect changes or improvements in student performance from section to section, even when the student fails repeatedly.

The third area evaluated was the overall pass rate. This is a measure of whether the student was successful or not in his performance. A passing score was awarded if a student achieved minimum score of 75 out of 100 points and did not fail any critical criteria sections. These critical criteria were essential because a failure to complete those specific actions could result in serious injury or death to the patient in real life. A student who fails on a critical criteria portion would fail even if they had a passing minimum score. For example, a student may perform the simulation correctly except for the fact that he stayed too long on scene. The overall score could be very high and above the minimum of 75 points that is needed to pass; but, the student would still fail because he did not meet the critical criteria of leaving the scene in an acceptable timeframe.

The amount stress during the simulation was essentially constant for each simulation during each 4-hour block with the exception of the average difficulty levels for the simulations used in Session 1, the amount of instructor applied stress in Session 1, and the difficulty level of each individual simulation. Each simulation scenario was given a difficulty rating from 1 to 3 based on three criteria: 1. The number of injuries or issues the simulation patient had; 2., the number of basic life support (BLS) interventions the student had to perform; and 3., the number of advanced life support interventions (ALS) the student had to perform. The more injuries, BLS interventions, or ALS interventions the simulation had, the higher the score. The numerical ratings for each category were determined by using the actual value for each category in the

simulation, and comparing that value relative to the average and standard deviation of the value for all 20 simulations. For example, if the average number of injuries for simulation was 5 and the average number of injuries for all 20 simulations was 10, with a standard deviation of 4, the simulation would receive a 1 out of 3 rating for injuries because the number 5 was less than 6, which is one standard deviation away from the average.

Values that were less than one standard deviation from the average were given a 1 rating. Values within one standard deviation of the average were given a 2 rating, and numbers grater than one standard deviation from the average were given a 3 rating. The ratings for the three categories: number of injuries, number of BLS interventions, and number of ALS interventions, were then averaged to provide an overall difficulty number from 1 to 3. Difficulty levels are important when evaluating the overall performance over time, as the more difficult a simulation, the more stress a student may experience.

For the data analysis, all student identifiers were removed and the data was analyzed in aggregate. This was done to protect individual student privacy and to mitigate outliers caused by the unique responses of individual students. The control is the first session when the students are initially exposed to the stressors in simulation. The other four sessions where the students continued to perform simulations under stressful conditions were compared to the control session. Specific evaluations in improvement from session to session were evaluated as well as overall improvement or

deterioration from the initial session to the final session at the conclusion of the Trauma Lanes Program.

Part II: Alumni Survey. A voluntary, anonymous questionnaire was sent to the alumni of all seven paramedic cohorts who successfully completed the Trauma Lanes Program and are currently licensed, practicing paramedics. The questionnaire asked specific questions about their perceptions of the program and how they believed the Trauma Lanes program benefited them in their paramedic training and practice. The survey provided a numerical scale from 1 to 5 for each question. A score of 1 indicated that the student believed that the area being discussed did not help, a score of three indicated that the student believed the topic discussed did help and a score of 5 indicated that the student believed the topic discussed was a crucial component. The student was also given the ability to provide comments on each question and a final area to provide overall comments.

This survey is significant because all of the respondents are currently licensed paramedics in Louisiana, Texas and Mississippi who are currently practicing in the field with a minimum of 18 months of experience. Some of the graduates would now qualify as veteran paramedics with up to five years of experience in the field as a practicing paramedic. Their responses provide valuable insight as to the effectiveness of the Trauma Lanes program in preparing paramedic students to successfully perform in their duties once they are licensed and working.

CHAPTER 4

Results

Part I: Student Performance Evaluations

Table 4. Summary of Student Performance Scores.

Session I	**Difficulty**	**Scene Time**	**Score**	**Pass/Fail**
AVERAGE	1.5	14:28:44	66.4	31.3%
MIN	1.0	6:20:00	28.0	
MAX	2.5	30:00:00	95.0	
STDEV	0.6	6:29:59	20.7	
n = 32				
Session 2	**Difficulty**	**Scene Time**	**Score**	**Pass/Fail**
AVERAGE	2.1	14:09:56	68.4	25.0%
MIN	1.0	8:00:00	37.0	
MAX	3.0	22:30:00	97.0	
STDEV	0.8	4:04:17	15.1	
n = 32				
Session 3	**Difficulty**	**Scene Time**	**Score**	**Pass/Fail**
AVERAGE	2.0	10:18:13	80.4	65.6%
MIN	1.5	5:00:00	47.0	
MAX	2.5	19:46:00	97.0	
STDEV	0.4	3:26:05	14.7	
n = 32				
Session 4	**Difficulty**	**Scene Time**	**Score**	**Pass/Fail**
AVERAGE	2.3	9:53:26	83.6	65.6%
MIN	1.0	7:00:00	51.0	
MAX	2.8	13:00:00	99.0	
STDEV	0.5	1:37:59	11.4	
n = 32				
Session 5	**Difficulty**	**Scene Time**	**Score**	**Pass/Fail**
AVERAGE	2.1	8:31:45	89.8	79.2%
MIN	1.8	5:00:00	55.0	
MAX	2.8	13:36:00	100.0	
STDEV	0.4	1:57:08	12.4	
n =24				

