

Towards Readiness: Defining the Operationally Competent Advanced Practice
Registered Nurse (APRN)

by

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Thesis submitted to the Faculty of the
Health Professions Education Graduate Program
Uniformed Services University of the Health Sciences
In partial fulfillment of the requirements for the degree of
Master of Health Professions Education 2019

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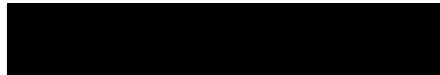
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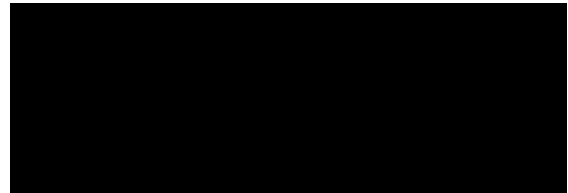
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Learning to Care for Those in Harm's Way

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Matthew R. D’Angelo, DNP, CRNA

March 7, 2019

ACKNOWLEDGMENTS

I owe an incredible debt of gratitude to my thesis advisors – Dr. Steven Durning, MD, PhD and Dr. Ronald Cervero, PhD. I would also like to thank Dr. Lara Varpio. Each professor has given me a tremendous amount of time and patience that ultimately carried this thesis and my journey to completion. I am not an easy student – I owe a great deal of my success to these giving people.

Additionally, this work was supported by Dean Carol Romano and the faculty and staff of the Daniel K. Inouye Graduate School of Nursing. The products of this work are a shared achievement – the GSN is defining what it means to prepare a ready healthcare force. Our efforts will undoubtedly influence the next generation of military healthcare team members and save lives on the battlefield.

I would like to specially acknowledge Dr. Matthew Welder. Matt deployed to Fallujah, Iraq 86 days after graduating from the Uniformed Services University and was thrust into one of the fiercest battles of the war in Iraq. The concept “Readiness for War” was nonexistent in those days. Matt’s experiences, both successes and failures, inspired this work and has shaped my understanding of what it means to be “Ready for War.” This master’s thesis is the actualization of countless hours of discussion and theorizing “readiness” models on cocktail napkins.

I also would like to acknowledge the Tactical Combat Medical Care (TCMC) Team at the AMEDD Center and School, specifically Bret Smith, Shon Compton and Mark Geaslak. TCMC training is a model training paradigm for military healthcare readiness. Working with and observing these professionals was integral to the program of research described in this thesis.

Finally, I will forever be indebted to all of the nurses, physicians, medics and other members of the military healthcare team who deployed and served in harm's way. We've all come home with blood on our hands. Through our experiences we may finally be able to begin to describe our role on the battlefield and develop ways to improve our training so we are truly "ready."

DEDICATION

This thesis is dedicated to my family – especially my wife Melissa and our five children. This journey has taken me away from home and distracted me from moments that counted in our lives. I will never truly be able to thank each of you enough for your support and patience; I can only hope that the body of this work will influence the future of military healthcare providers and make our sacrifices worthy.

~ mrd

ABSTRACT

Towards Readiness: Defining the Operationally Competent Advanced Practice Registered Nurse (APRN)

Matthew D'Angelo, DNP, CRNA 2019

Thesis directed by: Steven J. Durning, MD, PhD, Director of Health Professions Education, Department of Medicine and Ronald Cervero, PhD, Professor and Associate Director for Remote Campus Education

Purpose: Military Advanced Practice Registered Nurses (APRNs) and other members of the military healthcare team are deploying at great numbers in support of combat operations. While military healthcare team members complete rigorous educational programs, their education may not adequately prepare them for the experiences they have while in the operational setting. This thesis will explore a broad range of underdeveloped concepts that challenge military APRNs, and other military healthcare providers, in operational environments and ultimately further the understanding of what it means to be “ready” for military healthcare team members.

Methods: Through the lens of curriculum development, this thesis will explore individual and team competence to perform healthcare in operational military settings.

Results: This thesis produced three scholarly products that advance the understanding of APRN and military healthcare team member readiness. We submit: (1) a definition of readiness for the military healthcare team, (2) a critical appraisal of

teamwork literature and its implications to military interprofessional healthcare teams (MIHTs), and (3) a model to evaluate team performance.

Conclusions: Readiness of military healthcare providers is ill-defined. This thesis explores the notion of readiness and develops a novel definition of military healthcare readiness. Building on the readiness definition, this thesis presents an argument that civilian healthcare team literature may not fully address the complexity of the military interprofessional healthcare team. Lastly, this thesis offers a new lens to explore teamwork and provides a method to evaluate performance and remediate low-performing teams.

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CHAPTER 1: Introduction

INTRODUCTION:

The origin of this thesis began in 2004 when a Uniformed Services University of the Health Sciences (USU) alumnus was deployed to Iraq at the height of the Second Battle of Fallujah. What is significant about this alumnus, and frankly this event, is that Captain Matthew Welder deployed only 86 days after graduating from the Nurse Anesthesia Program. While the merit of sending a new graduate to war can be debated, CPT Welder met the requirements to deploy. He was physically fit, had successfully completed the nurse anesthesia program curriculum, and passed his certification exam. CPT Welder's experience in his first deployment was anything but ordinary. The 21st Forward Surgical Team (FST) cared for nearly 1,800 trauma patients in 180 days. In addition to the onslaught of casualties, each member of the FST was far from home managing the daily stressors of deployed life in an active combat zone on the fringes of a battlefield. While CPT Welder's experience in Fallujah was extraordinary, his tale is not unique; he was ill-prepared for the challenges he faced. If one assumes that healthcare in war differs from healthcare delivery in the United States, then we must wonder: what training "beyond" professional healthcare education is required to "ready" a healthcare team member for the unique experience of war?

This thesis will explore the concept of "readiness" of military healthcare providers. While the focus of this work will primarily analyze the gap in advanced practice nursing education, conceptually a great deal of this work could serve military medicine at large.

BACKGROUND

For nearly two decades, the U.S. military has been involved in global conflict. Through military campaigns like the Global War on Terror (GWOT), Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF) and the many succeeding Overseas Contingency Operations, the U.S. military has transitioned from the philosophy of land battles and conventional warfare to a philosophy that emphasizes counterinsurgency, counterterrorism, and unconventional war.

The unconventional nature of the current conflicts, and the evolution of modern warfare, have created a paradigm shift in the military. Large military land forces of wars have been replaced by expeditionary like forces that operate among indigenous civilian populations. Combat forces are strategically dispersed throughout the theatre of operations to provide security to civilians while gaining intimate access to intelligence sources.

The dispersed nature of this new battlefield is challenging the U.S. military to adopt new battlefield tactics in response to a highly dynamic battle space, and military healthcare leaders are transforming medical doctrine in response. Large, fixed hospital facilities are being replaced with highly mobile and austere medical platforms that serve farther forward with fewer resources to provide care to those in harm's way.¹

In parallel with this evolution in doctrine, the role of the military nurse continues to evolve. Military nurses now serve far forward with direct action forces, in civil affairs units and on elite mobile surgical teams.^{1,2} This transformation in roles is not just limited to Registered Nurses. Advanced Practice Registered Nurses (APRN) are deploying more often and in greater numbers than ever before. Many deployed APRNs immediately find

themselves assuming a greater scope of practice and facing demands not typically encountered in their peacetime positions.²

DESCRIPTION OF THE APRN ROLE

“APRN” is a title given to one of four advanced nursing specialties: Nurse Midwife, Clinical Nurse Specialist, Nurse Practitioner, and Nurse Anesthetist. APRN training is similar to that offered to medical students where didactic content is followed by clinical immersion. APRN education is transitioning to the practice doctorate; most commonly defined by the Doctor of Nursing Practice (DNP) degree. The DNP education is defined by a variety of stakeholders but is largely shaped by the DNP Essentials developed by The American Association of Colleges of Nursing (AACN). The DNP Essentials are eight terminal competencies required for APRN practice based on the influence of several Institute of Medicine reports. Although these standards were developed to meet the needs of the APRN practicing in the civilian setting they may not meet the needs of the military APRN serving in austere or operational settings.

The gap between civilian education and the clinical knowledge needed to function effectively in austere or operational military settings has been described in the nursing literature for many years. A recent international study identified a host of factors that were significant to nurses in the Iran-Iraq War in the 1980s.³ Some of the factors, including crisis management and orientation to the operational environment, remain relevant today.³ More recent studies conducted by U.S. coalition partners identify similar factors encountered by United Kingdom and Canadian nurses serving in Afghanistan. These authors noted that the nurse-patient relationship was different at war; that there were unique ethical considerations when nurses were working in wartime conditions, and

that nurses lacked familiarization and competency with nursing-specific skills not routinely taught in traditional healthcare education settings.⁴⁻⁷

Similar knowledge gaps between peacetime and wartime nursing practice has also been identified in studies conducted among American military nurses. U.S. military nurses felt ill-prepared for environmental conditions, weren't familiar with operational equipment, reported greater (sometimes frightening) levels of autonomy in practice, unique emotional stressors, unusual injuries/pathology, and a requirement to master some "military-specific" skills.^{4,8-10} Operational nursing and operational healthcare are unique and require the integration of civilian nursing science with a set of proficiencies that lie outside the civilian curriculum.

WHAT IS KNOWN ABOUT THE APRN AND OPERATIONAL READINESS

In 2006 Dargis and colleagues describe the Family Nurse Practitioner (FNP) role in a U.S. Army Combat Support Hospital (CSH) deployed to Iraq.¹¹ The authors describe a list of experiences that were unfamiliar to the NPs serving in this hospital. NPs reported feeling underprepared to care for the unique pathology of the civilian inhabitants, or for patients who required advanced trauma and emergency care. They were also uncomfortable with a variety of military-specific (soldier) skills.¹¹ Franklin, et al. (2008) echoed many of the observations noted by Dargis, reporting that Army FNPs were very diverse in their trauma competence and that FNPs needed Advanced Trauma Life Support (ATLS) before deploying.¹²

Lewis and colleagues expanded on Dargis' and Franklin's studies, noting that FNPs who were deployed experienced combat, served in a variety of military leadership roles, needed more trauma and advanced lifesaving experience (to include minor surgical

care), and when deployed were caring for more critically ill patients than they typically did in their stateside NP roles.² This sampling of work conducted by the NP community highlights the difference between the peacetime NP role (general wellness and primary care) and the operational NP role (primary care and urgent care along with a variety of administrative roles). It is clear from these studies that deployed military NPs need additional training to accomplish the leadership, military and clinical responsibilities expected of them in the deployed setting. While there is very little data describing other APRNs in operational settings, it is reasonable to believe that their operational roles vary from their peacetime missions.

