NOTES FROM THE FIELD

Operational Curriculum and Research Initiatives: Shaping the Future of Military Medicine

Maj Roselyn W. Clemente Fuentes, MD, FAAFP, FAWM, MMAS, MC, USAF

Background: The current operational tempo and transitions in the structure of the military health system demands a renewed commitment to operational medicine readiness. There is an official mandate as well as the practical necessity to increase operational readiness within the medical corps. There is also a need to continue the scholarly evaluation of military medicine through research to ensure the progression of evidence-based medical care for the war fighter. Military graduate medical education (GME) has been threatened by budget cuts and lack of understanding of its value. This article reviews the literature on operational medicine curriculums and makes recommendations to restructure current military medicine training to produce operationally prepared clinicians who are informed in operationally focused research principles.

Observations: During early medical training operational curriculum cements military identity, fosters military leadership skills, provides practice of scenarios unique to military medicine, and connects learners to experienced mentors. There have been several versions of curriculum development in various GME programs observed from a literature search; however, the curriculum overall is fragmented and there is no universal implementation. Studies have shown that deliberately mapped longitudinal curriculums can be well integrated into a existing medical curriculum. Multiple studies also suggest that military GME is a large component of the production of operational-themed medical research and is vital for continued advancements. Value-based analysis performed by multiple sources have found that the initial increased cost of a military medical school education and GME becomes cost-effective based on increased retention, deployments, and filling of leadership billets.

Conclusions: Access to existing operational training structures that have well-established programs should be increased, and individual GME program curriculums should be modeled on those that have shown proven success with a focus on operational training, leadership, and research.

Roselyn Clemente Fuentes is a Flight Surgeon, Medical Director at Flight and Operational Medicine Clinic, Eglin Air Force Base in Florida.
Correspondence: Roselyn Clemente Fuentes (roselynjan.w.fuentes.mil@mail.mil)

Fed Pract. 2021;38(10). Published online October 13. doi:10.12788/fp.0192

It is a time of significant change as the Military Health System (MHS) transitions to the purview of the Defense Health Agency (DHA). Additionally, the landscape of combat is ever changing, and military medicine needs to evolve to ensure that the lessons learned are utilized to optimize care of the war fighters. The purpose of this review is to evaluate the available literature on existing operational medicine curriculums and make recommendations to restructure current military medicine training to produce operationally prepared clinicians who are informed in operationally focused research principles.

OPERATIONAL MEDICINE

Before diving into the importance of creating a curriculum and investing in training for scholarly activity proficiency, operational medicine needs to be defined. It can be defined as *medical care provided in an austere environment with limited resources and possibly under hostile conditions*. Another way to look at operational medicine is as the evaluation of normal human physiology and pathology under abnormal conditions. The mission set of each of the services is unique. The Marines and Army may operate forward past the wire vulnerable to the environment, gunfire, and improvised explosive devices, remote from fixed medical facilities. The Navy has divers exposed to the risks of decompression sickness. The Air Force has pilots exposed to altitude changes and strains of G-forces during flight. Locations vary from cold high-altitude mountainous regions to high-temperature desolate deserts. Many times, medical practitioners may be remotely stationed, far from specialty or immediate definitive care. Patient care may consist of low-acuity management of individual patients in sick call to mass casualty events where patient numbers and morbidity may outstrip available resources, making the difficult task of triage necessary.

Despite the challenges of being a uniformed physician, the benefits of being embedded is a better understanding of the roles and capability of the unit. Military physicians need to have the unique knowledge of the type of injuries sustained in that particular theater of war, such as differentiating between the trauma pattern and care required for blast injuries vs high-velocity missiles. There are also chemical, biologic, radiologic, and nuclear threats that military physicians