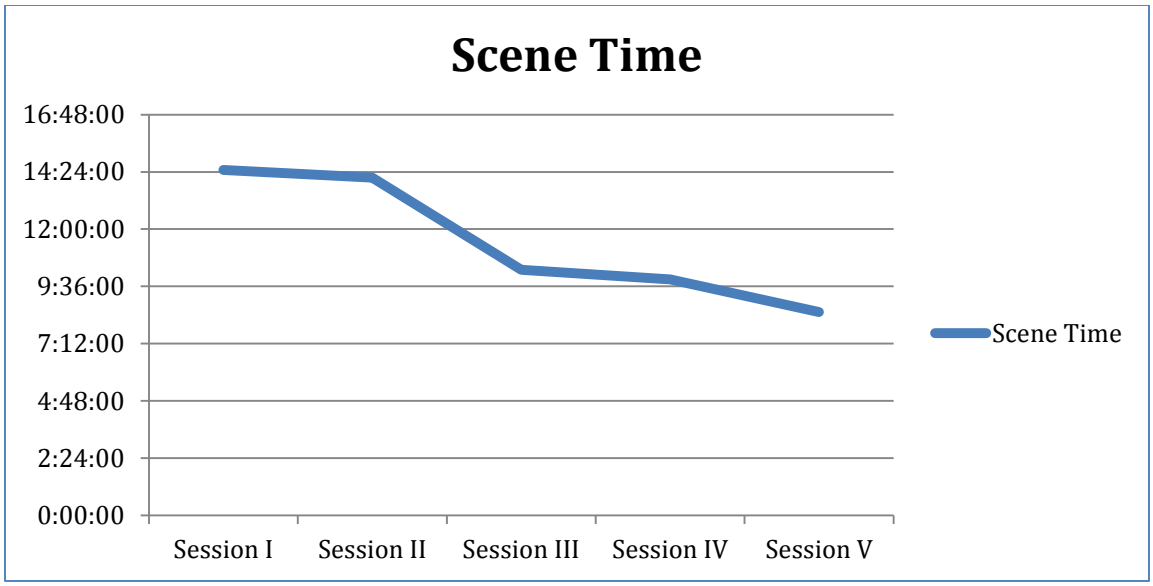

Figure I. Scene Times By Session

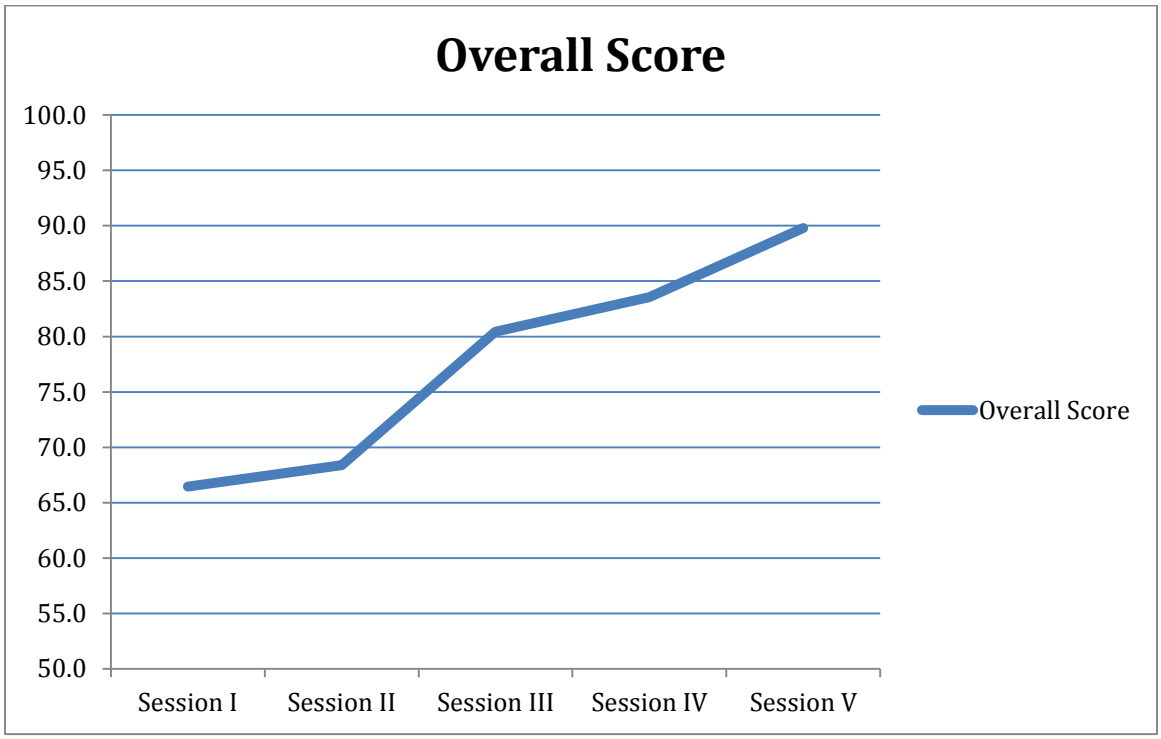

Figure 2. Overall Scores By Session

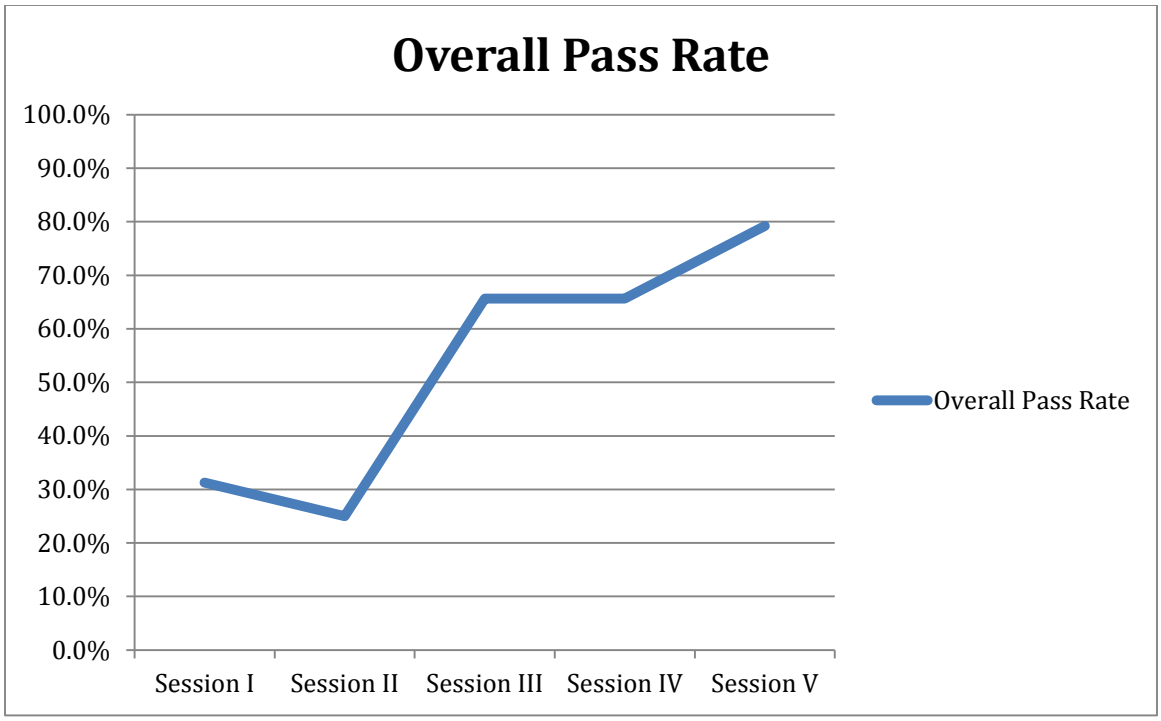

Figure 3. Overall Pass Rates By Session

Part II: Alumni Survey

Table 5. Distribution of Survey Participants

Question	Mean	Standard Deviation
How long has it been (years) since you participated in Trauma Lanes?	3.88	0.96