THEORETICAL FRAMEWORKS

We know there is a gap between professional civilian healthcare requirements and those required of nurses and other healthcare specialties at war. Operational nursing readiness is described by Reineck-Huebner and colleagues as the integration of clinical nursing skills around a core set of knowledge, skills, and attributes (KSAs) oriented towards the operational context. These specific operational KSAs include operational competency (special clinical skills used in operational settings), survival skills (military unique to include weapons training) and physical/psychosocial/personal readiness, leadership and administrative support, and group integration and identification skills.¹³ Although these competencies are likely to be relevant to non-deployed military healthcare providers as well, little guidance as to how these competencies are relevant to operational APRN practice has been provided. The literature on what APRNs need to be successful in a deployed setting is insufficient to inform the development and

implementation of a curriculum that will adequately prepare APRNs for an operational deployment.

This thesis is predicated on the principles of curriculum design and focused on the central tenet of Ralph Tyler's theory of curriculum development – defining the contemporary challenges that face military advanced practice nurses and developing instruction to meet those needs. Tyler (1902-1994), often called the “father of educational evaluation and assessment,” started his career teaching high school in the 1920s.¹⁴ He went on to earn a PhD in 1927 and join the faculty at Ohio State where in 1933 he led the evaluation arm of the "Eight-Year Study" (1933–1941), a large national study sponsored by the Progressive Education Association that examined the effectiveness of the American high school curricula in over 30 secondary schools and 300 colleges and universities. Journalist Maxine Davis wrote a book on the failure of the American education system titled “The lost generation; a portrait of American youth today.”¹⁵ In 1949, Tyler published “The Tyler Rationale,” a systematic approach to curriculum development that emphasized the importance of creating relevant objectives when developing successful curricula. Although his approach has undergone substantial interpretation and revision over the last 70 years, Tyler's influence has been profound, influencing many educators, including the authors that developed a Six-Step approach to curriculum development in medical education. The Six-Step model is a modern interpretation of Tyler's work and is a leading paradigm in healthcare and medical education.

The Six-Step model, originally presented by Kern, is based on the assumptions that educational programs (1) have specific aims and goals, (2) that educators have

ethical obligations to meet the needs of their learners, (3) educators are responsible for the outcomes of their interventions, and (4) logical and systematic approaches to curriculum development will facilitate these ends (p. 5).¹⁶ Table 1 summarizes the model and provides a brief description of each phase of the model.

	Description
Step 1	<u>Problem Identification and General Needs Assessment:</u> - Clearly define problem that includes impact on four dimensions (patient, practitioner, educator, society). - Evaluation of current state provides a platform to envision the ideal state of education. The difference between the two constitutes a general needs assessment.
Step 2	<u>A Targeted Needs Assessment:</u> - Identify targeted learners and baseline proficiencies. - Determine unique environmental settings. - Engage stakeholders (focus groups, structured interviews).
Step 3	<u>Goals and Objectives:</u> - Goals and objectives oriented to serve the needs identified. Suggests learning methods. - Goals are broad (provides overall purpose of the curriculum). - Objectives are specific that can be measured.
Step 4	<u>Educational Strategies:</u> - Strategies are to be congruent between methods and objectives. - Multiple methods to retain/reinforce content.
Step 5	<u>Implementation:</u> - Identify resources. - Obtain support. - Administrative structure. - Anticipate barriers. - Introduce.
Step 6	<u>Evaluation and Feedback:</u> - Identify users/stakeholders. - Identify evaluation questions and designs. - Choose measurement methods/instruments. - Collect data. - Analyze data. - Report results, amend curriculum as needed.

Table 1. Six Step Model of Curriculum Design

The Six-Step model provides a logical framework to address the unknown requirements of APRN operational readiness by identifying authentic challenges that learner faces, and uses this information to develop appropriate objectives and learning strategies to overcome these challenges.

PURPOSE AND RESEARCH QUESTIONS

This thesis will explore a broad range of underdeveloped concepts that challenge military APRNs and other military healthcare providers in operational environments. In Chapter 2, we explore the concept of “readiness” as it applies to operational military preparedness. *Readiness* is a term commonly used in the military health system, yet there is no shared understanding of what the term means to military healthcare, or how it pertains to APRNs preparing to deploy. Next, in Chapter 3 we will explore military interprofessional healthcare teams (MIHTs) and challenge the notion that teamwork literature in the civilian sector may apply to the military. Finally, we sought to determine what underpins effective healthcare teams. This thesis will propose a model that may be used to describe healthcare team performance and provide a means to remediate and build teamwork (Chapter 4).

CHAPTER 2: Decoding Readiness: *Towards a Ready Military Healthcare Force*

D'Angelo, M. R., Seibert, D., Welder, M. D., Cervero, R. M., Durning, S. J. Decoding Readiness: Towards a Ready Military Healthcare Force. *Military Medicine*. pii: 5299195. doi: 10.1093/milmed/usy419.

ABSTRACT

Introduction:

Readiness is defined as “The ability of military forces to fight and meet the demands of assigned missions.” While readiness is a strategic priority for the Department of the Defense its meaning in the context of military healthcare is ambiguous. The question remains “how do we prepare military healthcare team members for war?” Undeniably, there is chasm between the peacetime mission of the military healthcare system and the war time requirements of a Ready Healthcare Force. Although healthcare providers that have deployed to the operational setting know that healthcare in peace and at war can be different it remains unclear how to truly prepare healthcare providers for this role.

Materials and Methods:

This manuscript will explore the concept of military readiness as it is used in official testimony and from a historical perspective. From these viewpoints, the authors will examine how “readiness” models are developed for combatant units and argue that these approaches are ill-fitting for the military healthcare system; combatant units are “readied” in settings that mirror real world threats - military healthcare “practices” in the resource rich environment of the modern U.S. healthcare system.

Results:

Through this analysis the authors will propose a working definition for a Ready Healthcare Force and present a conceptual model to examine military healthcare readiness incorporating professional practice with the unique requirements of providing care in the operational setting. The authors propose that future healthcare readiness efforts should look beyond traditional healthcare competencies and metrics (volume, diversity and acuity) and integrate a holistic lens that incorporates the experience of providing care in the operational setting.

Conclusions:

Operational readiness is a complex. The skills required for stateside healthcare, alone, are inadequate to truly meet operational demands. Readiness models for the combat forces are inadequate to prepare a ready healthcare force. The dueling mission of the military health system presents challenges that make it difficult to meet the demands of operational missions. Military healthcare leadership need to look to readiness models that integrate U.S quality healthcare with the unique operational, military and cognitive skills required to immediately and expertly provide care for those in harm's way.

INTRODUCTION

A strategic priority for Secretary of Defense Mattis' and the Department of Defense is to optimize military readiness to produce a "lethal" fighting force.¹⁷ As the country transitions from regional conflicts and refocuses to future threats some may wonder "what is military readiness and how do we ready healthcare forces for war?" Readiness is defined as "The ability of military forces to fight and meet the demands of assigned missions."¹⁸ Although military readiness has become a recent focus of intense discussion in the media, its definition within the Pentagon and Halls of Congress remains can differ.¹⁹

Readiness becomes particularly complex when one considers how to ready a *healthcare* force for war. A Ready Healthcare Force (RHF) emerges when the members of the military healthcare team are prepared to provide care in operational settings to include a combat zone. This manuscript will explore the concept of military readiness and examine how "readiness" is operationalized in both combatant units and the military healthcare system (MHS). Through this exploration the authors propose an operational definition for a RHF and a conceptual model to examine military healthcare readiness that incorporates professional practice with the unique requirements of providing care in the operational setting.

WHAT IS "READINESS"?

The lingering question of *readiness* is due, in no small part, to how the word is applied in a discussion and equally what is meant in its use. A recent report from the Congressional Research Service (CRS) highlights the use of the term "readiness" noting that government and policy leaders often use the same language to describe very different

concepts.¹⁹ For instance, in 2017 Lieutenant General (LTG) Anderson, U.S. Army, testified before Congress that “*Readiness* is the capability of our forces to conduct a full range of military operations...through manning, training and equipping our units and leader development.”¹⁹ In contrast, U.S. Air Force General Stephen Wilson testified before the House Arms Services Committee that “...current budget levels require the Air Force to continue making difficult tradeoffs between force structure, *readiness*, and modernization.”¹⁹ LTG Anderson’s use of “readiness” refers to the broad abilities of the total force (all aspects of the military) to achieve its missions, while General Wilson uses a more narrow interpretation and describes components of readiness. These two testimonies suggests that military readiness is more than a singular concept and their comments highlight that it may be composed of both strategic and operational elements. We therefore believe that military readiness is a combination of strategic and operational elements that often interact with one another

Dr. Richard Betts explored the notion of strategic and operational readiness over two decades ago following the collapse of the Soviet Union.^{20,21} According to Betts, strategic readiness applies to larger aspects of the military organizational infrastructure that includes components such as force structure (number of brigades, aircraft, etc.), strategic posture (war plan), force size (manpower), equipment, logistics and weapons systems.^{20,21} In contrast, operational readiness describes a discrete unit (or individual) level capabilities such as a team’s experience, the team’s morale or individual (U.S. service members) competency to perform tasks.^{20,21} The balance between these elements produces an effect on the overall readiness of the forces. Figure 1A depicts a balanced relationship between strategic and operational readiness. In this model, the “balance” is

dependent on the budget. In Figure 1A the model the *military* is neither strategically nor operationally readied to its maximum capacity. This relationship is consistent with the U.S. posture prior to entering the Second World War.²⁰ While the U.S. was able to rapidly increase operational readiness through inscription, the strategic readiness (industrial capabilities to build planes, tanks, weapons) was the rate limiting factor causing the delay of the European invasion.²⁰ Figures 1B and 1C demonstrate variations in strategic and operational readiness. Large investments in weapons systems (strategic readiness Figure 1B) may reduce available funding for unit level field exercises (operational readiness); while conversely, widespread field exercises may increase an individual's operational readiness (Figure 1C), but consumes supplies, weary soldiers, increase wear on equipment that ultimately may reduce a unit's ability to be "ready" and deploy (influencing strategic readiness).

