PREDICTORS OF LEADER PERFORMANCE BY UNIFORMED MEDICAL

STUDENTS AT OPERATION BUSHMASTER: AN EXPLORATORY

INVESTIGATION

by

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The theme of my acknowledgments and of my future as a Clinical Psychologist, wife, mother, daughter, friend, military officer, leader, confidant is best captured based on a modern-day parable. A person is walking down the street when she falls into a hole. The hole is so deep and the walls are so steep she cannot get out. A doctor passes by and the person yells, "Hey! Can you help me out?" The doctor writes a prescription, throws it into the hole, and continues down the street. Then, a priest comes along and the person shouts, "Father, I am down in this hole, can you help me out?" The priest writes a prayer, throws it into the hole, and continues down the street. Then a friend walks by and the person in the hole yells, "Hey! Can you help me out?" The friend jumps into the hole. The person asks, "Are you stupid? Now we are both down here." The friend says, "Yeah, but I have been down here before and I know the way out." The people I thank jumped in the hole with me and guided me out.

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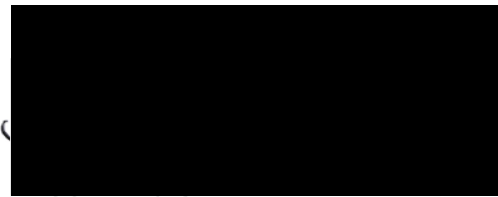
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ABSTRACT

Title of Dissertation: Predictors of Leader Performance by Uniformed Medical Students at Operation Bushmaster: An Exploratory Investigation

Kathryn E. Eklund, Ph.D., 2019

Thesis directed by: Neil E. Grunberg, Ph.D., Professor, Military and Emergency Medicine, Medical and Clinical Psychology, Neuroscience

The Uniformed Services University of the Health Sciences (USU) F. Edward Hébert School of Medicine (SOM) trains healthcare physicians, officers, and leaders to serve in the uniformed services. Successful leadership depends on character, competence, context, and communication, intrapersonally and interpersonally among dyads, teams, and groups. This project examined the feasibility of using a newly developed measure, the Leadership Assessment Report (LAR), to assess leader performance in a military medical field practicum. The measure assessed Character, Competence, Context, and Communication, personally, interpersonally, in teams, and organizationally and was used by faculty observer/controllers. Participants were 472 fourth year USU SOM students (163 female; 308 male; 1 unknown) from three cohorts (2015 – 2017), during Operation Bushmaster, a military medical and leadership field exercise. There were no differences in leader ratings by cohort for any of the LAR items. There also were no sex differences in leader performance on any of the assessed elements. Qualitative data were gathered from the faculty observer/controllers to assess their understanding and use of the LAR. These findings indicate that leader performance at Operation Bushmaster can be assessed. The results are preliminary, given the lack of validation of the LAR. An important next step

for this work includes determination of the psychometric properties of the LAR. In addition, follow-up studies are needed to identify any predictor variables that might help to improve leader and leadership education and development of USU SOM medical students.

GLOSSARY

Assess	Overall Assessment Score	SS	Sum of Squares
Comp	Overall Composite Score	df	Degrees of Freedom
Ch	Character	Sig	Significance
CpRS	Competence (Role-Specific)	Pt Eta^2	Partial Eta Squared
CpLS	Competence (Leadership Skills)	Hyp df	Hypothesis Degrees of Freedom
Cx	Context	Err df	Error Degrees of Freedom
CmS	Communication (Sending)	M	Mean
CmR	Communication (Receiving)	SD	Standard Deviation
CmNV	Communication (Non-Verbal)	MS	Mean Square
P	Personal	SE	Standard Error
I	Interpersonal	r	Pearson Correlation
T	Team	95% CI for B	95% Confidence Interval for B
O	Organizational	Sig. ΔF	Significant F Change

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CHAPTER 1: Introduction

PURPOSE

The etymology of the word doctor is "teacher." This word origin suggests that physicians should be able to effectively instruct and influence other health care professionals, trainees, patients, and significant others invested in patients' care in various situations (83). Communication is vital to teaching and is an important component in the military, in medicine, and in military medicine. Effective communication is a key competency of military medical leaders (19; 60).

Leadership is defined as influence on individuals and groups by enhancing behaviors, cognitions, and motivations to achieve goals that benefit the individuals and groups (19; 54; 79; 80; 121; 122). Successful leadership depends on character, competence, communication, and context, intrapersonally and interpersonally among dyads, teams, and groups (19; 54). Military medical leadership also must consider contexts and interactions among health care team members, line commanders, and the public to achieve these goals (76). Physicians must gain competency in role-specific tasks, and must learn, practice, and teach transcendent leadership competencies to be effective military physicians. Therefore, to be an effective doctor, or teacher, physicians arguably must become effective leaders.

Till et al (101) wrote about the importance of leadership development of health care professionals early in their careers and according to the Association of American Medical Colleges (AAMC) website leadership is critical for success (6). Many medical training programs report preparing future physicians to become health care leaders (75).

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Further, the need to develop medical students with leader ("human" capital) and leadership ("social" capital) competencies recently has become explicit. The AAMC (4) publication describing competencies needed to enter residency programs includes the expectation that medical school graduates will have the ability to "provide leadership skills that enhance team functioning, the learning environment, and/or the health care delivery system" (p. 16). A systematic review of 26 studies (most from the United States) found that medical students believe that learning leadership and management skills (see below for further descriptions of these terms) is important (1). A survey conducted in the United Kingdom reported that > 90% of medical students believed that training in leadership is important and > 70% of medical students want more leadership education and development in their curricula (99).

Some U.S. medical schools offer specialized MD/MBA combined programs (82; 115), whereas others have added leadership programs to their curriculum (e.g., 2017 and 2018 Uniformed Services University [USU] Medical Student Leader and Leadership Education and Development [LEAD] Summit and Working Group Meeting) (54). However, there is no consensus about whether to require LEAD curricula in undergraduate medical education (UME) and, if so, who to teach, what topics to teach, or where leadership best fits into the curriculum (54; 55). Further, only about 50% of medical schools provide training relevant to leader and/or leadership and/or management (78). There currently is no consensus regarding how leadership education and development should be implemented, taught (54; 55) or assessed; so there is still a large gap to fill.

Current Project

      The USU LEAD Program was designed and implemented to provide leader and leadership training for uniformed medical students at USU. **This doctoral research is an exploratory investigation designed to determine the feasibility of assessing leader performance during a field exercise (i.e., Operation Bushmaster) using a tool developed by faculty members in the USU Department of Military and Emergency Medicine to assess Character, Competence, Context, and Communication across four psychosocial levels (i.e., personal, interpersonal, team, organization).** Analyses of leader performance over several years of medical student cohorts may provide information about the LEAD program and how to improve it. It also is valuable to evaluate females and males separately to determine if there are differences that relate to the component elements of leader performance in a military medical field exercise (i.e., Operation Bushmaster) to determine if different aspects of leadership training should be addressed or emphasized for female and male medical students.

      By definition, women and men differ in at least one component of "Character" where Character refers to demographics and physical characteristics as well as to personality, values, and attitudes (19; 54). Because the military classifies individuals according to their sex (i.e., female and male) and because of the de-identified, retrospective nature of this doctoral study, there is no way to determine individuals' gender. However, because sex and gender are often linked and often used interchangeably, albeit incorrectly (88), the term sex will be utilized in this dissertation, as a proxy for gender, unless otherwise noted.

      Women and men often differ in Communication styles (21; 42; 45; 57; 58; 98) and some transcendent Competencies (e.g., emotional intelligence [EQ]) (70;

94). Feminine communication has been described as more indirect, elaborate, and emotional, whereas masculine communication has been described as more direct, succinct, and instrumental (77; 84). Reviews of sex, gender, and emotional intelligence have produced mixed findings. Some research indicates that women may have slightly higher levels of EQ compared to men (70; 94); however, others reported no significant differences regarding overall EQ between men and women (7). Additionally, psychosocial Context is different if a group consists of only females, only males, or both sexes in the roles of leaders and followers (41; 112). Understanding what variables predict leader and leadership performance by female and male uniformed medical students in a military medical field exercise may help to improve leader and leadership education and development of uniformed medical students.

This dissertation presents relevant background information about LEAD at USU and Operation Bushmaster; and a review of the Leadership Assessment Report (LAR) that was utilized at Operation Bushmaster to assess leader performance of the medical students. Next, specific aims and hypotheses are presented followed by methods. Then, the results and discussion are presented. Finally, a summary, conclusion, appendices, and references are presented.

Leader and Leadership Development

In leader development, the emphasis is on enhancing and protecting human capital through individual-based competencies associated with specific leadership roles (26; 27; 72). These learned competencies enable leaders to think and act in new ways (23). Leader development results as a function of purposeful investment in human capital. The primary emphasis of this development strategy is to build intrapersonal competencies

needed to form an accurate model of oneself as a leader (49), to engage in healthy

attitude and identity development (56), and to perform effectively as a leader in a variety

of roles and contexts. Examples of intrapersonal competencies associated with leader

development include self-awareness (e.g., emotional awareness, self-confidence), self-

regulation (e.g., self-control, trustworthiness, adaptability), and self-motivation (e.g.,

commitment, initiative, optimism) (11; 19; 26; 27; 54). See Appendix A, Figure 1.

Leadership development expands the collective capacity of organizational

members to effectively engage in leadership roles and systems (26; 27; 71; 72).

Leadership development embraces a more collective framework in which leadership is

developed in practice (59). Leadership development is the expansion of an organization's

capacity to enact basic leadership tasks needed to accomplish shared, collective work (27;

72). As a social process, it involves everyone in the system or organization (8; 100; 116),

and attention is placed on relations among individuals to add value to the organization

(12; 102; 103). At the core of this relational model is the commitment of members of the

organization toward mutual responsibilities, further supported by mutual trust and respect

(18). In this way, leadership is conceptualized as an effect rather than a cause (34).

In leadership development the emphasis is on social capital through building

networked relationships among individuals that enhance cooperation and resource

exchange in creating organizational value (3; 10; 11; 35; 36). The primary emphasis in

leadership development is on building and using interpersonal competence. Gardner (49)

defines interpersonal intelligence in terms of ability to understand people – building trust,

respect, and commitments. Key components of interpersonal competence include social

awareness (e.g., empathy, service orientation, developing others) and social skills (e.g.,

collaboration and cooperation, building bonds, conflict management) (51; 71; 72). The emphasis is on the social nature of this competence and that effective development best occurs in an interpersonal (i.e., social) context.

The Military Health System (MHS) has identified the importance of health care leadership to optimize performance, address the demands of combat operations, integrate the medical force with joint operations, and contain health care costs (64). Historically, leader and leadership development of medical students who will become the physicians, officers, and leaders of the MHS has relied on on-the-job training or military education career courses (e.g., the Army's Basic Officer Leader Course [BOLC], Captain's Career Course [CCC]) to teach leadership (68). However, physicians often lack necessary and vital leader and leadership skills and miss out on leadership opportunities when their leadership training occurs later in their careers.

A common approach to leader and leadership development addresses only challenges faced by individuals who are at or near the top of the leader pyramid and ignores the majority of individuals, and potential leaders, who are early in their careers. Failing to provide leader and leadership education and experience from the beginning of every MHS officer's career decreases the available pool from which to select senior level leaders and fails to prepare every physician to optimally care for patients in today's team-oriented, patient-centered environment (75). Focusing on leaders later in their careers does not take into account individual characteristics of leaders and leaders-in-training. These characteristics include, but are not limited to, sex, personality, and values, and can contribute to the potential and actual effectiveness of leaders (19; 44).

USU delivers a four-year, comprehensive LEAD program as a requisite part of the undergraduate medical education of all medical students. This doctoral research was an exploratory investigation to examine factors that might predict leader performance for fourth year medical students at Operation Bushmaster, a field exercise where USU medical students (and international guest students) and Graduate School of Nursing (GSN) students are evaluated about medical knowledge and leader and leadership performance in a simulated, resource-constrained, far-forward tactical field setting. The current doctoral research project examined three separate years of Bushmaster cohorts (2015, 2016, and 2017). The 2017 cohort received three years of the LEAD program, while the 2016 cohort received two years, and the 2015 cohort received one year. Analyses of potential cohort effects may provide information regarding the LEAD program curriculum, based on the leader performance scores of students in the various cohorts.

BACKGROUND

As background for this dissertation, relevant information is provided in Appendix C regarding: the MHS and the role of USU. The following sections describe the USU Leader and Leadership Education and Development (LEAD) program and Operation Bushmaster. Next, this dissertation presents Specific Aims and Hypotheses followed by Methods, Data Analytic Strategies, Results, Discussion, Summary and Conclusions.

Leader and Leadership Education and Development (LEAD)

Why was LEAD created? The mission of USU is to educate, train, and prepare uniformed services health professionals, scientists, and leaders to support the Military and Public Health Systems, the National Security and National Defense Strategies of the

U.S., and the readiness of the Uniformed Services (29; 107; 109). Recently, USU re-examined the content, quality, and impact of the leader and leadership training it provides to prepare graduates to be effective leaders within the MHS (81). As USU was reexamining its training, faculty and administrators considered whether USU was fostering core leader and leadership attributes important for future military leaders (81):

- Understand the environment and the effect of all instruments of national power;

- Anticipate and adapt to surprise and uncertainty;

- Recognize change and lead transitions;

- Operate on intent through trust, empowerment, and understanding;

- Make ethical decisions based on the shared values of the medical, nursing, and dental professions balanced with the Profession of Arms; and

- Think critically and strategically in applying health services support to joint warfighting principles and concepts in joint operations (37; 81).

Following the 2014 USU Strategic Framework (104; 108), the Military and Emergency Medicine (MEM) Department received responsibility to develop, implement, and oversee the curriculum in leadership, officership, and military professionalism and established the USU LEAD program (81). See Appendix A, Figure 2. As part of this doctoral dissertation, evaluation of the LEAD program included examining potential cohort effects of Operation Bushmaster cohort years 2015, 2016, and 2017.

In the fall of 2014, former Army Surgeon General LTG(R) Eric Schoomaker, M.D., Ph.D., was appointed as Director, USU LEAD program (76; 81). Professor Neil E. Grunberg, Ph.D., a medical and social psychologist with expertise in the scholarship of leadership, became Director, LEAD Research and Development. USAF Col(R) John E.

McManigle, M.D., a critical care physician with decades of experience as an educator who has served as an Associate Dean, Deputy Dean, and Acting Dean in the USU SOM, was appointed Director, LEAD Curriculum. Research Assistant Professor Erin Barry, M.S., a biomedical engineer and mathematician with expertise in research design and analyses, became LEAD's primary researcher and liaison for collaborations with the USU Long Term Career Outcome Study (LTCOS) group.