n=41

Table 6. Mean Scores of Survey Questions

Question	Mean	Standard Deviation
Do you believe the Trauma Lanes Program adequately prepared you for the physical effects of stress when performing as a Paramedic during stressful medical emergencies?	4.20	0.87
Do you believe the Trauma Lanes Program adequately prepared you for the mental effects of stress when performing as a Paramedic during actual prehospital emergencies?	4.15	1.04
Did the Trauma Lanes Program prepare you to be able to think critically and accurately under stress during actual prehospital emergencies?	4.29	0.81
Did the Trauma Lanes program prepare you to successfully perform a patient assessment on live patients during actual prehospital emergencies?	4.24	0.80
Do you believe the Trauma Lanes Program taught you how to successfully manage a prehospital trauma emergency?	4.12	0.87
Did the simulations in Trauma Lanes accurately reflect actual emergency patient encounters you experienced as a Paramedic in the prehospital setting?	3.90	0.96
To what degree did the trauma lanes program increase your confidence in your abilities as a Paramedic beyond what you gained in your Paramedic education program?	4.22	0.82
In your opinion, how important was the Trauma Lanes Program in your overall Paramedic education in preparing you to be a practicing Paramedic?	4.22	0.82
In your opinion, how important is it that future Paramedic students participate in a program like Trauma Lanes as part of their Paramedic training?	4.71	0.60

n=41

All scores used a likert scale from 1-5 with 1 being rated as "*it did not help at all* "and 5 being rated as "*it was crucial*."

CHAPTER 5

Discussion

Part I: Student Performance Evaluations.

In order to analyze the data, it is essential that it be compared to established metrics that meet desired outcomes for student performance. For this, one can look at minimum success parameters and/or optimal success parameters. These values were determined based on established national standards, and instructor preference. The data that was analyzed were average scene times, average scores, and the percentage of overall pass rates.

The maximum acceptable scene time for this project was set at ten minutes. This is because the accepted national standard for scene time in trauma is ten minutes. The optimal scene time; therefore, would be somewhere between ten minutes and zero minutes. The faster the scene time, the better; however, the reality is that the primary assessment and initial management of the patient takes time. Also affecting scene time is the amount of time required to extricate the patient from any obstacles. This time will vary depending on the both the obstacle and the skill of the responders. With these factors in mind, the optimal scene time was set at eight minutes or less.

The minimum passing score was set at 75 points out of 100 points. This score was chosen because the National Registry of Emergency Medical Technicians (NREMT), the only national certification body for paramedics, scores psychomotor skills stations

out of 100 points and requires a applicants to score at least a 75% out of 100 points on its psychomotor exam. The optimal score was set at 90 out of 100 points because this is the universally accepted threshold for an "A" or outstanding grade.

The overall pass rate is simply the percentage of the number of students who passed the simulation. It is essentially an inverse measurement of attrition, or how many students would fail out of the course or program. Most accredited paramedic programs attempt to keep attrition to a minimum. High attrition rates would indicate the root cause of the failure is more likely resulting from an issue with the training itself, rather than an issue with the student. The overall pass rate is essential because in real life, a critical criteria failure can result in serious injury or death. With these factors in mind, the minimum overall pass rate was set at 90%. This is consistent with acceptable levels of attrition set by many academic programs and reflects the serious consequences of a critical criteria failure in real life. The ideal overall pass rate would be 100%; however, in reality, this may not be possible. Some people simply cannot achieve this no matter how much time and effort is put into training; therefore, the optimal overall pass rate was set at 95%.

During each of the five, 4-hour sessions, the students acted as a team member or team leader for each of the four simulations. Ideally, the students were placed in groups of four so each student could be team leader for one of the four simulations; however, due to budget constraints and large numbers of students, sometimes the students were placed in groups of five. This resulted in one of the students not being

able to be a team leader for a session. When this occurred, the student who did not team lead would be a team leader in the next session. The scores for each session are the overall scores, over pass rates, and scene times for the team leader for each session. These scores were then analyzed in aggregate for an overall evaluation of student performance and to minimize the impact of outliers.

In Session 1, the average scene time was 14:29 minutes, the average score was 66.4, and the overall pass rate for all participants was 31.3%. These metrics are significantly below the minimum desired outcomes as established above. These results continue into Session 2, where the scene times and overall scores improve only slightly but the overall pass rate actually decreased to 25.0%. These poor results indicate that the acute stressors placed on of the students during the first two sessions of Trauma Lanes affected the students negatively. Session 1 and Session 2 were essentially the same, with the exception that the difficulty levels of the simulations, and instructor applied stressors were increased in Session 2. These results were expected, as the outcomes were consistent with numerous studies that described the negative effects on stress and performance.

In Session 3, there is marked improvement by the students. The average scene time improves to 10:18, almost meeting the minimum threshold. The average score is 80.4 and for the first time the minimum threshold for a parameter is met. The overall pass rate improves from 25.0% to 65.6%, a marked improvement, although still not meeting the minimum desired threshold. In Session 4, the scores continue to improve

with the average scene time now meeting the minimum threshold with a time of 9:53, the average score improves from 80.4 to 83.6 and the overall pass rate remains the same at 65.6%. In Session 5, results continue to improve with the average scene time now at 8:32, the overall average score at 89.8 and the overall pass rate has improved to 79.2%.