READINESS AND COMBAT FORCES

In the ideal world, military force would be analogous to a fire alarm pull station where it is activated (pull) only in the case of an emergency. This was largely the case prior to September 11, 2001.²⁰ Generally speaking, U.S. forces over the past century have employed force in between long periods of inactivity. Combat readiness was maintained by models that have evolved over the decades to meet challenges and future threats that serve to maintain force preparedness during periods of peace.

An example of this is the 82nd Airborne Division and its mission "strategically deploy" within 18 hours' notice.²² Units like the 82nd are expected to rapidly respond to global threats despite long periods of inactivity. In a memo to the U.S. Army, Chief of Staff General Milley notes that readiness of highly successful combat units in Iraq was

“not developed quickly, it was built long before these units ever crossed the line of departure...” through training.²³ Combat forces of all services remain prepared through deliberate efforts to sustain strategic and operational readiness.

Unfortunately, the model for the 82nd Airborne Division, and similar combat units, may not prove to be reliable for the military health system and a Ready Healthcare Force. The 82nd, and the like, are also strategically readied through the guidance of the U.S. National Military Strategy (NMS). The NMS, issued by the Chairman of the Joint Chiefs of Staff, provides specific aims of the armed services and provides directives where combat units are operationally readied through coordinated training where their war time skills are rehearsed in settings that mirror real world threats. In contrast, military healthcare “practices” in the environment of the modern U.S. healthcare system. The business of combat forces lies in the context of the battlefield; yet, the business of modern healthcare lies in a resource-rich peacetime practice. The chasm between war and peacetime healthcare is great. Therefore, a RHF requires a deliberate strategy to develop necessary requirements for the operational mission of the military healthcare team and do so while managing the tension of its dueling roles.

TENSION: THE DUELING ROLES OF THE MILITARY HEALTH SYSTEM

The notion of a RHF is a new concept and demonstrates the recognition and ever increasing value of healthcare in support of the war fighting mission. Unfortunately, despite nearly two decades of impressive medical results on the battlefield, the military healthcare system struggles to clearly define a “Ready Healthcare Force”. Ideally, a RHF integrates healthcare expertise with the skills required to meet the demands of both the peacetime and war mission of the MHS. In the peacetime MHS model, patients receive

non-urgent care in the community and are referred to specialty, emergency and surgical care at tertiary care medical facilities. Healthcare is provided in *brick and mortar* facilities to service members, dependents, and retirees. The in-garrison healthcare team is composed of both uniformed and civilian professionals.

Aspects of the wartime healthcare mission are different. The team may care for a foreign population with different medical needs than what is experienced at home. Team members may be required to employ trauma skills that are often not required for stateside practice. Unlike the peacetime setting, the healthcare team will only be uniformed personnel that may not be organically from a single unit and may be formed *ad hoc* with little to no prior experience working as a team. Along with these differences, the healthcare team may be required to perform in austere and unfamiliar settings that are different from home; functioning with limited resources and with teams that vary in personnel and configuration.

The chasm between the peacetime mission of the military healthcare system and the war time requirements of a RHF is clear. The peacetime mission of the MHS resembles the resource-rich civilian medical system. The operational mission may be in stark contrast where the healthcare team must function in austere settings with significant reduction in resources. In the absence of mass violence or austerity of resources, the MHS is challenged to provide authentic readiness experiences for its healthcare teams. The management of an isolated ankle fracture is considerably different than the management of a traumatic amputated limb caused by an Improvised Explosive Device (IED). The medical management of battlefield injuries is not the only difference: an IED blast injury would be cared for in a war zone, where resources are scarce, and assistance

may be limited, evacuation assets in question and where military healthcare providers are serving far from home and managing the personal stressors of a deployment.

There is little debate that the injuries, the context, the resources and the stressors experienced by those who care for the wounded in the battlefield are largely different from what is experienced at home. For these reasons healthcare practice within the clinic or MTF, alone, is only one aspect of readiness. Although an essential component, clinical practice is only one piece of the knowledge, skills and attitudes required to perform in an operational setting. *Additional* preparation is what separates the civilian healthcare industry from military medicine and a Ready Healthcare Force.

TOWARDS A DEFINITION OF A READY HEALTHCARE FORCE

While it is clear that MTF practice may differ from operational the question remains “what is a Ready Healthcare Force.” Fred Barnard is credited with the phrase “*A picture is worth a thousand words*”. A picture of war is probably worth many, many more words. A simple image search on the internet provides color and black and white images of healthcare providers caring for patients and the wounded. While the images display care they show more than procedures or skills. Some images are taken in tents, others show providers giving care in body armor. What is clear from these images is that they are not taken at *home*. Undeniably, operational healthcare is much more than *medical skills* in a tent, and involves the integration of an experience; an experience that involves the unknowns of a battlefield. A RHF therefore, must possess the professional healthcare skills tacit to the successful care of a patient in addition to the cognitive development to function within complex environments and to perform in operational settings.

Preparation for unknowns on the battlefield has become a topic of recent interest. Military Cognitive Readiness (MCR) is an emerging construct that has been developing over the past two decades. While MCR suffers from a lack of a generalized definition Grier summarizes its characteristics as: the mental preparation and the cognitive ability to adapt and sustain performance in complex, unpredictable environments with rapidly shifting threats.²⁴ While definitions vary by author, MCR can be distilled into two very distinct points: (1) stress reduces cognitive performance and (2) cognitive performance under stress can be improved through training. It is clear that both of these distinctions has a role in the readiness of a military healthcare provider as they prepare for the complex operational environment.

DEFINING A READY HEALTHCARE FORCE

Figure 2 adds to work previously described by Bolstad and colleagues²⁵ and incorporates Betts' definitions of strategic and operational readiness. This illustration identifies a variety of inputs that likely influence the individual provider and the operational healthcare team. In this figure, the individual "provider" delivers professional skills that contributes to teamwork and ultimately casualty care. Alterations to the environment, the individual, the team, and/or the organization has the potential to influence (positive or negative) patient care and outcomes. Based on Figure 2 the operational readiness of a healthcare provider involves the continued mastery of their profession, the acquisition of healthcare skills unique to the operational healthcare environment (specialized equipment, healthcare platforms, special procedures, etc.), the military skills to appropriately function in a battlefield, and the cognitive readiness to successfully function in the complex and often unpredictable operational environment.

Grounded in the interactions described in Figure 2, the role of healthcare forces in operational settings, and the influence of MCR, we define operational readiness of a healthcare force: *as the professional, cognitive, environmental, and operational development that an individual requires to work within military healthcare teams to sustain competent performance in both complex and unpredictable military operational settings*. On the basis of this definition, we propose that healthcare readiness is the integration of professional healthcare skills with the cognitive preparedness to meet the psychological, social and environmental challenges of the battlefield.

If this thought process is carried further then readying a medical force involves the development of individuals and, ultimately teams, to maintain (1) individual professional skills (medicine, nursing, medic), (2) develop specific skills for operational healthcare practice (i.e. outside of the MTF, familiarization with specialized field equipment), (3) acquire military based competencies (*survival skills*) to successfully function in an operational environment, and (4) develop individual and team based cognitive readiness skills to perform optimally in complex battlefield environments.

A WAY FORWARD TO BUILDING A READY HEALTHCARE FORCE

The task ahead presents many challenges yet, assuming that a RHF is more than the U.S. healthcare system superimposed in the operational setting then the preparation of such a ready force is not only a necessity but an ethical obligation to both the combatants and to the healthcare providers. A RHF must be developed using Betts' dual lenses of strategic and operational readiness and address Betts' three questions: (1) who and where is the enemy? (2) Will there be time to train forces (delayed) or will they be expected to respond immediately? And (3) Who is needed and what will they be expected to do?²¹

At their core, Betts' three questions are matters of strategy and reliant on a clear definition of the mission.²¹

The real work of healthcare readiness lies ahead of us. The model for readying combatants differs for a RHF. The infantry, for instance, train in combat-like conditions while military healthcare primarily trains in the MTF. Although professional competencies are essential, the focus needs to include a holistic view and integrate operational healthcare skills, military “soldier centric” skills and cognitive development.

In this manuscript we propose a working definition for operationally RHF, and provide a conceptual model that describes the influences that may modulate individual and team performance. The long standing notion that a healthcare provider is “ready” by the credentials after their name is only one part of the solution. While the Defense Health Agency (DHA), the Uniformed Services University and the individual services have begun to explore the individual and team requirements needed to perform in the operational setting it is imperative to recognize that this is only one component of readiness. The ability to perform a procedure or practice with limited resources, in a combat zone, managing complex situations, far from home, is very different than task competency.

Once developed, measuring the effectiveness of operational readiness training will be crucial to ensure the “readiness product” successfully meets the needs of the customer. There are lessons to be learned. In 1999 Stillion examined the effects of flight time and air to air combat skills for pilots. Surprisingly, the study demonstrated that flight time did not correlate with pilot missile launch accuracy. In other words, flight time (input) did not accurately predict pilot readiness to hit targets.^{21,26} Stillion's work

may have lessons for the MHS and how case counts and clinical hours are used to certify readiness. It could be a misstep to assume surrogate experiences (surgery/patient care) and clinical hours reflects operational healthcare readiness. Only through a thorough examination of the operational healthcare experience can we understand healthcare readiness and devise a readiness strategy that meets the needs of the “provider” and the demands of the customer.

CONCLUSION

Undeniably, the dual mission of the MHS challenges healthcare leaders to provide modern, world-class care in garrison while preparing its uniformed corps for the great unknown of future wars. Military healthcare readiness should not be viewed as civilian healthcare “wrapped in camouflage”. Rather, military healthcare readiness should be viewed as unique to the civilian model. Reflecting on Betts’ work, the battlefield and emerging threats should shape the strategic readiness of modern military healthcare and provide guidance to operationally ready the military healthcare team. Provider readiness can only understood in the context of the greater battle strategy. Only through this lens can differentiations between military medicine and civilian healthcare be understood.