Leadership was identified as one of the five critical domains in the 2014 – 2018 USU Strategic Framework – the others being Education and Training, Research and Scholarship, National Security and Global Health Engagement, and Service (104). In the 2017-2021 USU Strategic Framework, Leadership (under the Leadership and Service domain) is identified as one of the **three** critical domains (emphasis added) (109), along with Education and Training, Research and Scholarship. The LEAD curriculum includes classroom instruction, practical exercises, field applications, and student scholarship – including fourth year medical student capstone projects. The USU LEAD program has contributed to leader and leadership development exercises including Operation Bushmaster (described in greater detail in the following section) and Operation Gunpowder, an exercise developed for third year student physicians that focuses on tactical combat casualty care, en route care, teamwork, and communication.

Evaluation of LEAD. Effective program evaluation is described by the U.S. Department of Health and Human Services Center for Disease Control and Prevention (20) as a systematic way to improve and account for actions of a program by involving procedures that are useful, feasible, ethical, and accurate. Although a full, complete, and systematic program evaluation of the USU LEAD program is beyond the scope of this

dissertation, steps were taken to: (a) describe the program, (b) focus the evaluation design (e.g., examine cohort effects), (c) discuss results and future directions, and (d) share lessons learned (20). This component of the present doctoral dissertation is important because it is a first step in conducting a program evaluation for USU LEAD and systematic investigations of the merit, worth, or significance of medical school leadership programs is lacking (10; 48; 54).

The current lack of a common leadership conceptual framework across all undergraduate medical education programs presents a challenge (48), in terms of educating and developing physician leaders and evaluating leadership programs. While leadership may be understood as motivating and influencing others to bring about change, management involves achieving specific results through planning, organizing, and solving problems (122). Some scholars and programs consider leadership and management to be separate systems of action, but the terms are often used interchangeably (66; 74). Some leadership models focus on competencies required to fill leadership roles in a given organizational setting, such as self-awareness, technical and conceptual knowledge, and skills needed in leadership roles (60; 97).

Based on the steps for program evaluation drafted by the Center for Disease Control and Prevention (20), in the following pages: (a) the USU LEAD program is described (e.g., the need for the program, expected effects of the program, activities of the program); (b) a preliminary evaluation of the LEAD program is described (e.g., examining cohort effects, discussing with faculty their understanding of the USU LEAD conceptual framework and Leadership Assessment Report (LAR); (c) current methods of evaluation are described; and (d) results and future directions are discussed.

What is LEAD?

The USU LEAD program has emphasized the need to identify what components are important for uniformed health care leadership and how to effectively assess health care leadership. Leadership is defined as influence on individuals and groups by enhancing behaviors, cognitions, and motivations to achieve goals that benefit the individuals and groups (19; 54). The LEAD team views the leader's behaviors, cognitions, and motivations as reflections of the leader as a person, her or his leadership skills, an awareness of the leadership setting, and the leader's mastery of communication in all its forms (19; 54; 81).

An early step for the USU LEAD program was to identify the most appropriate types of leadership for uniformed health care professionals. Callahan (19) evaluated types and models of leadership, including adaptive, authentic, authoritarian, democratic, laissez-faire, servant, transactional, transformational, and so on, and reviewed 90 different papers regarding models and frameworks for leadership (2; 24; 52; 73; 114; 118).Callahan (19) determined that each type and model has value, but that each was incomplete. They drew key elements from many leadership models to create the FourCe-PITO leadership conceptual framework to guide the USU LEAD program, individuals in the program, and to assess individuals of the program. This framework also was developed to be consistent with Army (29), Navy (30), Air Force (110), and Coast Guard leadership concepts. See Appendix A, Figure 3.

FourCe-PITO. The FourCe-PITO leadership framework includes four "C" elements (FourCe) across four psychosocial levels (19; 54). According to Callahan (19) and expanded by Grunberg et al (54):

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- **Character** (**Ch**; "Who" the leader is) refers to psychological and physical aspects of an individual to include demographic (including sex) and physical characteristics as well as personality, integrity, confidence, trustworthiness, optimism, empathy, accountability, humility, and Service values for military medical leadership. It is important to know who we are and others; perceptions of who we are to become effective leaders, to understand what aspects of self-contribute to success as leaders and what aspects of self-detract from success as leaders (19);

- **Competence** (**Cp**; "What" the leader knows and does) includes both role-specific knowledge and skills and transcendent leadership skills, such as critical thinking, problem solving, decision making, conflict resolution, emotional intelligence, motivating others. A leader needs to have an understanding of the professional and technical competencies specific to their role as well as transcendent skills related to problem solving, critical thinking, and decision-making (19);

- **Context** (**Cx**; "When" and "Where" leadership occurs) is the consideration of physical, psychological, cultural, and social environments, including leadership under physical and mental stress. Context is particularly important for military medical leadership because military medical leaders must be able to adapt and perform in volatile, uncertain, complex, and ambiguous environments (13; 19);

- **Communication** (**Cm**; "How" leaders interact with followers) encompasses verbal (oral and written) and nonverbal (facial expressions, body language, tone, volume, and intonation) sending and receiving of information. Effective communication is a critical element in most leadership frameworks and models

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and takes into consideration the leader's narrative, vision for the organization and style of communication. Effective leaders are required to communicate in appropriate, emotionally-attuned ways so that their messages are understood and their followers are inspired (19; 119).

The four "C" elements (FourCe) of leadership occur across four psychosocial (PITO) levels based on the U.S. Air Force Academy leadership training program (61; 85; 110):

- **Personal (P):** focus is on aspects of self; refers to the individual leader, including psychological and biological aspects of the individual and incorporates the individual's demographics, values, personality (i.e., Ch), knowledge and skills (i.e., Cp); internal and external physical, cultural and situational environments (i.e., Cx), and the individual's ability to take in and record information (i.e., Cm);

- **Interpersonal (I):** focus is on interactions among dyads (e.g., with subordinate, peer, supervisor, patient); includes understanding others and perception of self by others (i.e., Ch), how well skills and knowledge are shared with others (i.e., Cp), environments that are relevant to dyads (i.e., Cx), and sending and receiving (verbally and nonverbally) information among dyads (i.e., Cm);

- **Team (T):** focus is on small groups (e.g., health care professionals) aligned with a shared goal, task, or purpose; refers to building team values and trust (i.e., Ch), understanding group dynamics and social intelligence (i.e., Cp), understanding environments and situations that impact small groups (i.e., Cx) and communicating in small groups (i.e., Cm);

- **Organizational (O)**: focus is on large groups or teams, institutions, and systems; refers to larger group operations at operational and strategic levels and inspiring core values (i.e., Ch), establishing an operational vision (i.e., Cp) while being mindful of various cultures (i.e., Cx) and communicating with large groups (i.e., Cm)(19; 54).

The FourCe elements and PITO levels interact, overlap, and operate together. The FourCe-PITO framework is intended to be inclusive and comprehensive and is relevant to education, development, and assessment of leaders (i.e., the person who leads) and leadership (i.e., the relationships and culture of aspiration and inspiration). See Appendix A, Figure 3.

Operation Bushmaster

Purpose

According to LTC(R) James Schwartz, USA, MSC, co-Course Director for Operation Bushmaster, this field exercise is a leadership experience (95). Overall, the objectives of Operation Bushmaster are to challenge the medical students in a simulated far-forward deployed environment. . LTC(R) Schwartz noted that because the medical students have had more than three years of role-specific competency training (i.e., medical competency), the emphasis of Operation Bushmaster and the evaluation metric of the medical students (see Appendix A, Figure 5) is on knowledge, skills, and performance as effective leaders (95).

Overview

Operation Bushmaster (a component of Military Field Practicum 202 [see Appendix C]) is the capstone event of the USU military medical curriculum. During this

intense, four-day field exercise, fourth year USU medical students (and international guest students) and Graduate School of Nursing (GSN) students are evaluated about medical knowledge and leader performance in a simulated, resource-constrained, far-forward tactical field setting (106). Students assume leadership and medical roles within a military medical aid station where they are presented with operationally-current, reality-based missions and operational problems for which they must plan and execute while simultaneously managing the medical care of simulated Disease and Non-Battle Injury patients, combat stress casualties, and combat trauma casualties (106).

Since 2009, Operation Bushmaster has undergone major revisions to emphasize its role as a leadership exercise. LTC(R) Schwartz indicated that prior to 2009, faculty evaluators had their own checklist with which to evaluate students in the various roles during Operation Bushmaster (e.g., surgeon, combat operation stress control, platoon leader, assistant platoon leader). Evaluation of students focused on individual role-specific competencies, did not focus on more global, transcendent leadership skills, and was not standardized (95). Between 2009 – 2014, students were evaluated utilizing a standardized evaluation created by LTC Justin Woodson; however, there was no standardized mission. Although a standard checklist had been created, the students were being evaluated on different missions, different skill sets, and each platoon was assigned a different Role of Care (95).

Role 1 care is point of injury care (e.g., Battalion Aid Station). This level of care includes triage, treatment, and evacuation with care provided by a physician, physician assistant, and/or medic. There is no surgical or patient holding capability and the goal of Role 1 care is to return service members to duty or to stabilize and evacuate to the next

higher role of care (15). Role 2 care includes basic primary care and also may include optometry, combat operational stress control and behavior health, preventive medicine and dental, laboratory, radiographic and surgical capabilities, when augmented (e.g., Medical company-brigade support battalion). Primary features of Role 2 care are to deliver blood, to provide resuscitative surgery, and to hold patients for up to 72 hours for individuals who are able to return to duty (15). At Role 3 care, patients are treated in a medical facility staffed and equipped to provide all categories of care to all categories of patients, including resuscitation, initial wound surgery, damage control surgery, and postoperative treatment (e.g., Combat Support Hospital)(15). Role 4 medical care occurs in continental U.S. (CONUS)-based hospitals and other safe havens (e.g., Landstuhl Regional Medical Center)(15). At Operation Bushmaster prior to 2011, there was no standard mission associated with each Pandakar day (i.e., one Pandakar day is equal to 4 hours) and each platoon modeled a different Role of care. Therefore, there was no similar context with which to evaluate and compare the students' performances (95).

Since 2015, the Leadership Assessment Report (LAR) (See Appendix A, Figure 5) was created by the LEAD team in collaboration with the Operation Bushmaster Course Directors to standardize evaluation of each of the students within the various roles and to ensure that assessment was consistent with the four-year leadership curriculum. Additionally, all students within each of the four Platoons simulate Role 1 care (as opposed to Role 2, 3, or 4 care) with 16 standardized missions that occur throughout the various Pandakar days (95). The current Operation Bushmaster training plan puts every student in sinilarcontexts and provides a standardized environment and assessment tool with which to evaluate student performance (95).

The present doctoral research project used the LAR as an assessment of leader performance of fourth year medical students at Operation Bushmaster across three separate Operation Bushmaster cohort years (2015 – 2017). The psychometric properties of the LAR, to include reliability and validity, have not yet been established. The faculty observer/controllers (O/Cs) receive a half-day training prior to Operation Bushmaster in which they review readings regarding the conceptual framework utilized at USU and Operation Bushmaster, receive instruction by faculty of the LEAD program, and engage in mock ratings utilizing case vignettes. Additionally, LEAD program faculty members are available throughout Operation Bushmaster to provide "on the spot" assistance and guidance to faculty O/Cs in response to any and all questions about the LAR and how to use it. In addition, a limitation of the current project is that leader performance ratings were not differentiated based on faculty O/C demographics or rank because this information was not available at the time of the project analysis.

This doctoral research was an exploratory investigation that evaluated the potential usefulness of using the LAR at Operation Bushmaster, recognizing potential limitations of the findings given the lack of psychometrics on the LAR. Because of the standardized evaluation of medical students since 2015, evaluation of the feasibility of utilizing the LAR as a leader performance assessment is now possible, recognizing the psychometric limitations of the instrument.

Roles of the Medical Students

Prior to attending Operation Bushmaster, fourth-year medical students participate in the Military Contingency Management course, described briefly in Appendix C. During this course, the students are presented with operational problems and receive pre-

deployment training (95). The students are assigned to one of two companies and each is sent sequentially to Ft. Indiantown Gap, Pennsylvania, where the company is divided into four platoons – all undergoing identical scenarios, planning and executing missions, while simultaneously caring for a variety of simulated patient causalities (69; 95).

While "deployed," students are assigned to various roles during the exercise (i.e., platoon leader, assistant platoon leader, surgeon, ambulance team leader, combat stress control, preventive medicine). Students spend an entire training "day" (i.e., 4 hours) in their assigned roles. Students rotate positions each training day to allow each student to perform and be evaluated by faculty observer/controllers (O/Cs) in multiple roles (95). In addition, each training day has an overarching mission associated with it. For example, on Day 1, the mission is troop movement (i.e., the platoon is required to move all personnel and equipment from billeting to the location of their battalion aid stations). All platoons experience the same mission and all roles are evaluated within the context of the particular mission (95).

Evaluation of Medical Students

Experienced uniformed, retired uniformed, and civilian faculty from USU (on-site and national faculty) and the MHS serve as evaluators, assessing individual health care leader and leadership and medical knowledge and skills. O/Cs provide formative and summative feedback utilizing the LAR (See Appendix A, Figure 5). However, to date, the psychometric properties of the LAR have not been examined. Since 2015, O/Cs receive several hours of training about the logistics and goals of Operation Bushmaster, the USU LEAD program and FourCe-PITO framework, and how to effectively guide, encourage, educate, and assess the medical students during this rigorous experience (95).

Information about the faculty O/Cs was not available for this project. O/Cs are assigned

and trained, via a one-day training seminar with the LEAD team, to evaluate specific

roles (i.e., platoon leader, assistant platoon leader, surgeon, ambulance team leader,

combat stress control, preventive medicine)(53; 95). O/Cs observe the medical students

and offer formative feedback during the exercise and summative feedback (i.e., the LAR)

at the end of each training day (53). Following the completion of each training day,

faculty facilitate After Action Reviews by the students to evaluate each platoon's

performance, what to sustain, and what to improve with action plans. The FourCe-PITO

leadership framework is utilized to standardize evaluations and AARs and to reinforce

elements taught in the leadership program (53).

The purpose of this doctoral research was exploratory to evaluate the leader

performance rating data gathered across three cohort years (2015 – 2017) during

Operation Bushmaster. Data from Operation Bushmaster for the medical student

cohorts of interest were matched with their demographic data (i.e., sex) gathered as

part of the Long-Term Career Outcome Study.