These improvements in results suggest that it takes a minimum of either 12 hours and/or a repetition of 12 simulations for the students to achieve the initial benefits of desensitization to the stress and the benefits of overtraining in learning how to overcome the negative effects of stress. This is an important fact as it indicates that a one or two day program will not be of sufficient length to produce successful outcomes. It takes a minimum of three sessions (12 simulations over 12 hours), to begin to see noticeable improvement. That improvement; however, barely meets only one of the three minimum thresholds set for competency. The student still needs more sessions to improve both performance and to achieve consistency in performance. This also indicates that desensitization alone is not effective in overcoming the effects of stress. Constant desensitization, combined with overtraining that provides immediate feedback by instructors, is essential.

By the end of Session 5, the students have met two of the three minimum thresholds (scene time and overall score), and are approaching the optimal thresholds for both. However, overall pass rates at 79% are still below the minimum established threshold of 90%. When this overall pass rate is compared to overall scores, it indicates

that many students are still failing despite achieving overall scores above the minimum passing threshold of 75 points. This fact suggests that overall pass rates are an indirect measurement of critical criteria failure percentage; that is the number of students who still fail to achieve a critical criteria component of the simulation and thus fail regardless of score. This is most likely due to the negative effects of stress that the students are experiencing. This fact also indicates the need to look at the critical criteria failure rate among students as an important measure of performance that is affected by stress. This is vitally important as a critical criteria failure in real life can result in serious injury or death to the patient, the paramedic, other first responders, or bystanders. These results indicate the need for further training to prepare paramedic students to successfully perform under stress.

The combined data from all five sessions yield significant results. The overall improvement in student performance in just 2.5 days, from the start in Session 1 to the end of Session 5 is quite significant. The overall average for scene times improves by nearly six minutes, the overall score improves by approximately 35%, and the overall pass rates improve by approximately 150%. These results indicate that the students can be trained to overcome the effects of the acute stress response and successfully perform under stress.

It is also interesting to note that although dramatic improvement was observed in performance, the students only met the minimum thresholds for two of the three parameters, average score and average scene times, and never reached the minimum threshold for overall pass percentage at the end of Session 5. The students did not

meet any of the optimal thresholds as well, although they were closely approaching the optimal scene time threshold of eight minutes with an average scene time of 8:32 and an optimal threshold for average score at 90% with an average score of 89.8%. These results continue to demonstrate that more sessions are needed to achieve optimal performance. These results also appear to support the use of desensitization and overtraining as effective tools to train students to overcome stress. The students, through the constant exposure to realistic scenarios and realistic stressors, combined with the repeated practice of trauma assessment and management, under close instructor guidance, continue to improve in their overall performance.

Part II – Alumni Survey

The Alumni Survey was designed to obtain the perceptions of former students who completed the Trauma Lanes program during one of the seven times it was held from 2009-2012. The survey was sent to a total of 71 students out of approximately 120 students that participated in Trauma Lanes and for which contact information was available. All survey participants are now licensed paramedics who are actively working in Louisiana, Texas and Mississippi, in urban, suburban and rural environments. Their perceptions and evaluation of the program provided a tremendous amount of information and insight about the program. The questions of the survey were designed to answer the following larger questions:

1. Did the students believe that the Trauma Lanes Program was helpful in overcoming the effects of stress they face during an actual emergency situation?
2. Did the students believe the Trauma Lanes Program helped them to successfully function as a paramedic in the field?
3. How important do the students believe the Trauma Lanes Program was in their overall paramedic education?

The response rate for the survey was 58% (41/71). The average time since the student participated in Trauma Lanes was on average less than four years (mean 3.88, standard deviation 0.98). The distribution had three alumni with less than two years, 13 alumni with less than three years, 11 alumni with less than four years and 14 alumni with less than five years. This distribution indicates that the survey reached a broad spectrum of graduates from all seven cohorts that participated in previous Trauma Lanes and thus a single cohort bias is unlikely. The average time is also is an indirect measure of the number of years the student has been a practicing paramedic in the field. This is because the Trauma Lanes program was held near the end of the paramedic education program and the students generally completed all licensing requirements in approximately 3-4 months after the completion of the Trauma Lanes program. Therefore, it can be approximated that the average alumni participating in the survey has 3.88 years of experience as a licensed paramedic.

The first question to discuss is whether the students believed that the Trauma Lanes Program helped them in overcoming the negative effects of stress. The students

were specifically asked if the Trauma Lanes Program helped to overcome the physical effects of stress and the mental effects of stress. The responses were very positive. The mean score for whether Trauma Lanes helped with the physical effects of stress was 4.20 with a standard deviation of 0.80. Forty-four (44%) percent of students believed it was crucial. The mean score for mental stress was 4.15 with a standard deviation of 1.04. Forty-nine (49%) percent of respondents believed it was crucial. In addition, there were numerous comments by alumni commenting on how the program was instrumental in overcoming stress. Some of those comments are as follows:

- *"Trauma lanes not only prepared me physically but mentally as well. The stress that I was put through during trauma lanes fully prepared me for the field work that I currently do. The things that was said and how I should do the task at hand is how I preform my duties in the field."*
- *"It was very effective in demonstrating the need to focus in a chaotic environment."*
- *"Trauma lanes adds the stress that you have on an actual call that classroom time can not produce. Very helpful when you are clear and on a actual call because you are able to preform at your best despite the stress around you."*
- *"The stresses simulated during the trauma lanes program are very similar to what I have experienced in the field and I feel the program helped a great deal."*

- *"It is hard to simulate the stressful situations that a paramedic can be faced with, but I feel that the Trauma Lanes Program helped me a great deal. I feel that more paramedic programs would benefit greatly from having this type of program."*
- *"Yes. To put it politely nothing like being chased with a bull horn and golf cart while being covered in fake blood to cause stress and get your brain and feet working."*
- *"There is no way to ever ADEQUATELY be prepared for the mental effects. I believe the trauma lanes teaches you to rely on and trust your training."*
- *"Given (a) the limited knowledge of students in the environment and (b) limited experience of the students, it certainly reinforced the need to retain focus with swirling distractions all around. I can recall more than one true-life call where images of Trauma Lanes came to my head. That recall led to positive outcomes."*
- *"Trauma Lanes thoroughly prepared me for the mental effects of stress while in the field. Being able to experience the high stress educed during Trauma Lanes taught me how to mentally prepare for the prehospital emergencies that I encounter."*
- *"The heightened stress levels that were induced during trauma lanes played a critical role in my preparation for stressful emergencies in the field.*

Trauma lanes taught me to maintain a cool and collected composure with even the worst emergencies that I have encountered."