Healthcare in peace and at war is very different. A ready healthcare provider must embody the expert skills of their profession along with the ability to successfully perform these skills in the operational environment. In addition to the tacit skills of providing care, the military healthcare provider must have the military centric skills to safely function in a combat zone while developing the cognitive readiness to maintain performance in stressful and unexpected environments.

The U.S. military has produced the lowest combat mortality in modern history. It is incontrovertible that with nearly two decades of sustained warfare “something” worked. Despite this achievement, the military healthcare cannot rest on its accomplishments. No, the complexities of the modern battlefield, coupled with emerging and future threats demonstrates that a RHF must be prepared to fight and support the demands of future missions. The challenge now for military healthcare leadership is to embrace the practice differences in peace and at war and interpret national strategy to ensure that RHF’s are strategically oriented and operationally readied to continue to successfully care for those in harm’s way.

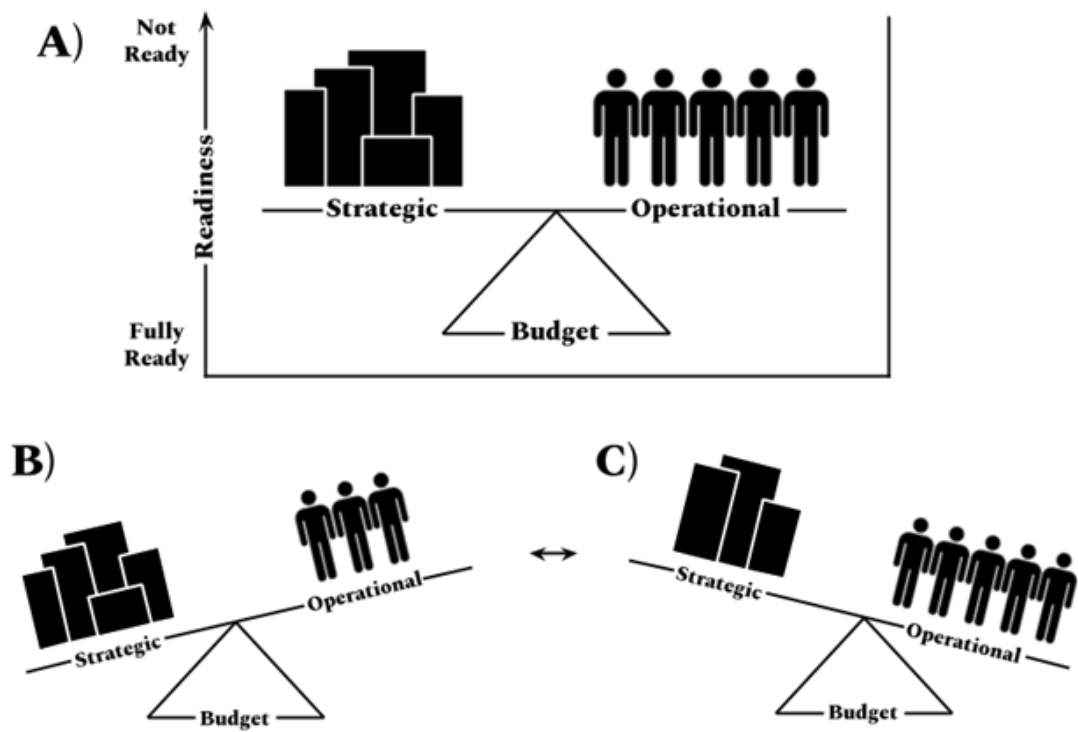


Figure 1. The continuum of Strategic and Operational Readiness

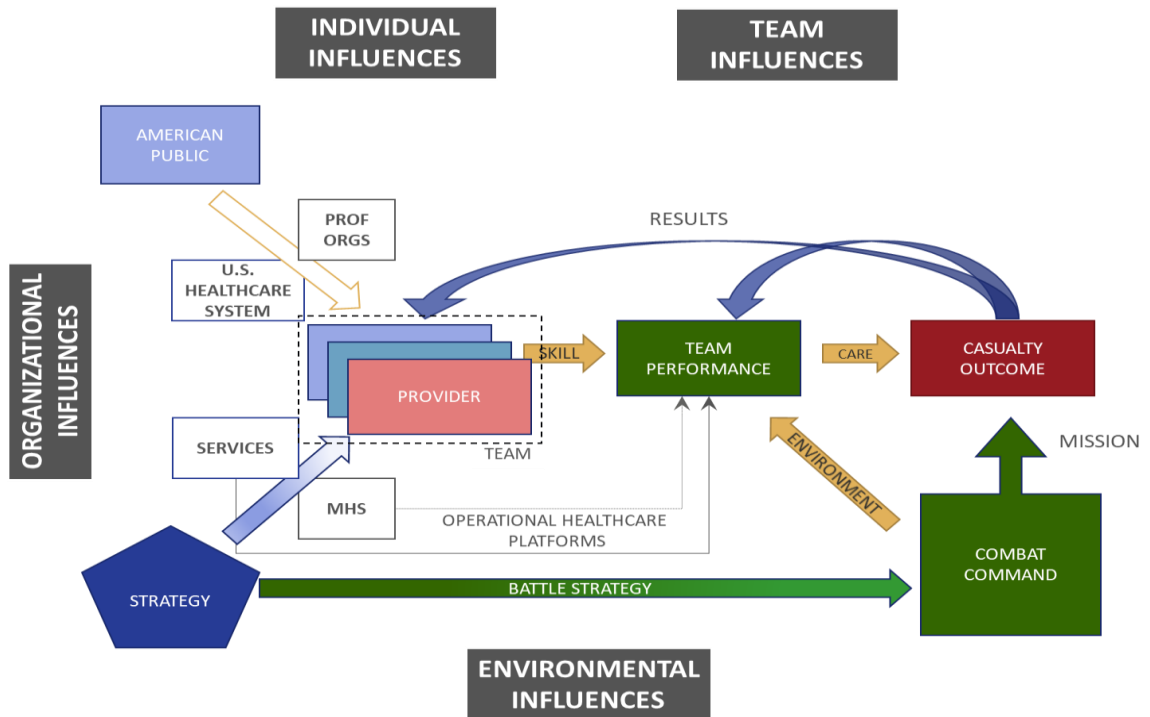


Figure 2. Influences to a ready medical provider

CHAPTER 3: Military Interprofessional Healthcare Teams

D'Angelo, M. R., Saperstein, A. K., Seibert, D. C., Durning, S. J., Varpio, L. Military Interprofessional Health Care Teams: How USU is Working to Harness the Power of Collaboration. *MilMed*. 2016 Nov;181(11):1404-1406. doi: 10.7205/MILMED-D-15-00558.

ABSTRACT

Despite efforts to increase patient safety, hundreds of thousands of lives are lost each year to preventable health care errors. The Institute of Medicine and other organizations have recommended that facilitating effective interprofessional health care team work can help address this problem. While the concept of interprofessional health care teams is known, understanding and organizing effective team performance have proven to be elusive goals. Although considerable research has been conducted in the civilian sector, scholars have yet to extend research to the military context. Indeed, delivering the highest caliber of healthcare to our service men and women is vitally important. This commentary describes a new initiative as the Uniformed Services University of the Health Sciences aimed at researching the characteristics of successful military interprofessional teams and why those characteristics are important. It also describes the interprofessional education initiative that Uniformed Services University is launching to help optimize U.S. military health care.

BODY OF THE TEXT

In 2000, the Institute of Medicine (IOM) warned that “healthcare in the United States is not as safe as it should be”.²⁷ More recently, in their 2015 report, the IOM again identified an alarming prevalence of errors in American healthcare. In the 2015 report, the IOM highlights how diagnostic errors account for delays in treatment and directly impact patient morbidity and mortality.²⁸ Problematically, despite a bevy of medical procedural advances, diagnostic and therapeutic developments, and groundbreaking healthcare technologies over the 15 years that separate these reports, scholars have estimated that over 440,000 lives continue to be lost each year to preventable healthcare errors.²⁹

Among the recommendations made in 2000, the IOM called for establishing “interdisciplinary team training programs.” (Recommendation 8.1).²⁷ In 2015, the IOM again makes several recommendations, the first of these being to “facilitate more effective teamwork” among the interprofessional healthcare team, including patients and their families.²⁸ Clearly, the IOM sees value in healthcare delivered by interprofessional teams. This is not a new idea. Introduced in the 1972 IOM report *“Educating the Healthcare Team,”*³⁰ interprofessional healthcare teams and teamwork have been studied for over 40 years, both in the US (Interprofessional Education Collaborative Expert Panel, 2011) and internationally (WHO, 2010). Recent research has reported numerous benefits of interprofessional healthcare teams, including: improved patient care^{31,32}; greater patient safety³³; more streamlined and cost effective patient care³⁴, reduced visits and hospitalization rates³⁵, lower staff absenteeism and turnover³⁶, and more effective use of resources and greater patient satisfaction³⁷. But, not all interprofessional

collaboration efforts have been associated with such benefits. For instance, some research describes the relative failure of healthcare teams to work effectively as cohesive, integrated units.³² Specifically, non-technical systems failures and team member miscommunication have been cited as diminishing the effectiveness of interprofessional healthcare teams.^{38,39}

These contrasting findings highlight that establishing and organizing effective healthcare teams can be difficult. Among the challenges of implementing effective interprofessional care teams are two foundational problems: (1) there are many definitions of “healthcare teams” described in the literature making comparisons across “teams” difficult to make, and (2) the best-practices for interprofessional healthcare teams in one setting are not necessarily transferable to others.³⁹ Given these 2 challenges, the benefits that have been associated with interprofessional collaboration might be context specific (e.g., advantages reported from research conducted in surgical settings may not be transferable to out-patient settings; the value added from interventions in the UK may not be realized in the US⁴⁰; the benefits reaped in civilian settings may not transfer to military settings). Set in this landscape, the IOM’s recommendation to “facilitate more effective teamwork” may be difficult to enact.

If the military healthcare system is interested in harnessing the power of interprofessional care teams, we believe it must first address the following foundational questions:

What is an interprofessional team in *the military* healthcare context?

What is effective interprofessional teamwork in *the military healthcare* settings?

How can an interprofessional team improve care in *the military healthcare* clinical context?