INDEPENDENT VARIABLES

Gender and Leadership

As discussed above in the FourCe-PITO model, various demographic variables

(e.g., sex) along with attributes, values, personality, aspirations, and so on comprise the

Character domain of the leadership framework. It is important to understand what aspects

of an individual may contribute to success as leaders; what aspects may need to be

considered or adjusted to succeed as a leader; and what aspects of an individual may

detract from effective leadership. A great deal of research has addressed leadership and

gender (17; 42-44; 80; 90-92; 112) and reported conflicting conclusions regarding gender and leader effectiveness. Recently, Eklund et al (44) used the FourCe-PITO framework to evaluate how consideration of gender may affect and optimize leadership development and effectiveness. Eklund et al (44) found that the FourCe-PITO framework is valuable to assess gender differences and leadership. The present doctoral research project was built upon this review.

Among female physicians, 30.4% are younger than 40 years old and 16.3% are older than 60 years old, compared to 15.7% and 37.3% of male physicians, respectively (120). Although males still account for the majority (66%) of all actively licensed physicians, the increase in the number of female physicians (11%) since 2012 is twice that of male physicians (5%) (120). Additionally, 31% of all actively licensed physicians are 60 years of age or older, an increase from 26% in 2012, reflecting either deferred retirement or license retention without practice and signaling a need for increasing the supply of younger physicians as older physicians exit the workforce (120). Third, the proportion of female physicians is inversely related to age, whereas the proportion for males is directly related to age. The percentage of female physicians younger than 40 years old (30%) is almost double that of their male counterparts (16%) (120). Increasing numbers of women have become physicians during the past few decades, with their numbers growing from 25,000 in 1970 to more than 235,000 in 2004 (120).

For more than 30 years, women have constituted 30 – 50% of medical students compared to the 1970s when women were only 11 – 24% of medical students (5; 120). The average medical school has only 46 full professors who are women compared with 156 men counterparts, resulting in women full professors comprising only 5% of all

faculty positions at medical schools (5). Additionally, women only account for 13% of department chairs and 11% of deans in medical schools (5). Whether these differences reflect cohort effects (e.g., historically greater numbers of male physicians) that will disappear over time or whether they reflect gender differences in some element of leadership is not clear. If, indeed, some particular elements of leadership contribute to the current differences in female and male physician leadership roles or whether variables can be identified that predict who (women and men) will succeed as physician leaders is relevant to medicine in general and to the MHS in particular.

Cohort and Leadership

The LEAD curriculum was implemented within the USU School of Medicine (SOM) in 2014 (Bushmaster cohort 2017; class of 2018). Therefore, the 2015 Bushmaster cohort (class of 2016) received limited leader and leadership education and development regarding the FourCe-PITO framework before Operation Bushmaster. The 2016 Bushmaster cohort (class of 2017) received more leader and leadership education and development and the 2017 Bushmaster cohort (class of 2018) received several years of the LEAD curriculum prior to Operation Bushmaster.

DEPENDENT VARIABLES

Operation Bushmaster Evaluation

The Leadership Assessment Report (LAR) is a leader performance assessment completed by faculty observer/controllers (O/Cs) of medical student performance according to the FourCe-PITO framework during Operation Bushmaster. O/Cs indicate the duty position of the individual being evaluated (i.e., platoon leader, assistant platoon leader, surgeon, ambulance team leader, combat stress control, preventive medicine), the

training program the students are from (i.e., School of Medicine, Graduate School of Nursing, or international students), and the platoon number.

Students are evaluated on a five-point scale from Unsatisfactory (U) to Outstanding (O) with Satisfactory (S) as the median, modifiable by a (+; S+) or (-; S-), or Not Observed. Descriptions of each of the assessments points are:

- Unsatisfactory (U): Many errors, negative influence on others, disregards feedback, unprofessional, gross poor judgment;

- Satisfactory - (S-): Some errors, poor response to feedback, some skills and knowledge do not meet expectations;

- Satisfactory (S): Few errors, professional, positive response to feedback, skills and knowledge meet expectations, good judgment;

- Satisfactory + (S+): Meets all expectations of Satisfactory, positive influence on others, seeks feedback;

- Outstanding (O): Role model, inspires others, distinguished performance, skills and knowledge exceed expectations.

The scale is utilized to evaluate students on eleven leadership items that correspond to the FourCe-PITO elements:

1. *Character (Ch):* Self-awareness, confidence, humility, integrity, empathy.

2. *Competence, Role Specific Skills (CpRS):* Technical skills, role-specific knowledge, tactical expertise, technical skills specific to simulation task.

3. *Competence, Leadership Skills (CpLS):* Critical thinking, problem solving, judgment, decision making, emotional intelligence, influences and inspires others.

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4. *Context (Cx):* Adapts to social situations, environments, and stress; situational awareness; demonstrates cultural sensitivity.

5. *Communication, Sending (CmS):* Conveys goals, thoughts, and ideas effectively; closed-loop communication; adjusts to context.

6. *Communication, Receiving (CmR):* Actively listens to others, recognizes and addresses misunderstandings.

7. *Communication, Non-verbal (CmNV):* Matches non-verbal to verbal communication; effective/appropriate use of facial expression and body language.

8. *Personal (P):* Self-aware, knowledgeable, effective communicator, situational awareness.

9. *Interpersonal (I):* Works effectively with other individuals; communicates difficult information effectively.

10. *Team (T):* Works effectively with teams; promotes team cohesiveness; responds well to different contexts.

11. *Organizational (O):* Understands vision and overall mission; smooth transition to next leadership group.

Additionally, O/Cs also can provide qualitative comments regarding each student's performance on any of the eleven domains.

This doctoral research was an exploratory investigation to evaluate the leader and leadership performance rating data gathered utilizing the LAR, across three cohort years (2015 – 2017) for which there are LAR data **during Operation Bushmaster.** Of note, interviews of O/Cs were conducted as part of this doctoral research to gather information about the faculty's use and understanding of the LAR; this

information will inform validity of the assessment. The psychometric properties of the

LAR are being examined by the LEAD team and, at the time of this project, full

evaluation of the reliability and validity of the LAR was not available.

CHAPTER 2: Specific Aims and Hypotheses

OVERVIEW AND SPECIFIC AIMS

Developing accurate and meaningful ways to assess leadership in simulated

contexts such as Operation Bushmaster is important. Additionally, taking the next step to

identify variables that relate to leader performance is a priority for military medical

officers, leaders, and educators. Analysis of leader performance during Operation

Bushmaster from three medical student cohorts provides an important first step in

examining the feasibility of assessing leadership in context.

Further, examination of potential cohort effects may provide preliminary

information relevant to the Leader and Leadership Education and Development (LEAD)

program. It also is valuable to evaluate females and males separately to determine if there

are differences that relate to the component elements of leadership and performance in a

military medical field exercise (i.e., Operation Bushmaster) to determine if different

aspects of leadership training should be emphasized for female and male medical

students. The study addressed two exploratory specific aims.

Specific Aim 1

To determine female and male uniformed medical student leader performance at

Operation Bushmaster according to the FourCe-PITO elements for three cohorts.

Hypothesis 1a. Cohort Effects

Leader performance will be more highly rated for more recent cohorts of both

female and male uniformed medical students.

Hypothesis 1a Rationale. The LEAD curriculum was implemented within the USU School of Medicine (SOM) in 2014 (Bushmaster cohort 2017; class of 2018). Therefore, the 2015 Bushmaster cohort (class of 2016) received limited leader and leadership education and development regarding the FourCe-PITO framework before Operation Bushmaster. The 2016 Bushmaster cohort (class of 2017) received more leader and leadership education and development and the 2017 Bushmaster cohort (class of 2018) received several years of the LEAD curriculum prior to Operation Bushmaster. Because of the continued increase in LEAD from 2015 – 2017, it is anticipated that later cohort years will be more highly rated on leadership performance compared to earlier cohort years.

Hypothesis 1b. Gender Differences

Leader performance will differ between female and male uniformed medical students.

Hypothesis 1b Rationale. Previous research discussed above has reported gender differences in leadership performance. Regarding the FourCe-PITO framework, gender differences are important to consider in some, but maybe not all, of the elements.

Eklund et al (44) indicate that "gender is a core element of Character and includes self-perception of Gender as well as perception of Gender by others. Therefore, with regard to Character and Leadership, Gender needs to be considered and is relevant across all four levels of PITO." Gender affects our self-perception (P), perception of self by others in dyads (I), small groups (T), and large groups or systems (O). It is necessary for one to have self-awareness (P) of Gender. When other people are involved (I, T, or O), it

is important for one to be self-aware and to understand perception of self by others to determine how to best lead (19; 44).

Gender is not a core aspect of Competence. Therefore, Competence should be judged regardless of Gender across the levels of PITO. However, biases often result in misinterpretation of competencies based on sex and/or Gender. A leader should be competent and have the abilities, skills, and knowledge necessary to perform jobs effectively. The Gender of the leader should not define a leader's competence across the PITO level. Yet, because Gender biases may affect perception of Competence in oneself and others, it is important to be aware of any Gender - related biases that contribute to misperceptions about Competence and to, instead, focus on each Competence *per se* (19; 44).

Gender is a key aspect of Context, including, psychological and social contexts, and situational stress. Context and Gender operate at all PITO levels. Cultural differences in Gender roles and biases as well as psychobiological differences in relative extent to which each of the three stress responses operate are likely to contribute to interactions among Context and Gender with regard to leadership (19; 44).

Gender and Communication is complex. Interpretations and reactions to different Communication styles are affected by the Gender of the "sender" and of the Gender of the "receivers" of the communication. With regard to Communication, Gender, and PITO, the same complexity of interaction operates such that the level of interaction affects whether Communications are differentially interpreted based on Gender (19; 44).

Specific Aim 2

To evaluate faculty observer/controller's understanding and use of the Leadership

Assessment Report (LAR). Interviews were conducted with faculty observer/controllers

(O/Cs) to gather information about how faculty O/Cs interpreted individual items of the

LAR and how they rated the medical students on each item. These interviews were

included and intended as a first step toward assessing validity of the LAR.

CHAPTER 3: Methods

OVERVIEW

This doctoral research was approved by the Uniformed Services University

(USU) Institutional Review Board (IRB) following procedures established for review of

Long Term Career Outcome Study (LTCOS)-related projects. Information about gender

was drawn from the LTCOS database; dependent variables were drawn from the

Leadership Assessment Report (LAR) data from Operation Bushmaster for cohort years

2015 – 2017. See Appendix A, Figure 6.

Specific Aim 1

A retrospective analysis was conducted of uniformed medical students' leader

performance (based on the FourCe-PITO framework) at Operation Bushmaster for three

cohorts of female and male uniformed medical students (2015 – 2017). The Operation

Bushmaster data were collected, via the LAR, from 501 (158 – 172 per cohort), female

and male, active duty, uniformed (i.e., Army, Navy, Air Force, Public Health Service),

USU 4th year medical students during Operation Bushmaster.

Specific Aim 2

Surveys. A sample (n = 11; descriptive information is described in the Results

section) of faculty Observer/Controller's (O/Cs) was individually interviewed regarding

understanding and use of the Leadership Assessment Report (LAR). The purpose of these

interviews was to gather information about how faculty O/Cs interpreted individual items

of the LAR and how they judged the medical students on each item. These interviews

were included and intended as a first step toward gathering validity evidence for the

LAR. These interviews were not expected to provide definitive validity and reliability evidence for the LAR; that is beyond the scope of this doctoral project. The instruction from the doctoral dissertation committee was to include qualitative information from a small (10 – 12) sample of faculty O/Cs regarding O/C interpretation and understanding of the LAR and its' component items. See Appendix A, Figure 7.

Step 1. The interview and script was drafted by this writer and reviewed, independently, by three different professionals; two of whom are members of the doctoral committee; two members of the Leader and Leadership Education and Development (LEAD) team (Dr. Neil Grunberg and Erin Barry, a statistician and methodologist) and the Director of the Long-Term Career Outcome Study (LTCOS) Team (Dr. Steve Durning) to determine whether the interview adequately captured the questions relevant for gauging faculty O/Cs interpretation of each item on the LAR, what the faculty used to determine their ratings of the medical students and whether or not faculty felt as though something was missing from the LAR. A total of 10 – 12 faculty were requested by the doctoral committee to be interviewed. See Appendix A, Figure 7.

Step 2. An email was sent to 21 current and/or former faculty O/Cs from Bushmaster on 1 May 2018 to request a brief phone call to discuss their use of the LAR. Interviews were scheduled with the six faculty members who responded to the email and conducted between 3 May 2018 and 13 June 2018. A second email was sent on 13 July 2018 to the remaining 15 faculty members from the original email sent on 1 May 2018 as well as seven additional faculty members whose names were provided by the director of Operation Bushmaster, MAJ Kevin Semelrath, M.D., FACEP, USAF. Interviews were scheduled with the one faculty member who responded to the second email and

conducted on 20 July 2018. Two additional faculty O/Cs were recruited by this writer

because of the professional relationship between this writer and the two additional faculty

O/Cs. Their interviews were conducted between 20 August 2018 and 29 August 2018. A

third email was sent on 2 September 2018 to the 21 faculty members who did not respond

to either the first or second email to request a phone call to discuss their use of the LAR.

One individual responded to the third email and was interviewed on 4 September 2018.

One additional faculty O/C was recruited because of this writer's professional

relationship with that O/C and that interview was conducted on 5 September 2018. In

total, eleven faculty O/Cs were interviewed regarding their understanding and use of the

LAR. Descriptive statistics regarding the faculty O/Cs are discussed in the Results

section.

Step 3. Upon completion of the interviews, this writer (who was also the

interviewer) began the process of thematic analysis following the steps outlined in Braun

and Clarke (16). Because of the exploratory nature of the interviews and the subsequent

analysis, thematic analysis was chosen as opposed to another qualitative analysis more

grounded in *a priori* hypotheses/theories (16). Namely, there was no *a priori* theory that

was driving the analysis of the qualitative interviews. For each interview, this writer

reviewed responses provided by the faculty O/Cs and wrote key elements, words, and/or

phrases for each question on the interview. Additionally, a second, independent reviewer,

reviewed each of the interviews and wrote key elements, words, and/or phrases for each

question. Although inter-rater reliability was not computed, there was complete

consensus between the two independent reviewers regarding key elements, words, and/or

phrases. Word phrasing that differed between the two reviewers and any differences were discussed during the thematic review in Step 4.