- *"Learning how to react under pressure and in stressful situations can never be learned in a book, or during your time as a candidate, or OJT (on the job training). You cannot gain confidence in yourself and your abilities with someone else there to hold your hand or clean up your mess. It is most effectively gained by sticking you in the situation, making you make critical decisions, and then educating and evaluating afterwards. The simulations were real enough to evoke physical and mental reactions for which you needed to learn to deal with or compensate for. They were very effective."*
- *"The Trauma Lanes Program was very effective at providing stressful simulations. Previously, myself and most of the participants were in a role in EMS where things were delegated to us and there was not that much decision making involved. As a participant in the Trauma Lanes Program, due to the several day long experience, you were given multiple opportunities to deal with incredibly stressful simulations where all the critical decisions rested on you. There were ample instructors and evaluators to help critique, educate, and provide immediate effective feedback. I consider it a crucial part of the paramedic program, during which you learned how to evaluate yourself both physically and mentally as you reacted to very stressful and intimidating situations."*

The scores as well as the comments provide strong evidence that Trauma Lanes does effectively simulate stress and that it does help students overcome the physical and mental effects of stress. The survey is also consistent with the student performance data that demonstrates that students can be trained to successfully overcome the effects of stress. Student performance scores and student perceptions agree that Trauma Lanes does help prepare the paramedic to successfully perform under stress by desensitization and overtraining.

The alumni survey indicates that the Trauma Lanes program achieves this through a variety of methods. Students report that Trauma Lanes helped them to be able to perform a patient assessment (mean score 4.26, standard deviation 0.80, 46% deemed it crucial), it helps them to think critically and accurately under pressure (mean score 4.29, standard deviation 0.81, 51% deemed it crucial), and it helped them to manage a prehospital trauma emergency call (mean score 4.12, standard deviation 0.87, 44% deemed it crucial). It exposed the students to realistic, difficult calls they may encounter in the field (mean score 3.90, standard deviation 0.96) and it helped develop confidence in their abilities as a paramedic (mean score 4.22, standard deviation 0.82, 46% deemed it crucial). Some of the student comments are as follows:

- *"I do believe it helps you learn how to manage prehospital trauma emergencies because it forces you to actually preform the interventions instead of just talking about them in the classroom."*

- *"Without a doubt, we were given the basic tools to think critically under stress."*
- *"Yes, decision making was questioned along the way by facilitators. Are you sure you want to XYZ?? (Knowing it was the correct thing to do). This builds confidence in decision making."*
- *"The similarities were striking. No matter how hard we try to make dummies life-like, it will always fall short. That said, I have experienced multiple incidents with similarities, particularly difficult extrications of critical patients. I can even remember a patient from Trauma Lanes that had fallen from a tree. Not long after going into the field, I had a patient that had fallen from a deer stand. Remarkably similar."*
- *"I have encountered all but one scenario in real life (I don't live in an area where boats are used)."*
- *"I have encountered several of the simulations and was able to reflect on Trauma Lanes to help me get through."*
- *"I believe it prepared me to be able to focus on the task at hand and treat life threatening injuries."*
- *"For the first time in most of the students careers and lives, they now found it necessary to make life and death decisions as well as evaluations of patient conditions during periods of sometimes intense and growing amounts of stress. This time was invaluable in determining how as a person*

you would react to those types of stimuli. It was a very effective tool at simulating life and death situations and the stress accompanied by those, in a simulation setting. I won't use the like riding a bike analogy, but when faced with actual serious trauma and medical emergencies later in my career, in which I was responsible for all aspects of patient evaluation and medical care, the manner in which I reacted with clarity and composure was definitely effected by the lessons about myself I had learned during the Trauma lanes program."

- *"Because the program was over several days, there was plenty of time for self evaluation, awareness, clarity and improvement. The simulation presentations and scenarios introduced varying levels of stress, as do all calls as a street paramedic. They challenged you to react to each scenario separately due the wildly differing nature of each scenario."*
- *"I feel it was vital to my success."*

These surveys and the comments demonstrate that the Trauma Lanes Program is very effective in recreating realistic scenarios and effectively training students to successfully manage them in real life. The results suggest that the overall experience of being exposed to the situation, feeling the real life effects of stress, actually performing patient assessments under stress, and managing those patient situations under direct instructor supervision, repeatedly over several days, results in improved performance,

increased confidence, and effective training that enables paramedics to perform under stress in real life.

Finally, the survey attempted to elicit from the students their perceptions as to how important the Trauma Lanes program was as part of their overall paramedic education. The survey results indicated that alumni believed the Trauma Lanes Program was very important in their overall paramedic program. The mean score was 4.43, standard deviation 0.75, and 58% of respondents stated it was crucial. Some of their comments are as follows:

- *"It was one of the most important things about paramedic class."*
- *"Behind only cardiology, I found Trauma Lanes to be a critical piece of the paramedic puzzle. Lecturing about stressful scenes cannot possibly demonstrate what actually happens. Trauma Lanes was a very effective introduction to reacting to scene chaos."*
- *"It was more effective than most clinicals, and it actually helped to expose you to some of the rigors of day to day life as a practicing paramedic. The experience and growth you gained were more important than 75% of the book learning we did."*
- *"The Trauma Lanes section was an important factor in preparing us for real-world situations. While the didactic portion of class was important, it could not on it's own prepare us to think critically under the mental and physical stress of an intense trauma call. In addition to the practice of*

running the simulated calls, it also brought to our attention the need to act quickly but deliberately to successfully manage such cases. I feel that Trauma Lanes has contributed to our successes as Paramedics."