TABLE 1 Operational Medicine Curriculum Studies

Authors (y)	Topics	Years	Designs	Evaluations	Population, (No.)	Findings
Suls et al (1997)[6]	Military family practice residency programs; survey of residency graduates (1987-1990)	1997	Various	Survey	18 Tri-service family medicine residencies (464)	No topics offered for instruction were positively correlated ($P < .05$) with the time available to teach the material
Salerno et al (1998)[7]	Perceptions of military internal medicine residents	1998	N/A	Likert Scale	14 Tri-service internal medicine residencies (221)	Half did not feel ready to practice deployment medicine; 19% felt comfortable with nuclear, biologic, and chemical warfare injuries; 32% felt unfamiliar with command and administration
Roop et al (2001)[8]	Operational medicine in military internal medicine residency curriculum	2001	3-y longitudinal operational curriculum	After action report	Army internal medicine residency	Perceived smoother transition in the first active-duty tour after participation in an operational curriculum
Perkins et al (2001)[9]	Operational experiences during medical residency from Walter Reed Army Medical Center Department of Medicine	2001	3-y longitudinal operational curriculum	After action report	Army internal medicine residency	Prepared graduates for field experiences that they are likely to encounter during their military careers
Murray et al (2006)[10]	Deployment course for graduating military internal medicine residents	2006	3-d didactic and hands-on training	After action report	13 Internal medicine residencies	Increased deployment medicine knowledge by 15% on posttest
Picho et al (2015)[11]	Survey of Uniformed Services University medical school graduates	2015	4-y longitudinal operational curriculum	After action report	1189 Uniformed Services University graduates, 1980-2001	Graduates most confident in preparedness for military-unique practice with mean (SD): 4.3 (0.7) military leadership, 4.0 (0.7) professionalism, 3.9 (0.7) patient care, 3.9 (0.7) communication and interpersonal skills, and 3.8 (0.7) medical knowledge
Jacobson (2018)[12]	Operational aerospace medicine collaborative programs	2018	4-y longitudinal aerospace/ operational curriculum	N/A	N/A	N/A
Gollsby (2013)[24]	Hybrid simulation field training	2013	6-d field training exercise	Postexercise feedback	200 Uniformed Services University medical students	Successful integration of a fidelity hybrid simulation curriculum into a dynamic, large-scale military medical student field exercise

need to recognize. Much of what disables a military fighting force is not a direct relationship to combat-related injuries; however, entire units have been taken down by infectious diarrhea or trench foot. There is also a need for familiarity of the infections and parasitology endemic to the particular theater with the aim of implementation of prevention whenever possible.

Military medicine does not fit in any box. Military physicians need to know the job requirements of various specialties, including elements of occupational medicine, such as aircrew piloting high-performance fighters or ground troops fully loaded with body armor and 80-lb backpacks. There are musculoskeletal injuries from the stressors of various military occupations. Working around weaponry and contact with hostile forces will create scenarios requiring emergent and critical care. In addition to physical injuries, there is the mental strain of combat with the risk of imminent personal injury, the guilt of survivorship, dealing with the scars and permanent physical damage of combat, and prolonged separation from family and other support systems.

The National Defense Authorization Act 2017 mandated the establishment of a standardized process to oversee all military graduate medical education (GME) programs with the goal of ensuring medical operational readiness.[1] This is no small task with > 3000 residents in more than 70 specialties, comprising approximately 12% of US residents.[1,2] Presently, 26 to 32% of the medical corps is enrolled in full-time training compared with 12% of the total force.[2] With significant time and resources

TABLE 2 Operational Curriculum Topics

Possible Topics	Additional Topics
Medical support planning	Tactical combat casualty care
Applied field medicine	Basic life support
Mass casualty incident preparation/triage	Advanced cardiac life support
Military medical ethics	Pediatric advanced life support
Combat casualty care	Advanced trauma life support
Ballistic, blast, burn casualties	Center for sustainment of trauma readiness skills
Nuclear, biological, chemical casualties	Expeditionary medical support system
Combat stress psychological injury	Chemical, biologic, radiologic, nuclear, and explosive
Disaster medicine	Tropical medicine
Occupational medicine	Mountain medicine
Preventive medicine	Dive medicine
Public health/hygiene	Aerospace medicine
Infectious disease	Fundamentals of global health engagement
Global medicine	Humanitarian assistance
Traumatic brain injury	Aeromedical evacuation
Musculoskeletal injuries	Uniformed Services University Operation Bushmaster
Whole blood transfusion	Wilderness medicine
Leadership	Overseas medical missions
Research principles	Service/grade specific professional military education
Operational medicine rotations/ clerkships	American Associate for Physician Leadership Certification
	Aerospace and physiology

expended during this period, it is vital to maximize the potential of the training.

LITERATURE REVIEW

A literature review was performed, evaluating historical precedence of specialized military medical training and research as well as current operational curriculums. Literature search was conducted in the PubMed and Uniformed Services University (USU) Learning Resource databases using the terms "operational medicine curriculum," "military medicine curriculum," "operational medicine training," "military medicine training," "operational medicine research," and "military medicine research," and included all articles from 1997 to 2020. Inclusion criteria included studies that detailed military medicine training programs and/or outcomes. The source types used in this research project included peer-reviewed journal publications—both review articles and original research—from medical and military journals. The citations of these articles were also reviewed for additional usable publications. Secondary sources included official reports and studies by the RAND Corporation, the US Government Accountability Office, and the Institute for Defense Analysis (IDA). Due to lack of literature on the topic, other sources such as talking papers, letters, and formal presentations from

subject matter experts were included to showcase the current state and gaps on this topic. Key findings from peer-reviewed publications are presented in Table 1.