While considerable research has been conducted in civilian settings, research has yet to investigate these questions in the military healthcare setting. While the military can draw inspiration and guidance from civilian models, the Military Health System (MHS) is arguably significantly and importantly different from civilian healthcare system. In contrast to their civilian counterparts, military healthcare providers care for a very wide range of patients in an equally wide range of locations: from retired veterans of campaigns long finished to troops currently deployed; from military service members to local civilians in war-torn regions; from combat missions to humanitarian aid missions; and from field aid stations to technologically advanced hospitals in the United States. In addition, practicing interprofessional healthcare in the MHS requires team members to navigate the expectations of rank and branch of service; to excel when “parachuted” into a team for mission-related reasons but without consideration with how that person will “fit” with the team’s current configuration; all while coping with the emotional stress that may result from prolonged family separation and/or operating in combat zones.

Given these considerations, we suggest that research conducted in civilian settings may be only partially relevant to the military contexts. Consequently, we believe the military should define its own vision of interprofessional healthcare teams—one that seeks to advance population health, ensure readiness, improve the experience of care, and maximizes returns on care dollars, all within the unique context of the MHS.

To address this need, the Uniformed Services University (USU) is pioneering an interprofessional education (IPE) program of research and curriculum development for future military healthcare leaders. The IPE initiative will begin this research by defining the qualities of effective military interprofessional healthcare teams. Specifically, this research asks: (1) what are the characteristics of successful military interprofessional healthcare teams, and (2) why are these characteristics important to success. By analyzing the perspectives of a wide range of stakeholders (e.g., from military line leaders and senior clinicians who have deployment experience, to the military service men and women and their families who receive care from military care teams), we will construct a multi-faceted description of the characteristics of successful military teams and an understanding of *why* these characteristics are important in different military contexts. These findings may then be used to inform USU's IPE curriculum.

USU's IPE initiative is a deliberate attempt to prepare our students to successfully perform together in military contexts and so to be better prepared to "care for those in harm's way". Medical students, graduate nursing students, graduate students and dental residents will participate in scheduled IPE learning activities where trainees will learn with, from and about one another.⁴¹ Learners will participate as members of interprofessional teams, exploring complex issues, such as death, pain and chronic disease with those from other professions via discussions, role-play activities, and collaboratively analyzing and finding solutions to challenging dilemmas. For the vast majority of these learners, the IPE experience will culminate with the Operation Bushmaster field exercise. In this four-day exercise, learners engage as members of interprofessional care teams while simultaneously serving in a variety of healthcare

leadership and military leadership roles. Indeed, through the full array of IPE initiatives planned for trainees, USU graduates will have the opportunity to hone the skills required to successfully perform as a member of military interprofessional healthcare teams. All of these learning activities and topics will be informed by the findings from the research into the characteristics of successful military healthcare teams, thus making this IPE initiative truly military-centric.

To take on the challenge of “facilitating more effective teamwork”, USU is embarking on an important mission to better prepare our trainees for the demands of military interprofessional healthcare teamwork. Our service of men and women deserve the best healthcare available. We believe that USU’s IPE initiatives will strengthen the Department of Defense’s call to deliver the highest caliber of care to the populations we have the honor to serve.

CHAPTER 4: The Teamwork Model: Proposing a Model for Studying Interprofessional Healthcare Teams

D'Angelo, M. R., Cervero, R. M., Durning, S. J., Varpio, L. The Teamwork Model: Proposing a Model for Studying Interprofessional Healthcare Teams. *MedEdPublish*. Accepted.

ABSTRACT

Patient safety is a preeminent healthcare concern in modern medicine. In the years since *To Err is Human*, researchers have found that the number of preventable deaths far exceeds 98,000; more accurately, 400,000 patients die each year from preventable healthcare errors. To combat the evolving patient safety crisis, a variety of organizations from Institute of Medicine to World Health Organization have called for the development of interprofessional healthcare teams. Interprofessional healthcare teams and teamwork have been a topic of discussion for over 40 years. And while some Interprofessional healthcare teams have been shown to be beneficial in some settings the success of these teams is not universal nor achieved in all healthcare settings. In short, research has found that interprofessional healthcare teams both improve and impede patient care. Building on this contradictions of interprofessional healthcare teams and teamwork, we present a model for the conceptualization of teamwork that could be readily applied to clinical experiences. This model is informed by the interprofessional healthcare team literature and relevant theories, and we believe will enable us to examine authentic interprofessional healthcare team interactions and identify moments when team interactions were breaking down, and reasons why those breakdowns were happening.

TEAMWORK FAILURE: A CASE SCENARIO

A 33-year-old male patient was admitted to a major medical center for open femur fracture following a ten foot fall off a ladder. Although the patient's previous medical history was unremarkable, the repair of the fracture was complicated by an acute vascular injury that required resuscitation following severe blood loss. The primary members of the perioperative team included an attending surgeon, a senior surgical resident, an operating room nurse, a nurse anesthetist, an anesthesiologist, and a surgical technician. On this particular day the attending surgeon was running late and the team attempted to expedite the induction of anesthesia to reduce the delay and ensure the room closed on time to reduce staff overages. The patient was "fast tracked" through the preoperative holding area and taken to the room before the attending surgeon arrived. The timeout was performed after induction by the operating room nurse. Unbeknownst to the operating room nurse the patient name and medical record number was incorrect and the name of another patient. This old label had been erroneously placed on the patient chart, an oversight that no other members of the team noticed or cross checked. The patient information on this old label was incorrect information for the patient on the operating table. Not only was the patient's name incorrect, but so was his blood type. Tragically, the otherwise healthy patient unexpectedly died postoperatively due to an acute hemolytic transfusion reaction from the administration of ABO incompatible blood. According to the post mortem root cause analysis, all members of the interprofessional healthcare team (that included physicians, nurses and technologists) were professionally competent employees of the medical center, had worked together, and had been long standing members of the organization. Despite the

individual competence of the team members, and the familiarity of the team to one another, it was determined that failed teamwork played a central and critical role in the patient's death.

INTRODUCTION

Unfortunately, adverse patient events such as the one described in this scenario happen all too often in healthcare settings. Understandably, then, patient safety has become a preeminent healthcare concern in modern medicine. This heightened awareness is also due, in no small part, to the Institute of Medicine's (IOM) 1999 landmark report *To Err is Human: Building a Safer Health System*. The *To Err is Human* report highlighted that more than 98,000 patient in the United States died each year as a direct result of preventable healthcare errors.⁴² While the report elevated the patient safety conversation to a national level and created a "call to arms" by patients, advocates and the healthcare industry, the report has been critiqued as grossly underrepresenting the true scope of this public health epidemic.⁴³ Arguably, *To Err is Human* merely shone a light on the proverbial "tip of the iceberg." The findings in the report represent merely a quarter of the actual preventable patient deaths at the hands of the U.S. healthcare system.⁴³ In the years since *To Err is Human*, researchers have found that the actual number of preventable deaths is far greater than 98,000; instead, more accurate estimates report that over 400,000 patients die each year from preventable healthcare errors.⁴³ Although organizations and the healthcare industry at large have made significant strides to improve patient safety through organizational changes like procedural time outs⁴⁴ and automated safety checks aimed to reduce iatrogenic morbidity and mortality,⁴⁵ the healthcare system continues to grapple with patient safety problems.

The public and healthcare industry were recently reminded of this by the IOM's 2015 report *Improving diagnosis in health care*. In this report the IOM asserts that missed and delayed diagnoses account for delays in treatment and directly impact patient morbidity and mortality.⁴⁶ Indeed, a recent BMJ article estimates that medical errors is the third most common cause of death in the United States.⁴⁷ Unfortunately, despite nearly two decades of awareness, and deliberate actions directed towards improving patient safety, data demonstrate that human factors continue to be a significant cause of preventable healthcare errors and a tragic loss of life.⁴⁸

To combat the evolving patient safety crisis, a variety of organizations from Institute of Medicine (IOM) to World Health Organization (WHO) have called for the development of interprofessional healthcare teams (IHT).^{42,46,49,50} IHT and teamwork have been studied for over four decades, both in the US⁵¹ and internationally.⁵⁰ And while IHTs have been shown to improve patient care^{52,53}, improve patient safety⁵⁰, reduce cost³⁴, reduced visits and hospitalization rates³⁵, lower staff absenteeism and turnover³⁶, and prove to be a more effectively use resources and improve patient satisfaction⁵⁴, these benefits are not universal and are not achieved among all IHTs and in all healthcare settings.⁵³ In fact, IHT failures from non-technological sources like decision-making, cooperation, problem solving and team member miscommunication have been reported as major barriers to the effectiveness of IHTs.^{38,39,55} Indeed, research into physicians' and patients' views of errors reports that the failure of health professionals to work together or communicate as a team is the third most important cause of preventable medical errors.⁵⁶

The effectiveness, or utility, of IHTs is a subject of ongoing and intense study for

healthcare organizations, scholars and clinicians. With more than 15 definitions of a “team” described in the context of healthcare, attempts to understand, model, and develop IHTs is a challenge.³⁹ This complexity is compounded further when we take into consideration that the criteria for determining the evaluation of team “effectiveness” are highly context dependent. In other words, the best-practices for in one setting are not necessarily transferable to others (e.g., advantages reported from research conducted in surgical settings may not be transferable to out-patient settings; the value added from interventions in the UK may not be realized in the US ⁵¹.

Due to the ambiguity surrounding the definition of the IHT and the lack of specificity on how to define an “effective” IHT, scholars regularly return to foundational questions about the causes that contributed to the medical error. For instance, in considering the scenario described at the beginning of this manuscript, we might ask: How is it that an incorrect blood product was dispensed from the blood bank by a trained technician, traveled to the operating room by a trained staff member, and was checked and verified for correctness by two team members (as is the process in this clinical context)? How could this blood product traverse multiple layers of safety checks to be deemed “safe” and administer to a vulnerable patient? Are the professionals in this scenario truly a “team” or are they in actually a loosely affiliated group of individuals connected by geography and a shared patient? How can a group of competent individual care providers fail to achieve collective competence as a team?⁵⁷

In this manuscript, we synthesize the literature on IHTs that addresses these foundational questions and we propose a model for conceptualizing teamwork. Specifically, relying on a recent literature, we (i) review the foundational definition of the

word “team”, (ii) examine the essential characteristics of successful IHT, (iii) describe a theoretical model that operationalizes the description of a team and characteristics of successful IHT, (iv) describe the theoretical underpinnings of the model, and (v) describe how the model can be operationalized to analyze and understand team performances.