- *"Trauma lanes were an amazing and educational experience. While nothing will ever be able to push you to the limits of working on a pediatric patient that was struck by a car, or your first electrocution patient, there is no greater way, in my opinion to prepare for these things. I would participate in the trauma lanes program again if I had the opportunity. It took the boring and repetitive nature of skill labs and put it into a more engaging and authentic "classroom." Everyone I know who has had the opportunity and privilege to participate in this program has come out saying the same thing. While I am not entirely sure what this survey is supposed to accomplish, I cannot speak highly enough of the program and praise the instructor(s)."*
- *"I realized as I was going through these questions that I was answering nearly all of them the same way, but these are accurate answers. The 3 days we spent in Trauma Lanes did as much (or more) for me as than the entire rest of the course. I truly don't believe that I would be the medic I am today without them. The way (the instructor) taught the course was exactly what was needed!"*
- *"I felt that what made this instructor's scenarios different than other programs I had been through was everything was based on making you a*

better paramedic, and not intended to simply humiliate you and expose weaknesses. Many times before I had been through skill sessions that revolved around humiliation and amusement for the instructors. While this program was a VERY humbling experience, it was always kept very professional. No one (instructors included) forgot that the point was to learn and ultimately provide better care."

- *"I loved Trauma Lanes. I believe that going through Trauma Lanes helped me become a better paramedic by exposing me to have to think critically earlier on in my career. I have trained many brand new paramedics who were not exposed to any similar programs and (they) are definitely lacking in critical thinking. Trauma Lanes even forced us to think out of the box when it came to extricating a patient or immobilizing patients whom are in awkward positions."*
- *"During the class, I hated trauma lanes. I dreaded it and thought it was a waste of time. It wasn't until being on my own on the truck that I realized it was useful. It definitely prepares you for the real world. It teaches second nature and critical knowledge. I am thankful (for) the experience."*
- *"I appreciated the yelling and screaming the instructors did to us AFTER the fact because we come across those situations quite often when family is yelling at us to get answers on their loved ones…"*
- *"I often find myself remembering the lessons learned during Trauma lanes during the prehospital emergencies that I encounter as a practicing*

paramedic. I am thankful for the experience and wish that more programs offered this type of high stress simulation program."

- *".... It was an invaluable experience, validated by my own experiences as a paramedic for the last 4 years. I highly recommend (I think it ought be mandatory) it to everyone that wants to practice as a paramedic."*
- *"I feel trauma lanes are so beneficial to not only new paramedics, but to older ones too. Trauma lanes with simulations is an amazing training/refresher tool. This program helps with time management, skills, scene awareness and confidence building. Truly, I have not seen another program as beneficial as this one."*
- *"Because of Trauma Lanes, I can attest that my first major trauma scene was not filled with panic. I had a sensation that I had been there before. What price can you put on that?"*

The alumni were also asked how important they believed it was for future paramedic students participate in a program like Trauma Lanes. This yielded the highest score of all of the questions. The mean score was 4.71, with a standard deviation of 0.60. Seventy-eight percent (78%) of the alumni stated that Trauma Lanes or a similar program was crucial for paramedic students. Several of these comments were as follows:

- *"Again, I have difficulty imagining an effective paramedic program without this type of exercise."*

- *"I believe it is a great part of the learning curriculum. I think all paramedics should be able to experience this type of training."*
- *"I think a large number of high stress educed simulations are crucial and should be mandated for all future paramedic education and training."*
- *"I have seen medics that have not been in the trauma lanes and I could see a big difference on how they handled the scene"*
- *"I think it was incredibly effective, and I am glad to have gone through the program. Every student that wants to have someone else's well being as their sole responsibility needs to be adequately prepared for what that really means. The Trauma Lanes program was very effective at bringing controlled and uncontrolled environments to an educational setting. I consider it mandatory that students be exposed to these types of stress and their reactions prior to being given the responsibility of doing it in a real life and death scenario."*
- *"I think that it is very important to put paramedic students through a high stress program like Trauma Lanes. There is a huge difference between reading a scenario and verbalizing the treatment versus recognizing signs and symptoms and providing the appropriate treatments in a timely manner. It is so much easier to be able to verbalize a treatment plan versus actually performing the treatment plan."*

- *"I think trauma lanes are very important to paramedic training. I learned more in 3 days of trauma lanes than I did in 3 weeks in the classroom."*
- *"It NEEDS to be done to every class. I almost feel as though I can tell who did trauma lanes and who didn't while running a trauma in real life. I feel more comfortable with a paramedic who did trauma lanes backing me up on a bad trauma call."*
- *"Its a must do. It helps and prepares you for so many challenges that one will face in the real world"*
- *"Without programs like these, students (will) only have real patient encounters to gain experience, which unfortunately could lead to the detriment of the patient."*

These scores and comments provide strong evidence that paramedics who went through Trauma Lanes as a part of their Paramedic training found the training very effective and crucial. This is reflected in their comments as to how the program helped them personally but also in their overwhelming belief that Trauma Lanes, or a program like Trauma Lanes, is crucial for future paramedics to participate in.

Limitations and Errors

There were some limitations in the research that need to be mentioned. The first limitation is that data from student evaluations were only available for two of the

seven cohorts of students that went through Trauma Lanes. This made the available number for the sessions at n=32. Although this sample size is small, there are still enough data points to develop a good statistical pattern of student performance. The performance of the first five cohorts during Trauma Lanes was consistent with the performance of students in cohorts six and seven for which data was collected. It is believed that if data were available from the first five cohorts, its addition would not result in any unexpected changes in the analysis; rather, it would have only strengthened the findings. The data that is available are consistent with published literature and consistent with the data collected from the alumni surveys that had participants from all seven cohorts. These facts indicate that the available data are valid. However, the study would have been much stronger if data from all seven cohorts were available.

The second limitation was that the data for Session 5 was reduced because the number of simulation rotations that were run was reduced in number from four to three. This was done in order to allow extra time for final clean up and conclusion of Trauma Lanes. This reduced the number of total simulations from n=32 to n=24. This was done before it was decided to perform analysis of the data and was an unintentional error. Even with this error, there are still solid data on student performance with the 24 simulations that were run in Session Five of Trauma Lanes.

The third limitation was that it was not possible to obtain contact information for all of the alumni who participated in Trauma Lanes. Approximately 120 paramedic

students participated in Trauma Lanes, and contact information was available for only 71 of the originally estimated 120 participants. However, the data is still considered to be valid because of the high response rate of 58%. The consistent pattern demonstrated by the data, the low standard deviation of the data, and the fact that the data are consistent with the data from the student performance scores, supports the inference that the data are valid.