Step 4. After the independent review of the interviews by the two raters, an evaluation occurred to determine whether or not themes existed within the data set. Braun and Clarke (16) indicated that a theme captures something important about the data in relation to the research question and represented some level of patterned response. Researcher judgment determined the themes. The two raters discussed whether or not there was consensus among the key words that each wrote based on the individual responses to interview questions. Themes were coded as those items that had consensus among the two independent raters for each interview question.

Step 5. Individual interview questions that did not have consensus among the two independent raters were discussed among the raters and interview answers were reviewed. Themes for individual interview questions were discussed among the raters and themes that were agreed upon were included in the coding.

Step 6. Themes were then reviewed and refined by the two raters and data compiled for each theme to determine if the data supported each theme and how the themes worked both within a single interview and between all interviews. Results for the qualitative analysis are described in the Results section.

Quantitative. Current findings by Erin Barry and the LTCOS team have shown that: (a) average leader and leadership performance, as rated by the LAR, was satisfactory ($M = 3.36$, $SD = 0.41$, on a 5-point scale); (b) overall leader and leadership performance and performance on each of the FourCe-PITO elements significantly improved over the iteration of Operation Bushmaster; (c) elements of leader and

leadership performance were significantly correlated with each other and with overall leader performance (r values between 0.40 – 0.83); (d) leader and leadership performance was not correlated with medical students' performance on the Medical College Admissions Test (MCAT; r = 0.02, p = 0.63) or the U.S. Medical Licensing Examination (USMLE; Step 1: r = 0.06, p = 0.20; Step 2: r = 0.09, p = 0.06; Step 3: r = 0.07, p = 0.41) (10; 11).

RESEARCH DESIGN AND PROCEDURES

Data Management

The research was conducted on de-identified data, previously collected by faculty observer/controllers (O/Cs) at Operation Bushmaster during the 2015, 2016, and 2017 training cycles. These three cycles of Operation Bushmaster years were selected because the LAR, upon which the dependent variables for this doctoral research were derived, was implemented at Operation Bushmaster in 2015. The Demographic data were drawn from the LTCOS database.

Participants

De-identified data gathered from 501 female and male, active duty officer, uniformed (i.e., Army, Navy, Air Force, Public Health Service), USU 4th year medical students who attended Operation Bushmaster in 2015, 2016, or 2017 were used in the present doctoral research.

Procedures

Independent Variables

Analyses were split by cohort for hypothesis 1a and split for sex (i.e., female and male) for hypothesis 1b.

Dependent Variables

Dependent variables were derived from the Leadership Assessment Report (LAR) utilized for evaluating leadership performance of 4th year USU medical students at Operation Bushmaster. See Appendix A, Figure 5.

Leadership Assessment Report

Medical students had between zero and eleven separate evaluations over the course of their participation at Operation Bushmaster.

Overall Assessment Score. The overall assessment score on the LAR refers to the one overall score given to medical students regarding the entirety of their evaluation period. This score is not an arithmetic mean of the individual LAR items, rather it is a judgment by the faculty O/Cs regarding the consideration of individual leadership elements that were deemed most relevant in a given role and a given situation.

FourCe-PITO Elements. FourCe-PITO elements refers to the eleven individual items medical students are evaluated on during Operation Bushmaster. The eleven individual items are: Character, Competence (Role-Specific Skills), Competence (Leadership Skills), Context, Communication (Sending), Communication (Receiving), Communication (Non-Verbal), Personal, Interpersonal, Team, Organizational.

Overall Composite Score. Overall composite score refers to the arithmetic mean of the eleven individual FourCe-PITO items.

Data analytic plan

Data Management

Data were evaluated for missing data, inclusion and exclusion, outliers, and distribution. On the LAR, "Not observed" was treated as missing data. If one or more of

the eleven FourCe-PITO items were marked as "Not observed," then the average score of all other items was imputed. If less than 90% of the data was available for an observation, then the observation was excluded.

Sample and Power

Participants were 501 female and male, active duty, officer, uniformed (i.e., Army, Navy, Air Force, Public Health Service), USU 4th year medical students who attended Operation Bushmaster in 2015, 2016, and 2017. Because the sample size is pre-determined, a sensitivity analysis using G*Power (46; 47) was conducted to determine the minimum effect size the study was sensitive to assuming a certain level of power. Utilizing the ANOVA: fixed effects test and assuming $\alpha = 0.05$, power $= 0.80$, total sample size $= 472$ (assumption made for missing or excluded data), and number of groups $= 3$ (cohorts), total effect size needed $= 0.11$ which is a small effect size.

Statistical Analyses

Specific Aim 1

The purpose of Specific Aim 1 was to determine female and male uniformed medical student leader performance at Operation Bushmaster according to the FourCe-PITO elements for three cohorts. To address this specific aim, two analyses of variance (ANOVA) were conducted with the dependent variable in one being the overall score on the LAR and the dependent variable on the other being the composite score. Additionally, multivariate analyses of variance (MANOVA) were conducted utilizing the eleven FourCe-PITO elements from the LAR. Cohort year was utilized as the independent variable for Hypothesis 1a and sex (female/male) as the independent variable for Hypothesis 1b.

CHAPTER 4: Results

DATA MANAGEMENT RESULTS

Variable Selection

The following independent and dependent variables were used in this doctoral research and were selected based on the criteria described in the Methods section.

Independent Variables

The independent variables were cohort and sex.

Dependent Variables

The dependent variables were derived from the Leadership Assessment Report (LAR) that is utilized at Operation Bushmaster to assess the medical students on their leader performance.

Leadership Assessment Report. Data from the LAR were analyzed to determine how many evaluations were provided for each student (See Appendix B, Table 1). Evaluations 1 – 4 were included because they had $\geq$ 85% completed data for the overall assessment score and for each individual item. Evaluations 5 – 11 were excluded.

Sample Size

Step One: Leadership Assessment Report

Individuals who did not have any evaluations via the LAR during Operation Bushmaster were excluded from the study. Of the 501 medical students in the sample, from the 2015, 2016, and 2017 Bushmaster years, 19 students did not have evaluations from the LAR during Operation Bushmaster; of which 10 (52.6%) were from the 2015

Bushmaster class and nine (47.4%) were from the 2016 Bushmaster class. This reduced the total sample size to 482. See Appendix B, Table 2a.

Step Two: Disenrollment status

Individuals who had been disenrolled were excluded from the study. Disenrolled individuals engage in relatively extreme violations of academic or ethical policies (106).

Of the 482 students remaining following exclusion of those without Bushmaster data, ten individuals were excluded: six individuals were disenrolled and four resigned from USU. Of these ten individuals, three (30%) disenrolled/resigned during preclerkship and seven (70%) disenrolled/resigned during clerkship; two were from Bushmaster year 2015 and eight were from Bushmaster year 2016; no students were disenrolled from the 2017 Bushmaster cohort. This reduced the total sample size to 472. See Appendix B, Table 2a.

DESCRIPTIVE DATA ANALYSES

Sample Characteristics

Of the 472 individuals remaining in the final sample, 33.9% (n = 160) were from the 2015 Bushmaster cohort, 32.4% (n = 153) were from the 2016 Bushmaster cohort, and 33.7% (n = 159) were from the 2017 Bushmaster cohort. The total sample was 34.5% female and 65.3% male. See Appendix B, Table 2b for characteristics of total sample and 2c for characteristics of females and males separately.

SPECIFIC AIM 1

The purpose of Specific Aim 1 was to determine female and male uniformed medical student leader performance at Operation Bushmaster for three cohorts.

Hypothesis 1a

Leader performance will be more highly rated for more recent cohorts of both female and male uniformed medical students.

An omnibus Analysis of Variance (ANOVA) was performed on the leadership performance data to compare each cohort year. An ANOVA was performed utilizing the overall assessment score and the overall composite score as the dependent variables and cohort year (i.e., 2015, 2016, and 2017) as the independent variable. A Multivariate Analysis of Variance (MANOVA) was performed utilizing the arithmetic mean of each of the individual items from the LAR as the dependent variables and cohort year as the independent variable.

Overall Assessment Score

Levene's Test of Equality of Error Variance was not significant; therefore, no corrections were applied. Overall ANOVA revealed no significant main effect of Bushmaster cohort year on assessment score of the LAR. See Appendix B, Table 3.

Overall Composite Score

Levene's Test of Equality of Error Variance was not significant; therefore, no corrections were applied. The overall ANOVA revealed no significant main effect of cohort year on overall composite score of the LAR. See Appendix B, Table 4.

Individual LAR items

The overall MANOVA did not reveal a significant multivariate effect for the LAR variables as a group in relation to cohort year. See Appendix B, Table 5.

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Hypothesis 1b

Leader performance will differ between female and male uniformed medical students.

An ANOVA was performed on the leadership performance data to compare females to males. An ANOVA was performed utilizing overall assessment score and overall composite score as the dependent variables and sex (i.e., female and male) as the independent variable. A MANOVA was performed utilizing the arithmetic mean of each of the individual items from the LAR as the dependent variables and sex as the independent variable.

Overall Assessment Score

Levene's Test of Equality of Error Variance was significant ($F = 9.66$, $p < 0.01$) see Appendix B, Table 6; therefore, an Independent Samples Kruskal-Wallis H test was utilized to examine overall assessment score in relation to females and males. The Kruskal-Wallis H test revealed no significant main effect of sex on overall assessment score ($X^2 = 0.45$, $p = 0.51$).

Overall Composite Score

Levene's Test of Equality of Error Variance was not significant; therefore, no corrections were applied. The overall ANOVA revealed no significant main effect of sex on overall composite score. See Appendix B, Table 7.

Individual LAR Items

The overall MANOVA did not reveal a significant multivariate effect for the LAR items as a group in relation to sex. See Appendix B, Table 8.

SPECIFIC AIM 2

Faculty Observer/Controller (O/C) Sample Characteristics

Eleven individuals who served as Operation Bushmaster faculty were interviewed: four (27%) females and six (73%) males, consistent with the percentages of total female and male faculty O/Cs (33% and 67%, respectively) (13). Faculty represented Army (55%), Air Force (18%), Navy (18%), and Civilians (9%). Military faculty ranged in rank from O-3 (Captain/Lieutenant) to O-7 (Brigadier General) and were Active Duty (70%), Reserves, Active Guard/Reserves, or Retired (each 10%). Interviews were conducted either in person (40%) or by telephone (60%).

Responses

See Appendix B, Table 9 for a table of interview questions, themes, and LAR descriptors. Responses to two overarching questions regarding the faculty O/Cs understanding of Operation Bushmaster and understanding of the LAR yielded similar responses across all respondents. Individuals indicated that the purpose of Operation Bushmaster was a leadership exercise (n = 9) and/or a military medicine exercise (n = 8). Some individuals reported one or the other, and other individuals reported both answers. O/Cs reported that the purpose of the LAR was an assessment (n = 6), a leadership assessment (n = 4), and/or a standardized assessment (n = 2). O/Cs were asked about their interpretation of each of the eleven individual LAR items (i.e., Ch, CpRS, CpLS, Cx, CmS, CmR, CmNV, P, I, T, O) and how they determined their ratings (i.e. U, S-, S, S+, O) of each of the LAR items.

Responses to how O/Cs interpreted individual LAR items were more varied compared to responses regarding their understanding of Bushmaster and the LAR. O/C responses regarding how they rated the medical students on LAR items were less varied than responses regarding interpretation. For all eleven LAR items, mission success/accomplishment was reported as a criterion to determine ratings. Finally, O/Cs were asked whether or not they thought the form captured a leader they admire; if they thought there was anything missing from the form; and if they think the FourCe-PITO framework is a good conceptual framework for leadership and its assessment. All O/Cs reported that the form captured qualities of a leader they admire; all O/Cs did not report anything missing from the form; all O/Cs indicated they thought the FourCe-PITO framework was a good conceptual framework for leadership and its assessment.

CHAPTER 6: Discussion

The purpose of this doctoral research was to evaluate leader performance data gathered across three cohort years of USU female and male medical students (2015 – 2017) during Operation Bushmaster, as assessed by the Leadership Assessment Report (LAR). This project involved collaboration between the LTCOS team and the Leader and Leadership Education and Development (LEAD) team to match demographic data with Operation Bushmaster data for the medical students in the three cohorts.

Dependent variables were drawn from the LAR: overall assessment score, character, role-specific competence, leadership skills competence, context, communication (sending), communication (receiving), communication (non-verbal), personal, interpersonal, team, organizational, and an overall composite which is an arithmetic mean of the individual LAR items. The current study was adequately powered.

FINDINGS

Specific Aim 1

Specific Aim 1 was to determine female and male uniformed medical student leader performance at Operation Bushmaster according to the FourCe-PITO elements for three cohorts.

Hypothesis 1a: The hypothesis that leader performance will be more highly rated for more recent cohorts of both female and male uniformed medical students was **not confirmed**. Leader performance did not differ by cohort year. It is noteworthy that the LEAD program began in Fall 2014; therefore, none of the cohorts in the present study receive the full four-year LEAD curriculum.

Hypothesis 1b: The hypothesis that leader performance will differ between female and male uniformed medical students was **not confirmed**. Leader performance did not differ by sex.

LIMITATIONS

Dependent Variables

There are some limitations with the study's dependent variables. With regard to the number of evaluations per student at Operation Bushmaster, most students (>85%) received four evaluations. Students should be evaluated in every role (i.e., platoon leader, assistant platoon leader, surgeon, ambulance team leader, combat stress control, preventive medicine) (95). Given that there are six roles in which students can be evaluated it is unclear why less than 100% of students from the 2015 – 2017 Bushmaster cohorts had six evaluations.

Reliability and Validity of the Leadership Assessment Report

All of the dependent variables for the current study were derived from the LAR. The potential limitation of having all dependent variables from this source is that the reliability and validity of the LAR has not yet been established. However, steps were taken during this study, and are ongoing outside of this study, to establish the psychometric properties of the LAR. Initial quantitative evaluations have been conducted with regard to establishing validity evidence for the LAR (10; 11). Additionally, students received between 0 – 11 LAR evaluations during Operation Bushmaster with the most receiving between 1 and 4 evaluations. Why there was variance in the number of evaluations students received is unclear and should be addressed in future Operation Bushmaster iterations.

Qualitative evaluations, conducted as part of this doctoral study, indicated that O/Cs believed that LAR captured elements of leaders they admired, did not believe that anything was missing from the LAR, and believed that the FourCe-PITO framework is a good conceptual framework for leadership and its assessment. O/C interviews identified a few potential limitations in the ways in which O/Cs are evaluating performance. All O/Cs interviewed indicated that mission success or accomplishment was an important criterion to determine a medical student's rating on each of the LAR items. However, interpretation of the items varied among faculty. Although LAR descriptors for each item were used by the O/Cs, additional information (e.g., from faculty experience or training) often supplemented LAR descriptors of what faculty used during evaluations. For example, some faculty O/Cs reported using past experiences as students at service academies, as faculty at service academies, and as platoon leaders in garrison and field settings to inform their judgements regarding leader performance. Regardless of the LAR item descriptors, mission success was a common standard by which O/Cs evaluated students.