DEFINITION OF TEAM

What is a team? *Teams* and *teamwork* are vaguely described in the literature and encompass a wide variety of meanings. Etymologically, the word *team* arises from Germanic languages and refers to a group of animals yoked together to collectively pull a carriage, move equipment or soil, etc.⁵⁸ The yoke served as a harness that was constructed from wood and rested upon an animal’s shoulders enabling multiple animals to pull or work together cooperatively towards a desired goal. From this description, a “team” can be defined as two or more individuals who work cooperatively through a framework to successfully complete a task. The components of the “basic team,” then, are (1) multiple individuals, (2) who work interdependently, (3) through a framework that supports collaboration, towards the (4) achievement of a shared goal. While these four components may appear straightforward, they are the foundation for successful teams and, when not aligned, is often a reason for unsuccessful, and failed team collaboration.

ESSENTIAL CHARACTERISTICS OF A TEAM

Mapping the characteristics of effective IHTs is an important but elusive goal for researchers and academics who study teams. In reviewing the healthcare literature, it is clear that many authors have attempted to describe the essential characteristics of a successful IHT. And while this effort has increased the understanding of IHTs, definitive accounts of the characteristics of successful teams remains tenuous.⁵⁹ Scores of authors

have identified a range of characteristics for IHTs. While characteristics differ across contexts studied, researchers commonly acknowledge a core set of qualitatively similar characteristics of effective IHTs. These characteristics are: common goals, effective communication, and respect among team members.^{50,60-63}

Over the last two decades, research suggests that teamwork can be defined by interrelated knowledge, skills, and attitudes (KSAs).⁶⁴⁻⁶⁷ Through extensive work within the healthcare domain⁶⁷⁻⁷² researchers have identified eight competencies that are present in successful IHTs. These eight competencies incorporate the three characteristics of successful teams and expands upon them. Further, teams that have these KSAs have been shown to outperform teams that did not have the KSA's.^{67,73-76} Salas, et al. (2004) define these KSAs as: (1) Leadership^{64,67,77}, (2) Backup Behavior⁷⁸, (3) Mutual Performance Monitoring⁷⁹, (4) Communication⁷⁹, (5) Adaptability^{64,67}, (6) Shared Mental Models⁸⁰, (7) Mutual Trust⁶⁷, and (8) Team Orientation.^{67,81} Table 1 presents a summary of these essential characteristics.

THE TEAMWORK MODEL

The eight KSAs identified above provide important insights into the characteristics of a successful IHT. One could argue, however, that this list is incomplete. While these eight KSA's describe important team characteristics, they do not consider the individual team members ability to perform effectively. These team-level characteristics assumes that individual team members are capable of functioning within the team. These KSAs fail to account for the clinical competence, emotional wellness, and physical ability of the individual team member.⁸² This is a significant omission since there is substantial focus in the literature investigating the individual's competence to

perform a skills or demonstrate knowledge.^{57,83,84} In this literature, a team member's professional competence is viewed, at least in part, as an important contributing factor to his/her ability to perform as a team member.⁸⁴ In other words, a key knowledge, skill and attitude consideration for IHT performance must ask: Does the team member have the requisite skills to perform with the team? Proxy measures like professional licensure can, and often does, serve as indicators of individual competence or ability. Unfortunately, while such proxy measures may demonstrate professional clinical competency, an individual team member's emotional wellness and or physical ability is often overlooked as a contributor to team performance. A clinically competent, yet emotionally distraught or physically injured team member could be a liability and reduce the efficacy of an IHT.

Therefore, we propose that the eight-part KSA model for successful IHT should be augmented with an additional KSA. A ninth KSA, individual competency, should be added to the list of successful team characteristics and should account for (1) the clinical skill that the individual brings to the team, (2) the emotional state that the individual brings to the setting and (3) the individual's physical ability that is brought to a task.

Based on these nine KSAs, we have developed the *Teamwork Model*. The *Teamwork Model* organizes the previously identified essential team characteristics (KSA's) and integrated individual competencies. We propose that successful teamwork is a result of four interdependent domains that contain the nine KSA's (see Figure 1 for an illustration of the *Teamwork Model*). The interdependent domains are: (1) Organizational Structure, (2) Individual Competence, (3) Team Performance Skills, and (4) Individual Interactions. The *Teamwork Model* can be visualized as four Venn diagram circles. Each circle represents an individual domain, which each domain

including a sub-set of the nine KSA's associated with successful IHT performance. Table 2 lists the organization of the *Teamwork Model* and subdivision of the KSA's within each domain. The four interdependent domains of the *Teamwork Model* are as follows:

1. The Organizational Structure Domain is purposefully located at the base of the diagram. We propose that a successful team must be grounded with a clear charter (or defined purpose), roles, leadership, goals, standards, rewards and penalties. The larger organization within which the team is housed (e.g., hospital, government, health professions accrediting body) is responsible to define, appoint membership/roles, and empower the members of the team so they may be positioned to be successful.

2. The Individual Competence Domain encompasses the responsibilities of the individual team member and includes the individual's clinical, emotional, and physical competence to serve on the team. It is the individual's responsibility to maintain this competence. While Individual Competence is a duty of the member, the Organization has the responsibility to regulate individual team membership and is entrusted with the authority to measure or ensure fitness for those who serve on the team.

3. The Team Performance Domain encompasses the team-level considerations including the team's collective ability to adapt to changing environments, monitor team performance, and provide backup to team members when they fail to meet expectations. The team and the individual team members are collectively responsible for this domain. These KSA's are acquired through socialization and practice with one another.

4. The Individual Interaction Domain relates to an individual's interaction with the team. The team member must learn to trust other members, be able to communicate with other members of the team, and develop a collective orientation to the team where the goals of the team outweigh the goals of the individual.

THEORETICAL UNDERPINNINGS OF THE TEAMWORK MODEL

The *Teamwork Model* relies on and is congruent with two theoretical frameworks that have been previously used to investigate IHTs. They are: Lingard's conception of Collective Competence and Engestrom's Cultural Historical Activity Theory.

Collective Competence

The concept of collective competence "reflects growing attention in the social and organizational spheres to healthcare's nature as a complex system."⁸⁵ It broadens the concept of competence that has traditionally held an individualist orientation, to include a collective participation orientation. Thus, in terms of IHT, collective competence highlights how healthcare teams are deeply interconnected, so much so that "a change or weakness in one part of the system affects both other parts and the performance of the whole."⁸⁵

Activity Theory:

The *Teamwork Model* is also conceptually grounded in the philosophical perspective of Cultural-Historical Activity Theory (CHAT) since it considers IHT's KSA through the complex goal directed social encounters of a team. CHAT was conceptualized by the Finnish educational researcher Yrjo Engestrom and is based on the foundation of Lev Vygotsky and Aleksei Leont'ev Activity Theory⁸⁶⁻⁸⁸. According to

Activity Theory (AT), humans interact with the environment through the use of “tools”. Activity theorists’ argue that individuals and groups use tools to influence reality.

Engestrom’s CHAT builds upon the theoretical foundations of AT and provides a succinct visualization of the interactions between the team member (i.e., subject) and the complex environment in which they will be required to work. Figure 2 represents Engestrom’s model of the activity system as incorporating the four domains of the *Teamwork Model*. As Figure 3 illustrates, the *Teamwork Model*’s four interdependent domains are aligned with Engestrom’s CHAT. The CHAT “subject” is the *Teamwork Model*’s individual team member, including the Individual Competency and Individual Interaction domains. The “community” element of Engestrom’s model represents the team itself and aligns with the *Teamwork Model*’s Performance Behaviors domain. The *Teamwork Model*’s Organizational Structure domain encompasses AT “rules”, “division of labor” and “objects”.

USING THE TEAMWORK MODEL TO ANALYZE TEAM PERFORMANCES

We propose that the *Teamwork Model* can be used to support the analysis of team performance to identify strengths and weaknesses. It is important to note that IHTs can function effectively without all domains being fully incorporated and without all KSAs being fully realized; however, teams that work outside the domains and KSAs described in the *Teamwork Model* may suffer from “near misses” in patient safety, delays in function or other characteristics of a poorly functioning team.

The *Teamwork Model* presumes that interdependent domains of KSA’s are required of an effective IHT. Through the *Teamwork Model*, we propose that when the domains of KSAs are coordinated and work interdependently, teams will function more

successfully and effectively. Furthermore, we acknowledge that it is important to consider teams in the context of their work domains. While we propose that successful IHTs will share similarities across a wide range of contexts, the component elements of the *Teamwork Model* will likely need to be weighted differently in different contexts.

We suggest that the *Teamwork Model* provides a means for assessing team characteristics and team performances. Using the *Teamwork Model*, we identify four (4) kinds of problematic team dynamics that may be produced when one of the model's interdependent domains is not present. Figure 4 illustrates where these four problematic team dynamics fall in the *Teamwork Model*.

The Blind Team is a group of affiliated individuals that lacks characteristics (KSA's) from the Team Performance Domain. Specifically, a Blind Team is one that is unable or poorly adapts to changes in their environment. This group does not monitor its performance or provide backup behaviors. While members of this group are individually competent, demonstrate good individual interactions, and follow the organizational mandates, they focus their attention to individual tasks and are not an integrated team.

The Pseudo Team is a group of affiliated individuals that lacks characteristics (KSA's) from the Individual Interaction Domain. This group may be high functioning, operate within the organizational structure, but it lacks trust, inter-team member communication, and a collective orientation to the objective.

Members of this group may be unable to delegate, work well with each other, or may put individual goals or motives above other members or the goals.

The Rogue Team is a group of affiliated individuals that lacks characteristics (KSA's) from the Organizational Structure Domain. Like the Pseudo Team, members of this group may be high functioning but operate outside or above the organization. This group lacks oversight, may fail to follow up, and can work outside of the standards and rules.

The Incompetent Team is a group of affiliated individuals that lacks characteristics (KSA's) from the Individual Competence Domain. These groups likely struggle to function and to meet requirements due to inadequate individual skills, emotional or physical requirements required to achieve the goal or objectives.