Overall, the literature review showed that longitudinal deliberately mapped out curriculums can be well integrated into the existing medical curriculum.[3] The military medicine course topics include environmental medicine, applied field medicine, combat casualty care, medical support planning, mass casualty incident preparation, and military-focused problem solving, decision making, and leadership.[4]

One 1997 study looked at the degree of implementation of military unique curriculum in 18 family medicine residencies. Only 30% of residents stated that their program had a specific operational medicine curriculum.[5] Salerno and colleagues surveyed current residents and recently graduated internal medicine physicians at 14 facilities in the Army, Air Force, and Navy to determine confidence level with military medicine. More than half did not feel ready to practice deployment medicine; just 19% felt comfortable treating nuclear, biologic, and chemical warfare injuries; and 32% felt unfamiliar with the command and administrative duties. A subgroup analysis showed that USU graduates felt more prepared in these areas compared with civilian program graduates.[6] Additional studies showed perceived smoother transition in the first active-duty tour after participation in an operational curriculum.[7]

Didactics can provide a foundation. However, just as the practice of medicine is learned in the clinic, the art of military medicine is learned in the field. Hands-on training in one study was accomplished through the Combat Casualty Care Course (C4), the USU Bushmaster exercise, and a field training exercise. The field exercise included components of mission planning, medical threat assessments, triage of a mass casualty situation, management of disease and nonbattle injuries, combat stress casualties, resource management, and patient evacuation.[8]

Another publication described a similar longitudinal curriculum with C4 after the first year of training and the Medical Management of Chemical and Biological Casualty Course during the second year. The operational curriculum 3-day capstone occurred at the end of medical training utilizing mannequins to realistically simulate combat casualty care, including emergency airways, chest tube, and tourniquets.[9] Due to the current deployment tempo, just in time refresher courses like this could be valuable preparation.

While most of the operational curriculums evaluated assessed efficiency over a short time interval, one study looked at 1189 graduates from the military medical school from the past 20 years. Preparedness was perceived to be high for military-unique practice and leadership.[10] The operational curriculum at USU had been purposefully structured to provide continuity. Didactics and casework were reinforced with hands-on training whether through realistic simulator training or field exercises. The authors note a weakness of many operational curriculums is inconsistency and fragmented training without deliberate longitudinal planning.

One of the more recent military GME curriculums include the creation of the operational medicine residency in 2013, which created a standardized longitudinal operational curriculum integrated along with the existing family medicine, emergency medicine, or internal medicine curriculum to create mission-ready military physicians upon graduation. Scheduled rotations include global medicine, aeromedical evacuation, occupational medicine, and tropical medicine. Completing military officer professional development and an operationally relevant research project is an expectation (Table 2).[11]

In addition to in-program training, other options include operational rotations offsite and military courses conducted outside the GME program.[12] Some of these courses may include just-in-time training such as expeditionary medical support system training prior to scheduled deployments. Examples of experiential training are listed in Table 3.

CRITICAL ANALYSIS

Current gaps were identified in the military medicine training pipeline's operational medicine curriculum and

TABLE 3 Experiential Training

Topics
Tactical combat casualty care
Center for Sustainment of Trauma and Readiness Skills
Combat casualty care
Aerospace medicine
Global medicine/fundamentals of global health engagement
Tropical medicine
Dive medicine
Mountain medicine course
Chemical and biological casualty care
Radiation injury care
Overseas medical missions
Wilderness medicine electives

research programs. The analysis looked at specific components that make the operational medicine curriculum and research unique as well as current readiness goals, to determine how to best align both to meet the mission requirements. Some factors considered included efficiency, cost, program portability, duplication minimization, retention, and sustainability.

Efficiency

A well-created curriculum that meets objectives will require more than an assigned rotation and a few lectures. The most successful ones in the literature review were the ones that were deliberately planned and longitudinal, such as the ones at USU that combined a mixture of classroom and field exercises over the course of 4 years.[4,8] In that way, the curriculum may not be considered time efficient, but if integrated well into the already existing medical training, the production of military physicians who are mission ready upon graduation—ready to serve as military medical leaders and deploy—will be invaluable.