Faculty and students need to fully understand the assessment instrument. If the LAR continues to be used or if another assessment instrument is implemented, the faculty need to understand how to use it and students need to understand the metric by which they are being evaluated.

Because the psychometric properties of the LAR have not yet been established, the present findings need to be taken with caution. For instance, it is not known whether the LAR is sensitive enough to detect differences between cohorts or genders. Gathering

validity evidence for the instrument and further verification of the findings are warranted in future studies.

FUTURE DIRECTIONS

To coincide with the aforementioned limitations and findings, future research might build upon the variables included in this study. Exploratory analyses could be conducted to attempt to identify variables that may be associated with leader performance ratings. Identification of any predictor variables (e.g., demographics, family status, military service, leadership experience, education) might be used to tailor leader and leadership education and development. Eventually, identification of predictor variables may help to improve leader and leadership assessment, education, and development of USU medical students and to inform the USU LEAD program regarding ways to enhance the program in order to meet the needs of students from varied backgrounds.

Future research should examine potential biases with regard to faculty ratings, personality, or cultural characteristics that may differ among individuals (e.g., Myers-Briggs Type Indicator) and that might emphasize different aspects of leadership styles and performance. Future research should also track post-medical school careers to examine leader performance and leadership achievements during post-medical school careers. It would be useful to compare leader performance at Operation Bushmaster with these additional post-medical school metrics. Additionally, it is important that data which might be useful in USU SOM analyses are provided to the LTCOS database (e.g., prior service).

It is noteworthy that all three cohorts that were included in the present study received only some of the leader and leadership education and development program at

USU and that there were no differences in leader performance in any overall or individual LAR item. Assessment data for the 2018 Bushmaster cohort (which was not available for the present study) and subsequent years would be worth studying in comparison with the cohorts included in the present study. Continued research would be valuable to evaluate and enhance the LEAD program and leader performance of USU medical students. The 2018 USU Leader and Leadership Education and Development Summit (10; 11) highlighted the need for meaningful and sound leader and leadership assessments in Undergraduate Medical Education. It also would be valuable to analyze the leader performance of individual students across time, including performance across days within a multiple day exercise such as Operation Bushmaster, over the four years at USU, and post-medical school.

Regarding the LEAD program, it might be useful to utilize the LAR at Operation Bushmaster as a tool to inform which leader elements to teach or emphasize in the four years of Undergraduate Medical Education at USU to better prepare medical students for Operation Bushmaster. For example, if students are consistently rated lower on leadership skills competence or context, then the LEAD program may want to emphasize those elements further during the leader and leadership curriculum. In addition, the LEAD program may want to emphasize and clarify these elements during the faculty O/C training prior to Operation Bushmaster.

Faculty O/C Interviews

Recruitment for O/C interviews was difficult. Response rates to emails sent was low with most O/Cs not responding to email inquiries. Future research which seeks to utilize O/Cs could be conducted at Operation Bushmaster to increase likelihood of O/C

participation and to minimize potential forgetting of information if O/Cs are interviewed

months to years after their participation at Operation Bushmaster.

Program Evaluation

Finally, a more thorough and systematic evaluation of the USU LEAD program

should be conducted to determine its effectiveness with regard to educating and

developing future leaders. Medical students received the LEAD program curriculum

during their pre-clerkship and clerkship years at USU, which may account for some

variance in performance at Operation Bushmaster. However, more research is needed.

Ideally, a randomized controlled trial would be conducted in which half of the

randomized sample received the LEAD program curriculum and the other half did not

and their leader performance at Operation Bushmaster was then compared. However, this

is not feasible; therefore, evaluating medical students from USU compared to medical

students from medical institutions either do not have a leadership program or one in

which many students do not participate, might be a viable alternative.

The fact that the LEAD program just began in 2014 and has evolved substantially

in substance and style of delivering curriculum highlights the value of continuing the

present study with upcoming cohorts of USU medical students. Collection of additional

data along with inclusion of educating faculty about the assessment tool is likely to

provide valuable information.

These findings indicate that leader performance in a military medical field

exercise can be assessed and these data can be analyzed in conjunction with LTCOS

databases. The present findings should be interpreted with caution because the cohorts

under study received only some of the USU LEAD program, the leadership assessment

report does not have substantial validity evidence, and the study was based on a modest

sample size. Follow-up studies are warranted to identify predictor variables that help to

improve leadership training of USU SOM medical students.

CHAPTER 7: Summary

The purpose of this study was to evaluate the leader performance rating data gathered across three cohort years (2015 – 2017) during Operation Bushmaster as assessed by the Leadership Assessment Report (LAR) and to compare leader performance ratings between sexes. This study did not confirm *a priori* hypotheses. Specifically, leader performance did not differ by cohort year or by sex. Continued examination of the variables that predict leader performance of medical students at Operation Bushmaster is important to improve leader and leadership education and development.

CHAPTER 8: Conclusion

Leader performance at a military field practicum can be evaluated. Variables collected from the Long-Term Career Outcome Study (LTCOS) and Uniformed Services University (USU) Leader and Leadership Education and Development (LEAD) program can be collected and analyzed together. This information could be used to refine the LEAD program at USU.

APPENDIX A: Figures

Figure 1: Summary of Differences between Leader Development and Leadership
Development (Day, 2000)

**Table 1.   Summary of Differences between Leader Development
and Leadership Development**

Comparison Dimension	Development Target	
	Leader	Leadership
Capital Type	Human	Social
Leadership Model	Individual	Relational
	Personal power	Commitments
	Knowledge	Mutual respect
	Trustworthiness	Trust
Competence Base	Intrapersonal	Interpersonal
Skills	Self-awareness	Social awareness
	Emotional awareness	Empathy
	Self confidence	Service orientation
	Accurate self image	Political awareness
	Self-regulation	Social skills
	Self-control	Building bonds
	Trustworthiness	Team orientation
	Personal responsibility	Change catalyst
	Adaptability	Conflict management
	Self motivation	
	Initiative	
	Commitment	
	Optimisim	

Figure 2: Uniformed Services University Military and Emergency Medicine Leadership
Model
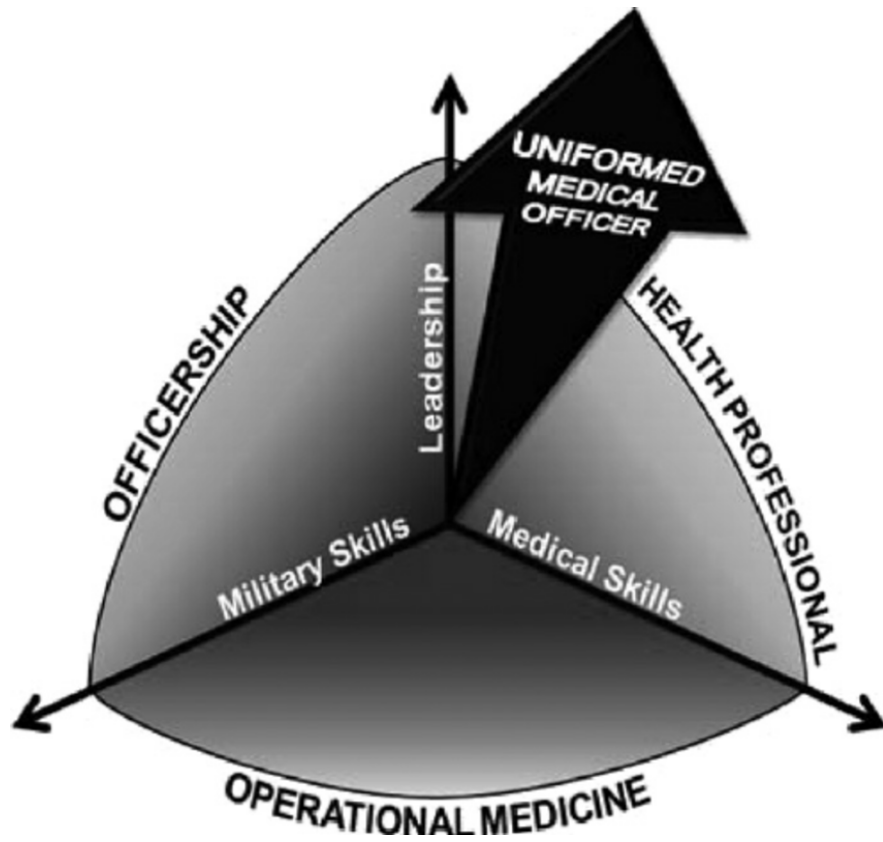
Figure 3: Expanded FourCe-PITO Framework

Figure 4: Military and Emergency Medicine Curriculum

Military and Emergency Medicine Curriculum

Leadership Focus Levels	Military Medical Practice and Leadership (MMPL) Pre-Clerkship				Emergency Medicine Clerkships		Advanced Military Medical Practice and Leadership BBB & Post-Clerkship				
Organizational											Leadership Capstone (Optional)
Team			Antietam Medical Staff Walk	Summer Operational Experience	MFP 102	Emergency Medicine Selective (Optional)	Emergency Medicine 4th Year Clerkship	MFP 201 "Gunpowder"	Operational Medicine Electives	Military Contingency Medicine	MFP 202 "Bushmaster"	
Interpersonal	Military Medical Practice & Leadership Activities	MFP 101										
Personal												

LEADERSHIP GROWTH AND DEVELOPMENT

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Figure 5: Leadership Assessment Report

FourCe-PITO Assessment

	U = Unsatisfactory	S- = Satisfactory (-)	S = Satisfactory	S+ = Satisfactory (+)	O = Outstanding	N/O = Not Observed
CHARACTER (CH) Self-awareness, confidence, humility, integrity, empathy	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
COMPETENCE (CP) (Role Specific Skills) Technical skills, role-specific knowledge, tactical expertise	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
SIM Case Skills (SRG ONLY) Technical skills specific to SIM task	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
COMPETENCE (CP) (Leadership Skills) Critical thinking, problem solving, judgment, decision making, emotional intelligence, influences and inspires others	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
CONTEXT (CX) Adapts to social situations, environments, and stress; situational awareness; demonstrates cultural sensitivity	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
COMMUNICATION (CM) (Sending) Conveys goals, thoughts, and ideas effectively; closed-loop communication; adjusts to context	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
COMMUNICATION (CM) (Receiving) Actively listens to others, recognizes and addresses misunderstandings	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
COMMUNICATION (CM) (Non-Verbal) Matches non-verbal to verbal communication; effective/appropriate use of facial expression and body language	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
PERSONAL (P) Self-aware, knowledgeable, effective communicator, situational awareness	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
INTERPERSONAL (I) Works effectively with other individuals; communicates difficult information effectively	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
TEAM (T) Works effectively with teams; promotes team cohesiveness; responds well to different contexts	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ
ORGANIZATIONAL (O) Understands vision and overall mission; smooth transition to meet leadership group	Ⓤ	Ⓦ	Ⓢ	Ⓟ	Ⓞ	Ⓝ

FOLD

COMMENTS:
Please use this space for CH, CP, CX, CM, P, I, T, O comments.
Be specific and add suggestions.

Additional Descriptions for Assessment

U= Unsatisfactory; many errors, negative influence on others, disregards feedback, unprofessional, gross poor judgment

S- = Satisfactory (-); some errors, poor response to feedback, some skills and knowledge do not meet expectations

S= Satisfactory; few errors, professional, positive response to feedback, skills and knowledge meet expectations, good judgment

S+= Satisfactory (+); meets all expectations of Satisfactory, positive influence on others, seeks feedback

O= Outstanding; role model, inspires others, distinguished performance, skills & knowledge exceed expectations

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Figure 6: Institutional Review Board (IRB) approval letter

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
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January 18, 2017

MEMORANDUM FOR STEVEN J. DURNING, M.D., PH.D, DEPARTMENT OF MEDICINE

SUBJECT: USU IRB #1 (FWA 00001628; DoD Assurance P60001) Amendment #9 Approval for Protocol KM83XV

Congratulations! The Amendment (#9) for your no more than minimal risk human subjects research protocol KM83XV, entitled "Long-Term Career Outcome Study (LTCOS) of USU Graduates" was reviewed and approved for execution on January 17, 2017 by Edmund G. Howe, M.D., J.D., Chair IRB #1 under the provision of 32 CFR 219.110(b)(2). This approval will be reported to the USU IRB #1 scheduled to meet on February 09, 2017.

The purpose of this study is to establish a database for conducting research related to quality assurance and evaluation of general academic programs and policies. Specifically, this database will enable academicians to monitor trainee selection, progress, and outcomes in graduate medical education and practice as required by regulatory agencies (LCME & MSCHE) as well as the BOR and the USUHS Dean's office. The specific aims of the project include: (1) addressing admissions, promotions & Deans' office quality assurance questions to help shape policies and programs; (2) address course and clerkship director programmatic evaluation questions regarding existing policies and programs to help shape course and/or clerkship innovation; (3) address LCME, Middle States, BOR questions regarding trainee & program performance; and, (4) serve as a data source for research projects explicitly relating to trainee performance. All analyses involve aggregated de-identified trainee data.

This amendment (#9) requests inclusion of a number of data fields to the LTCOS database related to the Bushmaster exercise and the (LEAD) program (USU Leadership and Education Development program). Faculty ratings of student performance in military medical leadership roles during the Bushmaster field exercise (collected since 2009) and simulated patient perception data (patient perception of each student's manner of interaction) will be included in the database. Additionally Myers-Briggs Type Indicator (MBTI) personality inventory data collected by the Department of Military and Emergency Medicine will be included in the data set for analysis. According to the investigators, all data will linked via designators but de-identified for analyses so that "no information will be revealed to identify students."

Authorization to conduct protocol KM83XV will automatically terminate on December 14, 2017. If you plan to continue data collection or analysis beyond this date, IRB approval for continuation is required. Please submit an application for continuing approval to the IRB Office 60 days prior to your termination date.

You are required to submit amendments to this protocol, changes to the informed consent document (if applicable), adverse event reports, and other information pertinent to human research for this project. No changes to this protocol may be implemented prior to IRB approval. If you have questions regarding this IRB action or questions of a more general nature concerning human participation in research, please contact Micah Stretch at 301-295-0819 or micah.stretch@usuhs.edu.

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Micah R. Stretch, M.A., J.D.
Senior IRB Coordinator

Figure 7: Leadership Assessment Report Interview

Date: .... Interviewer: ....