The final limitation of the data was that the last two cohorts for which data was available; there were more students participating in Trauma Lanes than in previous cohorts. This required that some of the student groups be increased from teams of four students to teams of five students. This resulted in some of the students not getting an opportunity to team lead in all five sessions. As a result, direct student performance for session to session is not available for all participants. However this fact is mitigated by the fact that the averages for all the students for each session were analyzed. This reduced the impact of this error to a minimum.

Conclusions

The following conclusions can be discerned from the data:

1. It is possible to effectively replicate stress in paramedic simulations and its effects on paramedic students. This is validated by both the student performance scores that demonstrate the negative effects of stress, and the

alumni surveys, where graduates consistently stated they experienced stress during Trauma Lanes.

2. It is possible to train paramedic students to overcome the effects of stress using a combination of desensitization and overtraining. This is supported by both improvements in student performance over time and from the results of the surveys where the students consistently reported that Trauma Lanes effectively prepared them for the real life stress of the profession.
3. Desensitization to stress is not sufficient; desensitization combined with overtraining is key to improving student performance and overcoming the negative effects of stress. This is supported by the fact that significant improvements in performance are not seen until Session Three, after 12 hours and 12 simulations have elapsed.
4. Students show remarkable overall improvement in performance from the beginning to the end of Trauma Lanes; however, more sessions are needed to achieve optimal results. This is demonstrated by comparing the final results to pre-determined minimum and optimal thresholds. Students after five sessions still did not meet the minimum threshold of an overall pass rate of 90%.
5. Alumni of Trauma Lanes consistently report that the program was a crucial component in their paramedic training that prepared them to successfully perform the requirements of the paramedic profession. They

overwhelmingly state that a training program like Trauma Lanes needs to be mandatory for all paramedic students.

6. Future research should focus on how many sessions are needed to achieve optimal levels of training competency for paramedic students participating in Trauma Lanes.

In conclusion, the retrospective analysis validates that the Trauma Lanes program was effective in successfully training paramedic students to overcome the negative effects of stress and to successfully perform under stressful conditions. Paramedics who participated in Trauma Lanes consistently state that the Trauma Lanes program was a crucial component of their paramedic education that prepared them for the realities of Paramedicine and needs to be provided to all future paramedic students.

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APPENDIX A:

Student Simulation Evaluation Form

EMS Simulation Evaluation

Student:_____
Team Members: _____
_____
Simulation:_____ **Date:**_____

	Performs Correctly	Performed; but at incorrect time or needs improvement	Does Not Perform or Performs Incorrectly
Preparatory / Scene Evaluation			
Evaluates scene safety and ensures safety of all persons at all times	6	3	0
Wears appropriate BSI for situation and constantly evaluates for effectiveness and integrity	2	1	0
Identifies total number of patients	2	1	0
Primary Assessment			
Performs a primary assessment on the patient	4	2	0
Identifies and manages all immediate life-threatening conditions as they are found	6		0
Rapid /Focused Assessment			
Performs correct assessment for situation	4	2	0
Identifies and manages all immediate life-threatening conditions as they are found	6	3	0
Scene Management			
Requests / utilizes resources as indicated	2	1	0
Effectively manages and directs the EMS responder team	2	1	0
Effectively manages the dynamics of the scene including bystanders and situational changes	2	1	0
Performs only necessary or relevant interventions on scene	4		0
Scene Departure	**Time:**		
Departs scene in an acceptable timeframe	6	3	0
Utilizes and justifies best method of transport	2	1	0
Chooses best destination for patient based on situational criteria	2	1	0
Secondary Assessment / Reassessment			
Performs a secondary assessment	4	2	0
Performs all necessary treatments and interventions	4	2	0
Reassesses patient's condition and responds appropriately to findings	2	1	0
Disposition			
Performs accurate and succinct radio report (when practical)	4	2	0
Performs accurate and succinct verbal report with person accepting patient care	6	3	0
Cognitive			
Formulates an accurate assessment of the patient's condition including primary and secondary diagnoses	4	2	0
Initiates the correct treatments/interventions/algorithms	2	1	0
Does not perform any dangerous, harmful, or otherwise inappropriate treatments, interventions or actions	4		0
Psychomotor			
Performs all skills correctly	10	5	0
Affective			
Acts in a professional manner at all times and treats the simulation as if it were a real life encounter	4		0
Maintains composure and emotional control	2	1	0
Follows the direction of instructors at all times	4		0
TOTAL POINTS		**+**	**=**

PASS_____**FAIL**_____
Critical Criteria Failure: Any yellow box marked is to be scored as a fail, regardless of score.

Evaluator: **Signature:**_____

Use the reverse side of this sheet for notes or additional comments. Document all critical criteria failures.

APPENDIX B:

Sample Trauma Lanes Simulation

PEDIATRIC MULTISYSTEM TRAUMA

TRAUMA - 16

PRELIMINARY/DISPATCH INFORMATION	**Read to student**
You are dispatched to the scene of a bicyclist struck. The scene is safe.	

HISTORY OF PRESENT ILLNESS/INJURY			**Provide only if asked for by student**
Age:	7	**C/C:** Unresponsive	**O:** 7 minutes PTA
Sex:	M	**Events:** Bystanders state the child rode out into traffic and was struck by a car. The driver states he was going approximately 35 miles per hour when the child just "darted out in front of him."	**P:** N/A
Race:	W		**Q:** N/A
Wt (lb):	70		**R:** N/A
			S: N/A
		LOI: UTO	**T:** N/A

PAST MEDICAL HISTORY			**Provide only if asked for by student**
Normal LOC:	A x 3	**Allergies:**	UTO
HX:	UTO	**Precautions:**	Full code
RX:	UTO		

INITIAL VITAL SIGNS					**Provide only when performed by student**
LOC:	U x 0	**HR:**	136	**RR:**	30
BP:	60/p	**Temp (F):**	98.6°	**SPO_2:**	90% RA