APPLYING THE TEAMWORK MODEL TO THE CASE SCENARIO

If we apply the *Teamwork Model* to the case scenario at the introduction of this manuscript, we can describe the team's problematic performance as an instance of a Blind Team. On this day, team members were competently performing their jobs and focused on their own domain or sub goal of the team. No member of the team recognized that the operating room nurse was reading the name of a patient from an old patient label in a hospital chart. Due to this oversight, the unconscious and vulnerable patient on the table was "transformed" into another person whose blood type of record was different than that of the patient on the table. The team failed to recognize the error because they were distracted from the time out while performing individual skills. Due to informal rules, the team attempted to expedite the procedure to avoid have a late running room. As a result, the patient's admitting documents were not fully scrubbed leading the OR nurse to read an incorrect patient identifier. In other words, the team performed as a

Blind team because members of this group were not reflective of their environment, the team or their goal. Members focused on individual task. This blind OR team failed to provide performance monitoring and backup behaviors. The team members assumed the OR nurse would correctly identify the patient. From this assumption the preoperative nurse was allowed to read an incorrect patient name without challenge. This team was blinded by assumption to this mistake. Through the simple oversight of an incorrect name a highly functioning group of individuals set the course for a disastrous event subsequently killing an otherwise healthy young man. As a result, the goal of correctly identifying the patient, along with all his relevant information including blood type, was not achieved and the patient was incorrectly identified for surgery.

Team failures such as the one described in this scenario are not unfamiliar to healthcare providers. Healthcare is complex, requiring professionals to provide care while balancing the needs of their patient with professional, organizational and personal influences. By all accounts, the individual members of this IHT performed competently as individuals. The patient was intubated, positioned and surgery initiated. The team followed organizational policies; performing the time out and checking blood before it was administered to the patient. Individual interactions were successful. But as a team, they were unable to be successful. Based on the *Teamwork Model* we can identify the team's functioning as a Blind Team and so can better understand how the team failed to perform as a successful collaborative IHT. With these insights, remediation can be appropriately directed ensuring that this error will not affect another patient in the future.

CONCLUSION

The *Teamwork Model* we present synthesizes into one model the major characteristics required for successful teamwork and adds to these characteristics an individual competence characteristic. The *Teamwork Model* incorporates individual-focused and collective-focused competencies, and builds on CHAT's attention to the individual, social, and material contexts that inform IHT performance. Organized as a Venn diagram, the *Teamwork Model* emphasizes integration and interdependence of the competency domains, highlighting that the "ideal" or successful team represents all characteristics. Grounded in the theories of Collective Competence and CHAT, the *Teamwork Model* is organized into four domains and provides a lens to functionally assess IHT performance. The *Teamwork Model* allows for organizations, teams, and individuals to analyze team performances and identify problematic team behaviors. Through this model, we believe that IHT performance can be evaluated and in some cases remediated to improve team function, team success and patient care.

IHT represents a paradigm shift in modern healthcare delivery and has been recognized as an important means for reducing iatrogenic sequelae and improving patient outcomes. But we cannot expect that simply introducing IHTs in healthcare can mitigate patient injury and improvements to care. Indeed, successful IHTs are composed of collectively competent individuals who work together to complete a shared goal. We hope that the *Teamwork Model* can provide a framework for putting into action the important discoveries already made about IHT towards the goal of developing interprofessional healthcare team that successfully function together to minimize cost, and improve the care of patients in the modern healthcare system.

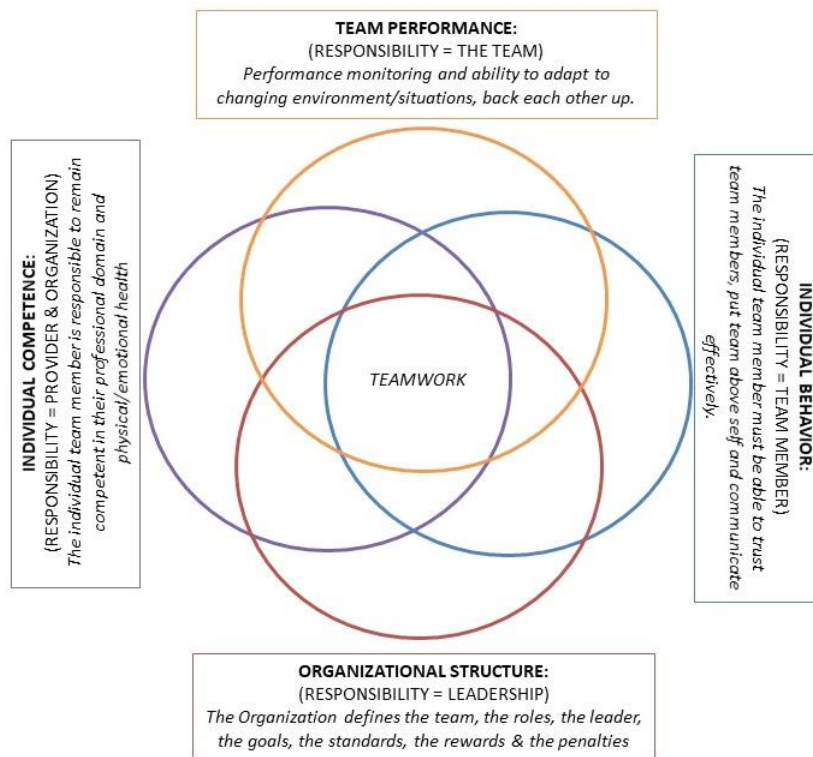


Figure 3. The Teamwork Model

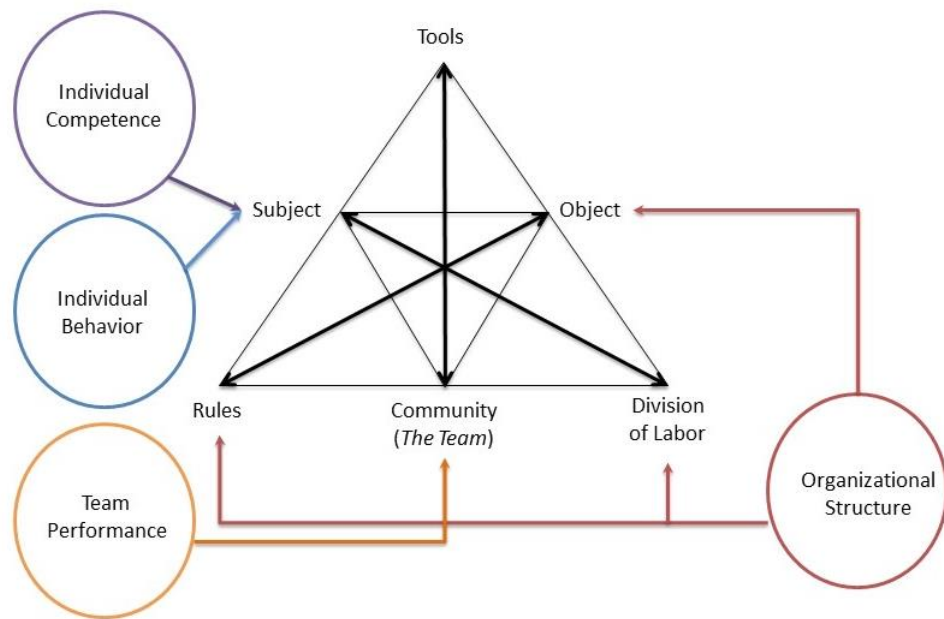


Figure 4. Engeström's model of the activity system & domains of the Teamwork Model