Thank you so much for meeting with me today. As I mentioned in my email, our conversation is relevant to my doctoral dissertation research in Clinical Psychology at USU. I am examining leadership performance of medical students at Operation Bushmaster. I'd like to ask you a few questions about the Leadership Assessment Report that's used at Operation Bushmaster to rate the medical students.

So before we begin, I have some information I need to collect, is that ok?:

Interviewee Name:

Title/Rank/Degree:

Department (if relevant):

Service (if applicable):

AD Status (if applicable):

How many times have you served as an Operation Bushmaster O/C:

If you can recall, what years and in what positions did you serve as Operation Bushmaster O/C:

Ok great, thank you.

What is your understanding of the purpose of Operation Bushmaster?

Anything else?

And what is your understanding of the purpose of the Leadership Assessment Report?

Anything more?

Thank you. Now, I want to discuss the assessment tool in more detail. Here is a copy for your reference.

So, for each of the leadership elements on the assessment tool, I am going to ask you two things: 1) how do you interpret each item, and 2) how do you determine your rating of the medical students on each item.

Now, starting with **Character**, how do you interpret what that means?

How did you judge the medical students on **Character** to determine their rating?

Anything more?

Ok, for **Role-Specific Competence**, how do you interpret what that means?

How did you judge the medical students on **Role-Specific Competence** to determine their rating?

Anything more?

For **Context**, how do you interpret what that means?

How did you judge the medical students on **Context** to determine their rating?

Anything more?

For Communication – Sending, how do you interpret what that means?

How did you judge the medical students on Communication – Sending to determine their rating?

Anything more?

For Communication – Receiving, how do you interpret what that means?

How did you judge the medical students on Communication – Receiving to determine their rating?

Anything more?

For Communication – Non-verbal, how do you interpret what that means?

How did you judge the medical students on Communication – Non-verbal to determine their rating?

Anything more?

For Personal, how do you interpret what that means?

How did you judge the medical students on Personal to determine their rating?

Anything more?

For Interpersonal, how do you interpret what that means?

How did you judge the medical students on Interpersonal to determine their rating?

Anything more?

For Team, how do you interpret what that means?

How did you judge the medical students on Team to determine their rating?

Anything more?

For Organizational, how do you interpret what that means?

How did you judge the medical students on Organizational to determine their rating?

Anything more?

Ok, thank you so much.

Now, how did you determine the overall assessment score?

Anything else?

APPENDIX B: Tables

Table 1: Response Completion for Leadership Assessment Report (LAR)

LAR Item	Freq; %; N = 472	LAR Item	Freq; %; N = 472
Evaluation 1		**Evaluation 4**	
Assess	472; 100%	Assess	447 (94.7%)
#1 Ch	467 (98.9%)	#1 Ch	444 (94.1%)
#2 CpRS	463 (98.1%)	#2 CpRS	432 (91.5%)
#3 CpLS	462 (97.9%)	#3 CpLS	437 (92.6%)
#4 Cx	459 (97.2%)	#4 Cx	439 (93.0%)
#5 CmS	468 (99.2%)	#5 CmS	444 (94.1%)
#6 CmR	468 (99.2%)	#6 CmR	445 (94.3%)
#7 CmNV	467 (98.9%)	#7 CmNV	443 (93.9%)
#8 P	469 (99.4%)	#8 P	446 (94.5%)
#9 I	470 (99.6%)	#9 I	444 (94.1%)
#10 T	467 (98.9%)	#10 T	443 (93.9%)
#11 O	430 (91.1%)	#11 O	410 (86.9%)
Evaluation 2		**Evaluation 5**	
Assess	471 (99.8%)	Assess	381 (80.7%)
#1 Ch	461 (97.7%)	#1 Ch	380 (80.5%)
#2 CpRS	460 (97.5%)	#2 CpRS	378 (80.1%)
#3 CpLS	460 (97.5%)	#3 CpLS	377 (79.9%)
#4 Cx	453 (96.0%)	#4 Cx	374 (79.2%)
#5 CmS	462 (97.9%)	#5 CmS	379 (80.3%)
#6 CmR	461 (97.7%)	#6 CmR	379 (80.3%)
#7 CmNV	456 (96.6%)	#7 CmNV	376 (79.7%)
#8 P	468 (99.2%)	#8 P	381 (80.7%)
#9 I	469 (99.4%)	#9 I	378 (80.1%)
#10 T	467 (98.9%)	#10 T	380 (80.5%)
#11 O	435 (92.2%)	#11 O	356 (75.4%)
Evaluation 3		**Evaluation 6**	
Assess	469 (99.4%)	Assess	211 (44.7%)
#1 Ch	468 (99.2%)	#1 Ch	207 (43.9%)
#2 CpRS	464 (98.3%)	#2 CpRS	206 (43.6%)
#3 CpLS	465 (98.5%)	#3 CpLS	206 (43.6%)
#4 Cx	465 (98.5%)	#4 Cx	207 (43.9%)
#5 CmS	469 (99.4%)	#5 CmS	208 (44.1%)
#6 CmR	467 (98.9%)	#6 CmR	209 (44.3%)
#7 CmNV	463 (98.1%)	#7 CmNV	206 (43.6%)
#8 P	468 (99.2%)	#8 P	206 (43.6%)
#9 I	468 (99.2%)	#9 I	209 (44.3%)
#10 T	462 (97.9%)	#10 T	209 (44.3%)
#11 O	418 (88.6%)	#11 O	193 (40.1%)

Response Completion for Leadership Assessment Report (LAR) continued

LAR Item	Freq; %; N = 472	LAR Item	Freq; %; N = 472
Evaluation 7		**Evaluation 10**	
Assess	90 (19.1%)	Assess	2 (0.4%)
#1 Ch	90 (19.1%)	#1 Ch	2 (0.4%)
#2 CpRS	87 (17.8%)	#2 CpRS	2 (0.4%)
#3 CpLS	86 (18.2%)	#3 CpLS	2 (0.4%)
#4 Cx	86 (18.2%)	#4 Cx	2 (0.4%)
#5 CmS	86 (18.2%)	#5 CmS	2 (0.4%)
#6 CmR	88 (18.6%)	#6 CmR	2 (0.4%)
#7 CmNV	87 (17.8%)	#7 CmNV	2 (0.4%)
#8 P	87 (17.8%)	#8 P	2 (0.4%)
#9 I	89 (18.9%)	#9 I	2 (0.4%)
#10 T	89 (18.9%)	#10 T	2 (0.4%)
#11 O	85 (18.0%)	#11 O	2 (0.4%)
Evaluation 8		**Evaluation 11**	
Assess	38 (8.1%)	Assess	1 (0.2%)
#1 Ch	38 (8.1%)	#1 Ch	2 (0.4%)
#2 CpRS	37 (7.8%)	#2 CpRS	2 (0.4%)
#3 CpLS	38 (8.1%)	#3 CpLS	2 (0.4%)
#4 Cx	38 (8.1%)	#4 Cx	2 (0.4%)
#5 CmS	38 (8.1%)	#5 CmS	2 (0.4%)
#6 CmR	38 (8.1%)	#6 CmR	2 (0.4%)
#7 CmNV	38 (8.1%)	#7 CmNV	2 (0.4%)
#8 P	38 (8.1%)	#8 P	2 (0.4%)
#9 I	38 (8.1%)	#9 I	2 (0.4%)
#10 T	38 (8.1%)	#10 T	2 (0.4%)
#11 O	37 (7.8%)	#11 O	2 (0.4%)
Evaluation 9			
Assess	12 (2.5%)		
#1 Ch	12 (2.5%)		
#2 CpRS	11 (2.3%)		
#3 CpLS	12 (2.5%)		
#4 Cx	12 (2.5%)		
#5 CmS	12 (2.5%)		
#6 CmR	12 (2.5%)		
#7 CmNV	12 (2.5%)		
#8 P	12 (2.5%)		
#9 I	12 (2.5%)		
#10 T	12 (2.5%)		
#11 O	12 (2.5%)		

Table 2a: Descriptive Statistics for Excluded Medical Students

	Descriptive Statistics for Excluded Medical Students	
	No LAR data (N=19)	Disenrolled (N=10)
	Frequency (%)	Frequency (%)
Bushmaster class	2015: 10 (52.6%) 2016: 9 (47.4%) 2017: 0 (0%)	2015: 2 (20%) 2016: 8 (80%) 2017: 0 (0%)
Gender	Female: 3 (15.8%) Male: 16 (84.2%)	Female: 4 (40%) Male: 6 (60%)

Table 2b: Descriptive Statistics for Included Medical Students

	Descriptive Statistics for Included Medical Students
	Total Sample (N=472)
	Frequency (%)
Bushmaster class	2015: 160 (33.9%) 2016: 153 (32.4%) 2017: 159 (33.7%)
Gender	Female: 163 (34.5%) Male: 308 (65.3%) Unknown: 1 (0.2%)

Table 2c: Descriptive Statistics for Female versus Male Students

	Descriptive Statistics for Included Medical Students (N=472)	
	Female (n=163)	Male (n=308)
	Frequency (%)	Frequency (%)
Bushmaster class	2015: 59 (36.2%) 2016: 53 (32.4%) 2017: 51 (31.3%)	2015: 101 (32.8%) 2016: 100 (32.5%) 2017: 107 (34.7%)

Table 3: Assess by Cohort Year: ANOVA, Mean, SD

Source	SS	df	MS	F	Sig.	Pt Eta^2	Power
Class	.209	2	.104	.627	.535	.003	.155
Error	78.069	469	.166				

Cohort	M	SD
2015	3.37	0.43
2016	3.37	0.43
2017	3.33	0.37
Total	3.36	0.41

Table 4: Comp by Cohort Year: ANOVA, Mean, SD

Source	SS	df	MS	F	Sig.	Pt Eta^2	Power
Class	.060	2	.030	.305	.738	.001	.098
Error	46.119	469	.098				

Class	M	SD
2015	3.35	0.33
2016	3.37	0.33
2017	3.34	0.28
Total	3.35	0.31

Table 5: Individual LAR items by Cohort: MANOVA, Mean, SD

Overall MANOVA of Individual LAR Items

Effect	Value	F	Hyp df	Err df	Sig.	Pt Eta^2	Power
Cohort Wilk's Λ	.933	1.464	22	918	.077	.034	.949

Overall MANOVA of Individual LAR Items Between-subject Effects

Source	DV	SS	df	MS	F	Sig.	Pt Eta^2	Power
Cohort	Ch	.432	2	.216	1.344	.262	.006	.290
	CpRS	.094	2	.047	.280	.756	.001	.094
	CpLS	.035	2	.017	.085	.918	.000	.063
	Cx	.081	2	.040	.296	.744	.001	.097
	CmS	.105	2	.053	.280	.756	.001	.094
	CmR	.032	2	.016	.125	.882	.001	.069
	CmNV	.185	2	.093	.844	.431	.004	.195
	P	.684	2	.342	2.390	.093	.010	.482
	I	.719	2	.359	2.452	.087	.010	.493
	T	.012	2	.006	.035	.966	.000	.055
	O	.046	2	.023	.136	.873	.001	.071
Error	Ch	75.40	469	.161				
	CpRS	78.80	469	.204				
	CpLS	95.55	469	.204				
	Cx	64.03	469	.137				
	CmS	88.10	469	.188				
	CmR	60.55	469	.129				
	CmNV	51.53	469	.110				
	P	67.14	469	.143				
	I	68.73	469	.147				
	T	83.95	469	.179				
	O	79.36	469	.169				

Individual LAR Item x Cohort Year: M and SD

LAR Item	Class	M	SD	LAR Item	Class	M	SD
Ch	2015	3.49	0.42	CmNV	2015	3.25	0.35
	2016	3.48	0.41		2016	3.27	0.34
	2017	3.42	0.37		2017	3.22	0.29
CpRS	2015	3.23	0.43	P	2015	3.40	0.39
	2016	3.26	0.43		2016	3.33	0.39
	2017	3.22	0.36		2017	3.32	0.36

CpLS	2015	3.29	0.48		I	2015	3.38	0.40
	2016	3.27	0.45			2016	3.44	0.41
	2017	3.28	0.43			2017	3.34	0.34
Cx	2015	3.28	0.39		T	2015	3.37	0.42
	2016	3.29	0.38			2016	3.37	0.46
	2017	3.26	0.33			2017	3.36	0.38
CmS	2015	3.26	0.48		O	2015	3.25	0.43
	2016	3.30	0.43			2016	3.26	0.44
	2017	3.27	0.38			2017	3.27	0.36
CmR	2015	3.33	.037					
	2016	3.35	.039					
	2017	3.34	0.32					

Table 6: Assess by Sex: ANOVA, Mean, SD

Source	SS	df	MS	F	Sig.	Pt Eta^2	Power
Sex	.199	1	.199	1.193	.275	.003	.193
Error	78.078	469	.166				

Sex	M	SD
Female	3.39	0.46
Male	3.34	0.38
Total	3.36	0.41

Table 7: Comp by Sex: ANOVA, Mean, SD

Source	SS	df	MS	F	Sig.	Pt Eta^2	Power
Sex	.207	1	.207	2.116	.146	.004	.306
Error	45.949	469	.098				

Sex	M	SD
Female	3.38	0.34
Male	3.34	0.30
Total	3.35	0.31

Table 8: Individual LAR Items by Sex: MANOVA, Mean, SD

Overall MANOVA of individual LAR items

Effect	Value	F	Hyp df	Err df	Sig.	Pt Eta^2	Power
Sex Wilk's Λ	.965	1.510	11	459	.124	.035	.784

Overall MANOVA of individual LAR items between-subject effects

Source	DV	SS	df	MS	F	Sig.	Pt Eta^2	Power
Sex	Ch	.351	1	.351	2.188	.140	.005	.315
	CpRS	.088	1	.088	.526	.469	.001	.112
	CpLS	.157	1	.157	.773	.380	.002	.142
	Cx	.074	1	.074	.542	.462	.001	.114
	CmS	.193	1	.193	1.027	.311	.002	.173
	CmR	.145	1	.145	1.124	.290	.002	.185
	CmNV	.189	1	.189	1.717	.191	.004	.258
	P	.254	1	.254	1.766	.185	.004	.264
	I	.383	1	.383	2.604	.107	.006	.364
	T	.267	1	.267	1.498	.222	.003	.231

	O	.455	1	.455	2.706	.101	.006	.375
Error	Ch	75.268	469	.160				
	CpRS	78.806	469	.168				
	CpLS	95.206	469	.203				
	Cx	64.035	469	.137				
	CmS	88.008	469	.188				
	CmR	60.429	469	.129				
	CmNV	51.525	469	.110				
	P	67.448	469	.144				
	I	68.919	469	.147				
	T	83.676	469	.178				
	O	78.889	469	.168				