EXAMINATION				**Provide only when examined by student**
Skin:	Pale, cool	**Pelvis:**	Crepitus	
HEENT:	Abrasions to forehead	**GU:**	WNL	
Neck:	Tracheal deviation to right side, no JVD noted	**Posterior:**	WNL	
Chest:	Lack of chest movement, contusion on left side	**Extremities:**	L femur fracture, numerous abrasions	
Resp:	Snoring, absent left side **$ETCO_2$:** 35	**Psych:**	UTO	
CV:	Tachycardic without radial pulses	**Labs:**		**GLU:** 100 mg/dL
EKG:	Sinus tachycardia	**Neuro:**	UTO	**GCS:** 1,1,1=03
Ab/GI:	Rigid, distended			

ASSESSMENT	**The student must provide one or more possibilities**
1. Multisystem trauma	**4.**
2.	**5.**
3.	**6.**

SUGGESTED TREATMENTS / INTERVENTIONS		**Student should perform**	
BLS		**ALS**	
OPA, suction PRN	Trauma center	Thoracic decompression	
O_2 15 LPM BVM	Stabilize fractures en route	ET intubation	
C-spine immobilization	Priority transport	IV NS x 2, fluid to maintain	
Consider ALS intercept		systolic BP 80 - 90 mmHg	

PATIENT STATUS				**Post interventions**
IMPROVEMENT			**DETERIORATION**	
LOC:	U x 0	**GCS:** 1,1,1=03	**LOC:** U x 0	**GCS:** 1,1,1=03
BP:	60/p	**Pain:** UTO	**BP:** 0	**Pain:** N/A
HR:	120	**GLU:** 100 mg/dL	**HR:** 0	**GLU:** 100 mg/dL
RR:	12 BVM	**Temp (F):** 98.6°	**RR:** 0	**Temp (F):** 98.6°
SPO_2:	99%	**$ETCO_2$:** 35	**SPO_2:** 85%	**$ETCO_2$:** 6
EKG:	Sinus tachycardia		**EKG:**	PEA - Bradycardia
OTHER:			**OTHER:**	

PEDIATRIC MULTISYSTEM TRAUMA

TRAUMA - 16

SIMULATION OBJECTIVES

BLS

1. Appropriately manage and treat a multisystem trauma.
2. Correctly perform airway management including insertion of an oral airway, BIAD insertion, and ventilation.
3. Correctly apply a long back board and implement spinal movement restriction precautions.
4. Have a scene time of 10 minutes or less.

ALS

1. Perform immediate on scene needle decompression.
2. Perform in line endotracheal intubation on scene.
3. Initiate two large bore IV's en route and administer the appropriate amount of fluids.
4. Appropriately manage a patient in decompensated hypovolemic shock.

DISCUSSION QUESTIONS

BLS

1. What are your priorities with so many injuries?
2. What is going to save this patient's life?

ALS

1. What are your treatment priorities?
2. Should chest decompression be performed on scene?
3. Should endotracheal intubation be performed on scene?
4. Should you take time to stabilize the pelvis and put on a traction splint?

MOULAGE INSTRUCTIONS

If using real patient have airway head available	Abrasion to forehead
Cyanosis to lips and face	
Red to back	
Open L femur fracture	

EQUIPMENT LIST

BLS		**ALS**	
Item	**Quantity**	**Item**	**Quantity**
Model patient or simulator	1	Intubation module	1
Stretcher (optional)	1	12 lead EKG	1
Airway module	1	End tidal CO_2 monitor	1
Oxygen tank with regulator (1 - 15 LPM)	1	IV start module	1
Adult BVM, NRM, NC	1 ea	Medication module	1
Assessment module	1		
Trauma module	1		
Spine board / cervical collars	1 ea		
Automatic external defibrillator trainer	1		

INSTRUCTOR NOTES

- The priority is to treat all immediate life threats to airway breathing and circulation (ABC's). The EMS provider should look at ABC's as life threats to be corrected simultaneously rather than sequentially. Surgery and blood products are the key to the patient's survival. The goal of the EMS provider is a scene of 10 minutes or less.
- A tension pneumothorax is an immediate critical life threatening injury which much be corrected to prevent death. Chest decompression should be performed during the primary assessment immediately after it is identified.
- Endotracheal intubation should be performed on scene because of the high risk of the patient aspirating. An oral airway should be inserted during the primary assessment and intubation should be performed after the rapid trauma assessment. This is because all bleeds must be identified first.
- It is possible to perform chest decompression, endotracheal intubation, back boarding and still have a scene time in less than 10 minutes. The student should not be allowed skip critical treatments to airway and breathing with the rationale of saving time on scene by doing them en route. The reality is that it is very difficult to perform these skills in a moving vehicle, under stress, and these interventions are truly time critical.
- All other treatments, including intravenous therapy, medication administration and splinting, should be performed en route. A traction splint should not be applied on scene. The student should splint the femur to the backboard.

VITAE

Nicholas Miller is a decorated Paramedic and Emergency Medical Services Educator with over 18 years of experience in urban, suburban, and rural EMS environments. He is a nationally recognized expert in US military EMS education and has trained the elite United States Air Force Pararescuemen (PJ's) and Survive Evade Resist Escape (SERE) Independent Duty Medic Technician (IDMT) Paramedics. Nicholas created and developed the first Military Medic to Paramedic Bridge Program in the United States endorsed by the United States Army that transitions certain military medics to civilian paramedics in 16 weeks. He has consulted with various US military agencies, state EMS bureaus, community colleges and universities on providing EMS education to current and former Military Medics. Nicholas was honored for his ground breaking work in military EMS education with the *2010 JEMS/Physio Control EMS 10 Award* which recognized him as one of the top innovators in EMS in the United States.

Nicholas is also a recognized expert on civilian Emergency Medical Services. He is a national conference speaker and published simulation author. Nicholas is an expert in all aspects of EMS education including quality instruction, curriculum development, clinical coordination, program management, simulation, continuing EMS education, and online EMS education.

Nicholas is currently an Education Coordinator with the National EMS Academy, one of the largest accredited paramedic programs in the United States; and during his career, he has provided EMS training to various EMS agencies, fire departments,

hospitals, clinics, industrial first responders, and community organizations throughout the United States.

Nicholas received his Paramedic Certification from Rolla Technical Institute, a Bachelor's of Science Degree in Health and Wellness with a Life Science Core from the University of Minnesota, and a graduate certificate in Fire and Emergency Services Management from Eastern Kentucky University.