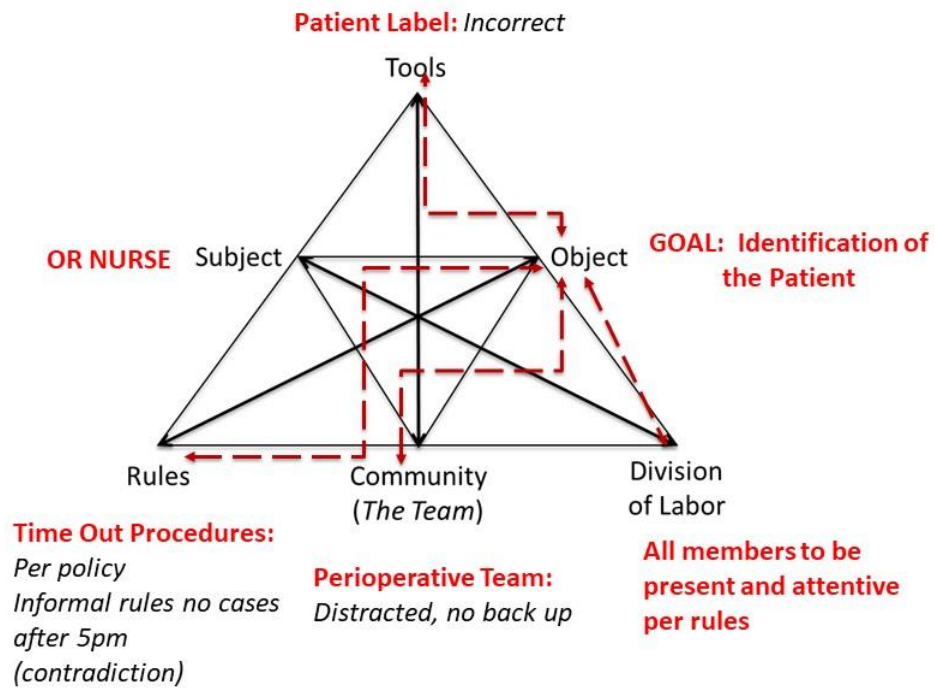


Figure 5. The Teamwork Model and its relationship with CHAT

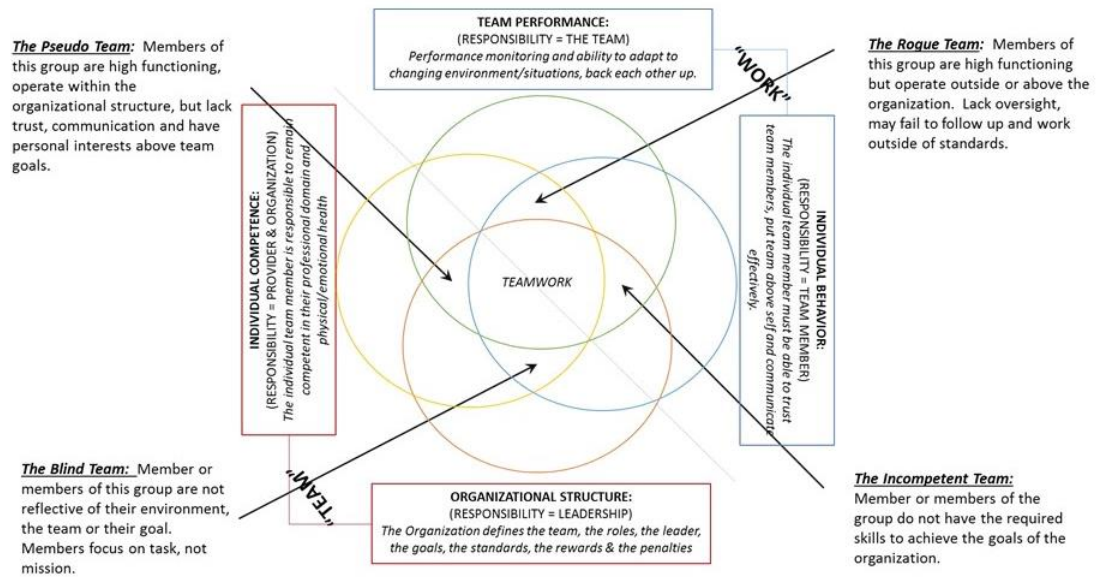


Figure 6. Problematic Teams identified by the Teamwork Model

KSA	Description
Leadership	Ability to direct, motivate, plan, assign, and coordinate team activities. Establishes team climate.
Backup Behavior	Ability to anticipate other team member's needs
Mutual Performance Monitoring	Know other team members role, provide feedback, redistribute work.
Communication	Effective Information exchange
Adaptability	Ability to adjust strategies and performance to evolving situations
Shared Mental Models	Understanding team organization, shared goals.
Mutual Trust	Members will perform their responsibilities to the team, and protect team members.
Team Orientation	Take others behaviors and solutions into account. Put team above self.

Table 2. Competencies of a Successful Team

Individual Competence	Organizational Structure	Individual Team Performance Skills	Individual Behavior
Clinical Competence to perform	Leadership	Performance Monitoring	Mutual Trust
Emotional Competence	Shared Mental Model	Adaptability	Team Orientation
Physical Competence		Backup Behavior	Communication

Table 3. The Teamwork Model and Competency Domains

CHAPTER 5: Discussion

The purpose of this thesis was to explore a broad range of underdeveloped concepts that challenge military APRNs and other military healthcare providers. The task at hand is complex because first we must define the scope of the problem of “*What does it mean to be ready?*” This thesis is a novel attempt to address the complex notion of what it means to be “ready” in military healthcare. Specifically, this thesis defines readiness, explores military teams and suggests a model to evaluate teamwork performance.

Undoubtedly, operational healthcare differs from stateside practice. These operational experiences make the notion of degree completion or advanced certification an incomplete metric of military healthcare team member preparedness. Healthcare educational standards are derived from the civilian community. This experience alone is inadequate to prepare military healthcare team members for the operational mission of the Department of Defense.

This chasm between current preparation of military healthcare providers and the requirements needed for war is great. Military healthcare providers are prepared to modern civilian standards that may be very different than what is experienced and required in the operational environment. This chasm is not new and is reminiscent to Ralph Tyler’s experience in the early 20th century. For Tyler and other educational leaders of that time, the American high school system was inadequately preparing graduates for work. Their education was inauthentic for graduates to meet the challenges of the marketplace. Fast forward a century and we see similar inadequacies between the civilian healthcare educational system and the experiences of military healthcare

providers. Civilian education alone is insufficient to prepare healthcare learners for the complexities of war and operational medicine. Channeling Tyler, modern healthcare educators and leaders must identify the *contemporary challenges* facing military healthcare team members in the operational environment and develop new methods that ensure our men and women in uniform have the tacit knowledge, skills, and attitudes to meet the healthcare needs on the evolving battlefield.

Using the Six-Step Model of curriculum development in medical education, this thesis attempts to advance the conversation by identifying what “readiness” means in the context of military healthcare and explores how readiness may influence APRN competencies and teamwork.

PROBLEM IDENTIFICATION: READINESS DEFINED

The Department of Defense Dictionary of Military Terms (2017) defines readiness as “the ability of military forces to fight and meet the demands of assigned missions.” This definition is vague and provides very little formal guidance on how to prepare military APRNs and other healthcare team members to practice within unique context of the operational military environment. Although professional organizations define curricular standards for practice within civilian health care settings, these standards, and the readiness definition provided by the DoD are not adequate to define the requirements to provide care for patients in austere or operational settings.

Chapter 2 of this thesis explores the complex notion of readiness as it applies to a ready healthcare force. In *Decoding Readiness: Towards a Ready Military Healthcare Force* the authors describe a novel framework that seeks to explain the complex interactions of readiness and the military healthcare team member. Through the analysis

of literature, historical military readiness philosophies and policy statements the authors define readiness of a military healthcare team as the integration of four competency domains where professional, cognitive, environmental, and operational skills are individually developed to work successfully within military healthcare teams.

NEEDS ASSESSMENT: DEFINING REQUIREMENTS

The problem, as defined by the *Decoding Readiness* manuscript, provided the foundation for the second step in the Six Step Model – A generalized needs assessment. A needs assessment was conducted to identify APRN operational competencies. In coordination with the USU Daniel K. Inouye Graduate School of Nursing (GSN) a Task Force was empaneled to evaluate the relevancy of the current operational curriculum, conduct a literature review to identify themes in current literature and consult subject matter experts (including APRNs with deployment experience) to identify relevant skills required to perform in operational environments. As a result of this task force, the GSN operationalized APRN readiness through a holistic lens to include professional, leadership, and teamwork skills. The results of this endeavor were published January 2018 in *Military Medicine* and can be referenced in Appendix A.

TEAMWORK: INDIVIDUALS PROVIDE SKILLS, TEAMS PROVIDE CARE

Military units are organized based on the principles of the Roman Army. A Roman Legion is equivalent to a modern-day Battalion. While organizational nomenclature varies, a legion or battalion serves to structure manpower and improve performance. Through teamwork, individual soldiers work with others to achieve a common mission. The notion of “teamwork” was a reoccurring theme throughout the

APRN needs assessment. As noted in *Decoding Readiness*, individuals provide skills, teams provide care.

Chapters 3 tackled the challenging perception of interprofessional healthcare teams and the application of teamwork literature to the unique context of the military setting. The contribution of this work is three-fold. First, this work challenges the common use of the term “team” and questions the idea that proximity of healthcare workers connotes teamwork. Second, this manuscript highlights the disparity of successes among healthcare teams. Specifically, the authors highlight the inconsistencies between healthcare teams and calls to questions the differences between highly functioning teams and those that fail to reduce patient morbidity and mortality. Lastly, this work challenges the notion of assumed teamwork in the military healthcare setting. Without appropriate inquiry it may be unreasonable to apply civilian teamwork research to the complex military environment.

Chapter 3 aptly lays the foundation for the final product of this thesis, the *Teamwork Model*. The *Teamwork Model* presented in Chapter 4 is a theoretical framework grounded in Lingard’s conception of Collective Competence and Engestrom’s Cultural Historical Activity Theory (CHAT). This manuscript reviews the evolution of the teamwork discussion over the past 40 years and synthesizes relevant literature, identifying 9 domains or competencies of successful teams. Through these competencies we presented a model for the conceptualization of teamwork that could be readily applied to clinical experiences. This model is informed by the interprofessional healthcare team literature. We believe this model will contribute to the growing domain of teamwork literature and enable us to examine authentic interprofessional healthcare team

interactions and identify moments when team interactions were breaking down, and reasons why those breakdowns were happening.

MILITARY RELEVANCE

This thesis represents an early exploration in military healthcare team readiness and does so through the lens of an alumnus of the Uniformed Services University who graduated and went to war. Through CPT Welder's experience we can readily understand the tension that a newly graduated healthcare provider would experience in a combat zone whose experience greatly benefitted from the resource-rich healthcare experience they had during training. CPT Welder's experience was not unique and has been experienced by many of us who have served far from home. While Welder was ready to deploy by all measures he was not prepared, nor had he trained adequately for the complex operational environment that was the Battle of Fallujah.

Using Tyler's influence and the Six-Step Model this collection of manuscripts represents an attempt to understand the requirements for a ready healthcare force. Chapter 2 provides the first definition of a ready healthcare force. Chapter 3 recognizes the limitations of civilian teamwork literature. And Chapter 4 provides a model that shows how to integrate individual performance into highly functioning teams. Together these documents lay the foundation to further develop the individual and team competencies to prepare healthcare team members for war. This work is not only relevant to the military. It is an imperative to the growth of military healthcare services and a moral obligation to those who fight and defend our freedom.

LIMITATIONS

This thesis is predicated on the notion that military healthcare providers may be inadequately prepared for their operational mission, and while some evidence may support this assertion, it is limited and should be explored with empirical investigation. While the Global War on Terror and subsequent Contingency Operations have been the focus of a variety of manuscripts and reports over the past two decades, very few of these publications specifically relate to inadequacies of formal training. Therefore, the author can only speculate as to the true extent of this problem. More empirical work in this domain of education is required.

CONCLUSIONS

This thesis should only be a beginning – a baton of sorts that can be handed off to others. As mentioned throughout this discussion, the work here is not complete and only the “tip of the iceberg” of what needs to be done to better understand how to prepare clinicians in a military ready way. The readiness model proposed in Chapter 2 is untested in empirical work. While individual healthcare competencies are actively in development it is far from clear what operational, team and cognitive skills are required to successfully function in the operation environment.

The Teamwork model described in Chapter 4 is significant for its contribution to teamwork literature. This work combines concepts from a variety of domains and incorporates teamwork knowledge, skills and attitudes into a single framework that integrates individuals with team performance. This novel approach provides an accessible framework to assess team performance and provide a means to remediate less successful teams.

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