Individual LAR Item x Sex: M and SD

LAR Item	Sex	M	SD	LAR Item	Sex	M	SD
Ch	Female	3.50	0.44	CmNV	Female	3.28	0.35
	Male	3.45	0.38		Male	3.23	0.32
CpRS	Female	3.26	0.43	P	Female	3.38	0.41
	Male	3.23	0.40		Male	3.33	0.36
CpLS	Female	3.25	0.49	I	Female	3.42	0.42
	Male	3.29	0.43		Male	3.36	0.36
Cx	Female	3.29	0.40	T	Female	3.40	0.48
	Male	3.27	0.35		Male	3.35	0.39
CmS	Female	3.30	0.50	O	Female	3.30	0.44
	Male	3.26	0.39		Male	3.24	0.40
CmR	Female	3.36	0.40				
	Male	3.33	0.33				

Table 9: Interview Questions, Themes, and LAR Descriptors

Question	Theme (frequency)	LAR Descriptors
Understanding Bushmaster	Leadership (9) Military Medicine (8)	N/A
Understanding of LAR	Standardized Assessment (2) Leadership Assessment (4) Assessment (6)	N/A
Character Interpretation	Carries self (3) Integrity (4) Situational Awareness (1) Interpersonal Interactions (2) Courage (1) Commitment (1) Humility (3) Confidence (3) Empathy (2) Performance under stress (2) Response to feedback (1) Personality (1) Personal values (1) Mores (1) Drivers (1) Motivation (1) Self-aware (3)	Self-awareness Confidence Humility Integrity Empathy
Role-Specific Competence Interpretation	Application of SOM knowledge (1) Knowledge and skills of specific role (5) Skills of specific role (1) Role performance (1) Standards (1) Mission success (2) Recognize situation (1)	Technical skills Role-specific knowledge Tactical expertise
Leadership Skills Competence Interpretation	Decision making (1) Interactions with others (1) Decisiveness (1) Critical Thinking (1) Communication (2) Emotional Intelligence (2) KSA + transcendent leadership skills (1) Mission success (1) Inspiring others (1) Problem solving (1) Utilize physical and human resources (1) Understanding of and communicating effectively with team members (1) Troop leading procedures (2) Planning (1) Communication (1) Values (1) Teamwork (1) Influence others to achieve mission (1)	Critical thinking Problem solving Judgment Decision making Emotional intelligence Influences and inspires others

	Organization (1)	
Context Interpretation	Ability to adapt (1) Situational adjustment (2) Cultural adjustment (2) Understanding environment (1) Situational awareness (3) Social interactions (1) Emotional intelligence (1) Communication (1) Situational awareness of internal and external environment (1) Understanding mission (1)	Adapts to social situations, environments, and stress Situational awareness Demonstrates cultural sensitivity
Communication (Sending) Interpretation	Oral communication emphasized (1) Closed loop communication (2) Clear communication (2) Clarity of providing information of up from and down "chain" (1) Adjusting to context (1) Ensure understanding (2) Thoughts and intentions conveyed (1) Efficient communication (1) Brevity (1) Effective communication (1) Clear and concise (1)	Conveys goals, thoughts, and ideas effectively Closed-loop communication Adjusts to context
Communication (Receiving) Interpretation	Understanding of information received (2) Utilization of information received (1) Accuracy of information received (1) Closed loop communication (1) Listening (1) Willingness to receive information (1) Response to communication (1) Listen without communication (1) Reception (1) Acknowledgement of communication (1)	Actively listens to others Recognizes and addresses misunderstandings
Communication (Non-Verbal) Interpretation	Participative listening (1) Body language (7) Tone of voice (2) Stature (1) Appearance (1) Facial expression (3) Intonation (1) Body posture (1) Interpersonal communication (1)	Matches non-verbal to verbal communication Effective/appropriate use of facial expression and body language
Personal Interpretation	Self-awareness (7) Whole picture of the individual (1) Situational awareness (1) Comfortable with self (1) Preparation (1) Motivated behavior (1)	Self-aware Knowledgeable Effective communicator Situational awareness

	Mores (1)	
	Character (1)	
Interpersonal Interpretation	Dyad interactions (2)	Works effectively with other individuals Communicates difficult information effectively
	One or two others (2)	
	Communication with others (2)	
	Are they successful? (1)	
	Self-awareness (1)	
	Communication (1)	
	Adapting (1)	
	Use peers (1)	
	Reactions to another individual (1)	
	Communication between individuals (1)	
Team Interpretation	Multiple dyads (1)	Works effectively with teams Promotes team cohesiveness Responds well to different contexts
	Groups (2)	
	Platoon (1)	
	Communication (1)	
	Morale (1)	
	Planning (1)	
	Willingness to take feedback (1)	
	Teem effectiveness (2)	
	Mission success (1)	
	Mission effectiveness (1)	
Organizational Interpretation	Big picture (5)	Understands vision and overall mission Smooth transition to next leadership group
	Brigade level (1)	
	Platoon and larger (1)	
	Knowing the mission and goals (3)	
	Organization (1)	
	Communication (1)	

Question	Theme (frequency)
Character Rating	Personal Experience (1)
	Formal Education (1)
	Used descriptors (4)
	Motivate (1)
	Inspire (1)
	Understanding character (1)
	Mission success (2)
	Performance (1)
	Willingness to learn (1)
Role-Specific Competence Rating	Applying relevant K & S (4)
	Technical and tactical application of relevant KSAs (1)
	Performance in specific role (1)
	Mission success (3)
	Communication (1)
Leadership Skills Competence Rating	Performance on descriptors (2)
	Mission success (7)
	Mission understanding (1)
	Mission performance (2)
	Communication (2)
Context Rating	Situational adjustment (5)
	Situational awareness (3)

	Mission accomplishment (2) Motivating others (1) Response to O/C questions (2)
Communication (Sending) Rating	Observation (3) Clear communication (2) Effective communication (1) Mission accomplishment (1) Clear and closed loop communication (1) Performance (1) Responses of receivers (1) Succinctness (1)
Communication (Receiving) Rating	Responses to information received (3) Demonstration of understanding of information (1) Asking questions (1) Mission success (1) Adjusting behavior based on information received (3) Receptive to communication (1) Accurate recounting of information received (1)
Communication (Non-Verbal) Rating	Appropriate nonverbal communication (2) Hand signaling (1) Outwardly expressed non-verbal communication (1) Mission success (2) Observation (2) Watch and determine appropriateness of body language (1) Responses between sender and receiver (1)
Personal Rating	Performance (3) Performance under stress (2) Performance and attitude (2) Mission accomplishment (2) Observation (1) Self-awareness (1)
Interpersonal Rating	Observation (8) Mission accomplishment (1) Dyad performance (1) Asking for reactions from others (1)
Team Rating	Performance of the team (5) Mission success (1) Attitude and enthusiasm of the team (1) Encourage feedback (1) Attempt to improve performance (1) Mission effectiveness (1)
Organizational Rating	Performance within context of larger mission (4) Mission success (2) Mission accomplishment (1) Continuity of leadership (1) Appropriate selection and use of information relevant to overall and unit goals (1) Performance of upward communication (1)

Overall Assessment Rating	Plurality of LAR scores (1) Overall encompassing score considering individual scores, but weighted based on relevance of individual items (1) Weighting of items (2) Mission accomplishment (1) Gestalt (1) Consideration of performance in all elements (3) Majority of individual items (1)
Does the form capture a leader you admire?	Yes (11)
Is there anything missing on the form?	No (11)
Do you think the FourCe-PITO framework is a good conceptual framework for leadership?	Yes (11)

APPENDIX C: Additional Background

Military Health System (MHS)

The importance of the USU is best captured within the larger scope of the MHS. The health of military personnel is critical to readiness and battlefield performance. The U.S. requires healthy soldiers, sailors, Marines, and airmen to fight and win wars. Systems and policies to promote the health of service members, therefore, are key national security functions as well as central personnel matters. Maintaining the health of each individual service member requires another personnel infrastructure—spanning uniformed service members, civilians, and contractors—to offer everything from nutritious meals to medical services.

The U.S. MHS is one of the largest health care providers in the world providing care to more than 9.7 million beneficiaries, including service members, retirees, and their families (111). The direct care components of the MHS includes 56 hospitals, 361 ambulatory care clinics, and 249 dental clinics being operated by more than 60,000 civilians and 86,000 military personnel, including graduates of USU (111). The nonpartisan Congressional Budget Office (CBO) indicated that the Department of Defense (DoD) spent $52 billion for health care services for service members, retirees, and their families in 2012 (25). This amount represents a 130% increase in spending within the MHS since 2000 and an increase in the DoD's spending budget from 6% to nearly 10%. Additionally, the CBO estimates that military health care spending will increase to 11% of the DoD's budget by the year 2028 (25; 96).

The health care received by beneficiaries covers virtually any procedure, assessment, or intervention with annual out-of-pocket expenses capped at $1,000 for

active duty and reserve families, and $3,000 for retirees (25; 62). Additionally, the MHS

supports all health care requirements for every military mission, operation, and

deployment anywhere in the world. "The MHS is without equal in terms of the number of

individuals provided services, the variety of services offered, and the physical

environments where the MHS routinely operates - from McMurdo Station, Antarctica, to

the American military astronauts living aboard the International Space Station" (76). The

unparalleled scope of operations within the MHS combined with an ambiguous financial

future underscores the need for responsible, accountable, and adaptive leaders. This

thought is echoed among civilian health care providers who indicate that addressing the

"leadership gap," (i.e., the lack of formal leader and leadership development programs

and assessments), is imperative to improve health care efficiency and curtail rising health

care costs (14).

Health care costs in the MHS have increased nearly 300% since 2001 (65; 96)

which far outpaced the private sector which grew by an estimated 100% over the same

period (65). As one government official said, "Today, we're on the path in the

Department of Defense to turn it into a benefits company that may occasionally kill a

terrorist" (63). The rising cost of the MHS cannot be continued. In the U.S., the

imperative to deliver quality care while cutting costs and eliminating system variation

requires thoughtful and effective leadership.

Physician residents training in primary area programs today still provide the

majority of inpatient care for children and adults, but they do so with one-fifth less

training time since the 80-hour work week became the standard a decade ago (compared

to the previous "standard" 100-hour work week)(19). As the inpatient tally drops,

residents in training may have decreased overall patient experience because of diminished patient exposure. At the same time, the care of critically ill hospitalized patients has become more complex (50). Designing safe systems to care for these complex patients with less experienced personnel requires leadership.

The days of physician house calls and the omniscient, "one-stop-shop docs" are gone. Increasingly, patients in hospitals and clinics require multi- and inter-disciplinary care teams of professionals from various disciplines to assure the highest outcomes (19; 50; 54). Today's healthcare involves a team of primary care physicians, nurses, specialists, physical therapists, occupational therapists, psychologists, dentists, and others. Leading these teams requires professionals who can effortlessly move back and forth from vertical to horizontal leadership roles while other providers take the lead during different aspects of patient care. Juggling to attain balance between complex and dynamic care team scenarios requires well-honed leadership skills.

Additionally, joint uniformed health care is becoming commonplace throughout the MHS as a result of fiscal and political realities that over a decade ago would have seemed implausible. The most visible example was the 2011 merger of Walter Reed Army Medical Center and the National Naval Medical Center to create one of the largest military hospitals in the world – the Walter Reed National Military Medical Center (28). Additional examples involving the Army and the Air Force include the merger of Brooke Army Medical Center and Wilford Hall Medical Center to create the San Antonio Military Medical Center. Today, an Army surgeon may lead a team composed of Navy corpsmen and Air Force nurses in a joint military treatment facility (MTF) that would have been difficult to imagine several years ago. This joint military medical model is

even more striking in Army, Navy, and Air Force enlisted medical training which consolidated into a single tri-service Medical Education and Training Campus (METC) at Joint Base San Antonio - Fort Sam Houston, Texas in 2011, and since becoming fully operational, graduates about 20,000 Army, Navy, Air Force, and Coast Guard students annually from one of the more than 50 entry-level and advanced medical career programs (89).

Further, healthcare delivered via interprofessional healthcare teams has been found to improve patient satisfaction, enhance collaborative behaviors, reduce clinical error rates, and streamline management of care delivery (86; 87). The aforementioned positive benefits of interprofessional healthcare teams were attained due to training via interprofessional education; not by simply requiring different professionals to work together but by training teams to work together (86; 87). Varpio et al (113) found from a review of the literature that military interprofessional healthcare teams were successful when there was: (a) clear, continuous communication between individual members of the team and across the team as a whole, (b) supportive team environments, and (c) shared role understanding and equity among team members. Additionally, positive leadership and the importance of a clear mission were cited as important elements of fostering clear communication and establishing a supportive team environment (67; 113).

In this increased collaborative and interprofessional environment, the effective uniformed health care leader must inspire, influence, and lead diverse groups of people working toward common goals despite different organizational cultures, biases, experiences, varying levels of motivation, and varying ranks. Developing leaders who can adapt and thrive in this collaborative and ever-changing environment requires new

approaches to training, teaching, and assessment from a Joint-Service health care perspective. Fortunately, there is a long-established uniformed academic health care institution that is uniquely capable of directly answering the gaps in health care leader and leadership development: The Uniformed Services University of the Health Sciences.

Uniformed Services University of the Health Sciences (USU)

USU was created by Congressional charter in 1972 (107). However, the idea of USU began much earlier, following the end of World War II when a mass exodus of individuals from the Armed Forces left the services with a diminishing number of individuals in the Medical Corps (107). Debate ensued regarding the merits of establishing such a program and it was not until the end of the draft (announced in 1972 to go into effect in January, 1973) that the military realized that it could no longer rely on draftees to provide medical care to troops and their families. This end of a reliable supply of physicians resulted in a renewed focus on the future of military medicine. Congressman F. Edward Hébert was at the forefront of championing the creation of USU and nicknamed the university "The West Point for Doctors" (107). In 1972, Congressman Hébert lobbied for this military medical school and, with support from then Secretary of Defense Melvin Laird, legislation to create USU was passed by Congress and President Richard Nixon signed the university into law on September 21, 1972 (107). More than 5,000 physicians have graduated since USU opened its doors in 1976, many of whom have occupied or currently occupy top uniformed medical leadership positions around the world (3; 109).

The mission of USU is to educate, train, and prepare uniformed services health professionals, scientists, and leaders to support the Military and Public Health Systems,

the National Security and National Defense Strategies of the U.S., and the readiness of the Uniformed Services (107). To accomplish this mission, USU trains uniformed student physicians, advanced practice nurses, and medical scientists in the four uniformed health care agencies (i.e., Army, Navy, Air Force, and Public Health Service).

USU's F. Edward Hébert School of Medicine (SOM) – "America's Medical School" - focuses on health promotion, disease and injury prevention, and readiness. The school has a year-round, four-year curriculum that is nearly 700 hours longer than any other U.S. medical school (107; 117). In addition to disease prevention and health promotion, these extra hours focus on epidemiology, tropical medicine, emerging and infectious diseases, military and emergency medicine, leadership, field exercises, disaster medicine and other subjects that relate to the requirements of career-oriented uniformed physicians (117). In addition to receiving an accredited education in medicine (i.e., M.D. degree) or medical science, uniformed students at USU also receive joint-service and service-specific military leadership training designed to develop them as military medical officers and leaders. When compared to other sources of uniformed providers (e.g., Health Professions Scholarship Program [HPSP], direct commission), USU graduates serve longer in the MHS (average years of service by USU medical graduates = 20 years vs. 7 years for HPSP graduates) and often occupy senior levels of MHS leadership (36; 38; 39).

Post-medical School Service

USU was founded as a uniformed health care leadership academy. Since its creation in 1972, USU alumni have held senior positions of clinical and administrative leadership (3). A 2013 analysis of Navy physicians found that although USU graduates

represent a consistent 10 – 14% of annual accessions, USU alumni represent 27% of commanding officer and executive officer billets – positions that are the pinnacle of military medical leadership (32). Additionally, the proportion of Navy leadership positions held by USU graduates has continued to trend upward over the last decade (32). Since 1976, 31 graduates of USU have attained the rank of flag officer, including two uniformed Surgeon Generals, two Deputy Surgeon Generals, and the Surgeon General of the Canadian Armed Forces (3; 105).

Physician, Officer, Leader

According to LTG(R) Eric Schoomaker, M.D., Ph.D., 42nd Surgeon General of the U.S. Army (2007 – 2011), leadership is inherent in officership (93). Further, LTG(R) Schoomaker noted that in the nation's current all-volunteer military, when individuals make the decision to become officers and physician-officers, they are taking on a responsibility to attend to needs of the nation and the personnel for whom they are responsible (93). Attending to these needs involves a leadership perspective that includes care for individuals and for the fighting force. Physicians have a responsibility beyond one-on-one patient care in which leadership is paramount (93).

Leaders must adapt to various contexts and to think on the tactical, operational, and strategic levels. To effectively promote health, wellness, and total force fitness, physicians must become competent, capable leaders. In addition to Competencies (knowledge and skills) specific to physicians, uniformed physician leaders must develop transcendent leadership Competencies (e.g., decision making, problem solving, emotional intelligence) and Communication skills, verbal and nonverbal, appropriate for various Contexts (e.g., day or night, garrison or deployed, jungle or desert, non-stress or stressed)

(19). Health care professionals need to develop these vital leadership skills to care for our Nation's Warriors and their families (54; 93).

Leader and Leadership Training at USU

History

Prior to 2014, USU's Department of Military and Emergency Medicine (MEM) provided training in leadership development through: formal classroom instruction about the art of military briefing; military medical history lectures and experience at Operation Bushmaster – a four-day field exercise where fourth year medical students and advanced practice nurses perform field medicine and small unit tactics (95; 106). Although these activities met the standard for leadership education and development throughout the first several decades of USU's establishment, political, financial, and leadership challenges of the MHS brought renewed focus on USU's important role to develop and assess uniformed health care leaders.

In 2014, at the inaugural meeting for USU's Strategic Framework task force, the Department of Defense (DoD) Assistant Secretary of Defense for Health Affairs, Dr. Jonathon Woodson, challenged the University to embrace leadership as a key element of its mission (81). Dr. Woodson indicated that "USU must lead and excel in Leadership Training" and he envisioned USU as the "leadership academy of the Military Health System" (81). Dr. Woodson outlined three core requirements for this activity: (a) create officers who are the foundation for the future, (b) establish an unquestioned set of values, and (c) outpace any institution in the world in leadership training (81). Echoing this sentiment, the President of USU, Dr. Charles Rice oversaw the USU Strategic Framework 2014 – 2018 which stated:

By the end of [calendar year] 2018, the Uniformed Services University of the

Health Sciences will be widely recognized as the pre-eminent national educational

institution for the creation of career uniformed services leaders in the health

sciences who are prepared to serve the nation and support the readiness of the

uniformed services. USU will be a central hub for uniformed services-related

health education and training, research and scholarship, **leadership education**

and training, and national security as it relates to global health. Each USU

graduate will be a health & health care professional **and leader** prepared with an

outstanding health education, interprofessional health training, **leadership**

training, and a deep and abiding commitment to selfless service, the uniformed

services ethos, and the security of the U.S. (104) [emphasis added].

The emphasis on leadership development was accompanied by the establishment of the

USU Leader and Leadership Education and Development (LEAD) program in October,

2014, which is at the core of the present doctoral project.

Curriculum and Assessment. The USU LEAD program is a diverse curriculum

that involves traditional classroom education, small group exercises, field applications,

reflections and discussions, and scholarship. It is designed to complement and enhance

educational programs of the USU SOM, and prepare officers and physicians-in-training

to meet the demands and needs of the MHS.

The LEAD curriculum is built on effective and ethical leadership and officership

including: self-awareness, communication skills, effective followership, planning and

organization, technical competence, teamwork and teambuilding, among others (81). The

curriculum also is based on the notion that for career military medical officers to progress

as physicians, officers, and leaders, they must master the competencies required of a physician and officer. Over time, a uniformed health care officer can build upon these basic skills and develop the necessary knowledge and expertise to hold more senior positions and commands. Medical students must develop and function on a continuum beginning with leading oneself and progressing to leading others in a large, organizational structure (19; 81). As students' progress through military and medical leader and leadership education, they build knowledge and skills appropriate for each level of PITO which serves to reinforce the leadership, officership, and professionalism required in the practice of clinical medicine (81). See Appendix A, Figure 4. The following paragraphs briefly describe each of the MEM field experiences that include elements of the LEAD FourCe-PITO framework.

Medical Field Practicum 101. Medical Field Practicum 101 (MFP 101) is a 5-day military medical field exercise that takes place about 2 months into the 4-year USU SOM curriculum. The exercise is performed in conjunction with the field patient experience where first year medical students play roles of patients for Operation Bushmaster (81). Playing roles of patients is important to drive home to first year medical students the perspective of patients and to encourage fourth year medical students to be aware of how they are perceived by patients. First year medical students, as patients, observe and rate fourth year medical students in leadership roles to begin identifying effective as well as not so effective leadership skills and traits (81).

This exercise is an opportunity early in medical school for military medical officers-in-training to be introduced to the practice of medicine in a simulated deployed environment. It also provides exposure to the culture of military medicine. In MFP 101,

medical students are introduced to major roles and responsibilities as military physicians in operational settings and some of the unique challenges they will face. In addition, MFP 101 is an opportunity for first year medical students to begin forming identities as military physicians and officers and to work with classmates, with whom they will be colleagues for many years. With regard to leader and leadership development, MFP 101 includes FourCe-PITO elements. The specific objectives of MFP 101 are to:

- Introduce the culture and life of military physicians, particularly in the deployed environment (Cx);

- Provide an environment in which students begin to gain basic proficiency (knowledge, skills, and attitudes) in fundamental aspects of military medicine in the deployed setting (Cp, Cx, Cm);

- Reinforce and foster core values and principles particularly relevant to military medicine such as teamwork, leadership, professionalism, service, ethics, and integrity (Ch);

- Promote individual identity formation as military medical officers (Ch);

- Foster class identity, cohesion, and bonding (P, I, T);

- Engender excitement and interest in operational military medicine (O)(81).

Medical Field Practicum 102. Medical Field Practicum (MFP 102), or Advanced Combat Medical Experience [ACME], focuses on advanced role-specific competencies and crisis communication. Objectives include:

- Complete national training requirements for patient contacts (e.g., Basic Life Support; Cp);

- Expand knowledge of rapid combat trauma assessment and implement with realistic casualties in field environment (Cp, Cm);

- Appreciate environmental elements affecting troop performance (Cx, I, T);

- Enhance understanding of medical operational planning, and multimodal combat pain control options (O)(81).

Medical Field Practicum 201. Medical Field Practicum (MFP 201), or Gunpowder, incorporates development of role-specific competencies in addition to small unit leadership and team work with an emphasis on the importance of context and situational awareness, particularly through Tactical Combat Casualty Care (TC3). Effective principles of leading teams are reinforced with small unit leadership as medical students are organized as treatment team-sized elements (9 – 11 personnel), and given missions of negotiating leadership reaction course-type challenges in medical scenarios (81; 106). Medical platoon drills focus on introducing students to scenario-driven medical battle drills to prepare for the Military Contingency Medicine (MCM) course including Operation Bushmaster. After Action Reviews and discussions include team interactions, leadership, and discussion of medical treatment effectiveness (81).

Medical Field Practicum 202. Medical Field Practicum (MFP 202) is comprised of MCM and Operation Bushmaster. MCM, including its field component Operation Bushmaster, is an important component of the USU SOM 4-year integrated military medicine curriculum. MCM is 4 weeks long and includes both classroom didactic teaching and an intensive, 4-day in-field training – Operation Bushmaster (81).

MCM is structured around a simulated deployment to a notional developing country. The didactic portion of the course provides the "pre-deployment work-up" for

the deployment and helps medical students to acquire/strengthen the critical knowledge and skills competencies, and attitudes required for successful assignment and deployment as a military medical officer in their branch of service (95). The course employs a variety of teaching methodologies ranging from lecture to small group discussions and applied practical exercises to build upon topics introduced throughout the entire four-year USU military medical curriculum. Topics include, but are not limited to, military environmental medicine, applied field medicine, health service support planning, military decision making, problem solving, leadership, personal and family readiness, mass casualty incident preparation and response, stability operations, TC3, and medical intelligence (81). All coursework is designed to emphasize learning objectives focused on the current, real-world, operational environment. Following the four weeks of didactic, pre-deployment "spin-up," the fourth-year medical students participate in Operation Bushmaster.

Long-Term Career Outcome Study (LTCOS)

History

LTCOS was established by the USU SOM Dean Larry Laughlin, M.D., Ph.D., and his staff in 2005 (37) in response to a Liaison Committee on Medical Education (LCME) recommendation to collect institutional outcome data (35). Originally, LTCOS was comprised of a team of faculty from the Department of Medicine, Department of Preventive Medicine and Biometrics, and the SOM Dean's office. This group was tasked with creating an electronic database of admissions, registrar, and promotions data (39) of current medical students and alumni (37). The first task completed by the LTCOS team was to develop, implement, and analyze results from an alumni survey to assess

outcomes of USU SOM graduates from 1980 – 1989 (22) in terms of leadership

positions, operational accomplishments, awards, and academic landmarks (39).

Since that first study conducted by the LTCOS team, the scope of LTCOS has

expanded to include additional research regarding USU medical students before, during,

and after medical school. Research about medical school applicants has sought to find

what factors are associated with future performance in medical school and following

medical school (38). The LTCOS team has focused on curriculum and factors that may

predict performance in various pre-clerkship courses, as well as how education theory

and predication models can inform medical education practice (38). As the name LTCOS

suggests, much of the research conducted is focused on post-medical school professional

performance and achievements to help continue to revise the medical school curriculum

to enhance the performance of USU graduates. The LTCOS team has published many

papers addressing these issues (36). Please see below for a more detailed discussion of

LTCOS.

Purpose

The LTCOS team systematically monitors the career trajectories of the graduates

of USU's medical school (38). The LTCOS has three primary missions:

- **Program evaluation for accreditation**: Collect and analyze data to generate
  evidence-based evaluations of the USU SOM's success in meeting its educational
  objectives (e.g., for accreditation and other program evaluation purposes);

- **Leader in health professions scholarship**: Generate scientific knowledge that
  establishes USU as a local, national, and international leader in the field of health
  professions education; and

- **Translation of education research findings into practice**: Support the translation of research in health professions education into improved practices and policies within USU's medical school, clerkships, residencies, and beyond (e.g., to inform and improve admissions, instruction, and other educational processes). LTCOS findings serve to *inform* key stakeholders both inside and outside of USU (e.g., admissions and curriculum committees, clerkship and program directors, etc.); the LTCOS generates data that support policy decisions within the SOM and military graduate medical education (35).

The LTCOS vision is to be the premier provider of programmatic evaluation and health professions education scholarship in the MHS and the U.S. It supports the USU SOM Masters and PhD in Health Professions Education programs by providing graduate students with the opportunity to participate in collaborative research about educational issues relevant to the MHS (35). To date, the LTCOS team has published more than 65 manuscripts on various topics ranging from effects of instructional authenticity on medical student learning to the assessment of diagnostic reasoning and clinical performance in residency training (3); however **the LTCOS has not explicitly examined sex or gender differences**.

Previous Research and Findings

Previous LTCOS research has sought to identify variables predictive of success during medical school and post-medical school during internships and residencies (36). For example, Durning et al (37) found that more than 70% of USU graduates remain on active duty for 20 years or longer, compared to 12% of Health Professions Scholarship Program graduates. Additionally, Dong et al (33) found that controlling for gender,

undergraduate grade point average (GPA) and previous research experience predicted

higher pre-clinical GPA in medical school and higher scores on the U.S. Medical

Licensing Examination (USMLE) Step 1. Further research from the LTCOS group found

that Medical College Admission Test (MCAT) scores, undergraduate science GPA, pre-

clerkship GPA, and total medical school GPA were associated with board certification

(40). However, LTCOS has not explicitly examined potential sex or gender differences in

any of their studies to date. In addition, LTCOS has evaluated proxies of leadership (e.g.,

rank, time in service, board certification), but it has not examined leadership performance

as assessed by any leadership assessment tool. The current doctoral research sought to fill

these gaps by evaluating leader performance for female and male USU medical students

using demographic data supplied by LTCOS and leader performance data from the LAR

gathered at Operation Bushmaster.

LEAD and LTCOS Partnership

Communication between the USU LEAD program and LTCOS began in February

2016 (9). The partnership was created to combine LEAD variables with LTCOS variables

to assess leader and leadership performance at USU utilizing the FourCe-PITO

framework and pre- and post-medical school leader and leadership performance utilizing

LTCOS variables. Historically, LTCOS has not evaluated combinations of variable

clusters in females versus males to predict leader and leadership performance. It is

through the LEAD and LTCOS partnership that evaluation of various clusters of

variables and leadership by females and males may occur in the future (9).

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