Cost Comparison

Due to the associated overhead of running a training platform and the additional hours of operational training, military GME is more expensive initially compared with civilian outsourcing. In USU, for example, there is an additional 700 hours of operational curriculum alone. This cost difference more than doubles the cost of a USU education vs a Health Professional Scholarship Program (HPSP) scholarship at a civilian medical school. However, a causal analysis performed by the IDA to determine value basis noted that USU graduates deploy almost 3 times as much and serve 6 years longer on active duty.[3]

After graduating medical school through either accession source, physicians complete specialization training in a GME program. The IDA study noted an average $12,000 increased cost of military GME compared with civilian programs. The analysis included resident compensation and overhead costs of running the program as well as the net cost, which also accounted for resident productivity and workload by training in a military facility.[3] Calculations due to mandated budget cuts estimated cost savings of closing the military medical school at < $100 million while significantly impacting the military physician pipeline and operational research output.[3]

Duplication of Effort

There are already established training programs such as Tactical Combat Casualty Care (TCCC) that could be incorporated into the curriculum to avoid expending additional resources to recreate the wheel. USU has a validated operational training curriculum and may be able to make opportunities available for outside trainees to participate in some of its military-unique training and leadership exercises. Other ways to decrease duplication of effort and improve cost efficiency include focusing on the creation of an academic health system (AHS) and consolidating similar programs to conserve resources. Increasing existing military program sizes will not only ensure the continuation of the military medicine pipeline, but will spread overhead costs over a larger cohort, decrease costs of civilian outsourcing, and ensure the less tangible benefits of military cultural exposure early in trainees' careers. For example, increasing the class size of

USU by 30 students actually reduces the cost per student to $239,000 per year from $253,000, while decreasing the need for HPSP accessions training in civilian programs, making the endeavor overall cost neutral.[3]

Program Portability

The operational medicine residency has proved that an operational curriculum can be remotely managed and reproduced at a variety of residency specialties.[12] Remote education could be developed and distributed throughout the MHS, such as the proposed USU course Military Medicine and Leadership course.[3] Centralized training programs like Global Medicine and C-STARS could be scheduled TDYs during the medical training calendar.

Retention

The military medical school, USU, is the largest military medicine accession source. An IDA report notes that retention of USU graduates is 15.2 years compared with 9.2 years served by civilian trainees. Due to the longevity in service, USU graduates also make up more than 25% of military medical leadership.[4] The long-term outcome study that looked at the past 40 years of USU graduates observed that over 70% of graduates served until retirement eligibility and are overrepresented in special operations units.[3,13] While some of this longevity may be attributed to the longer USU service contracts, military GME graduates were still noted to be 4 times more likely to commit to a multiyear service contract.[14] A RAND study on the retention of military physicians in the Army, Air Force, and Navy noted that overall retention increased throughout all the services for physicians who went through the military GME pipeline.[15] Conversely, civilian GME training was associated with a 45% chance in leaving active duty.[16]

It is theorized that early military acculturation during training increases the likelihood of instilling a sense of mission. Being involved in military GME on the teaching side also showed increased retention rates for 63% of survey respondents.[17] Reduced burnout and increased work satisfaction for those involved in military GME was noted on another faculty satisfaction survey.[17]

Sustainability

Programs like USU, which have been around for decades, and the newer operational residency program evolving since 2013 have shown sustainability.[4,11] Dissemination of proven curriculums as well as centralization of already validated training programs can help standardize operational medical training throughout the MHS. In order to flourish at individual programs, the faculty need to be well versed in a train the trainer model and have institutional support. The ability to engage with the line at individual locations may be a factor as well.[18] In regard to research, once residents are taught the principles of scholarly activity, they will have the tools to continue operational medicine research advancements and mentoring students.

DISCUSSION

The 2020 NDAA recommends the establishment of an AHS.[3] This step will create a culture of military medical readiness from the top down as congressional mandates push reorganization of the MHS, including military GME programs. An overall restructuring of military medicine will require prioritization of resources toward operational requirements vs the historic significant division of attention to beneficiary care that has caused a lack of unity of effort and additional strain on an already heavily tasked medical force. The changes in military GME are just one aspect of that. It is vital to look at the restructuring with a comprehension of the unique challenges of combat health rather than only from an in-garrison, hospital-based aspect.[19] Benefits of having a military medicine AHS include opportunities to share resources and successful business models as well as foster interdisciplinary teamwork and partnerships with civilian health care facilities and research institutions as a force multiplier.[19]

There has been recent discussion about budget cuts, including shutting down USU and military GME and transitioning all training to civilian programs to be cost-effective.[4] If this were to happen, it would be a step backward from the goal of operational readiness. Maintaining US Department of Defense (DoD) control of the military medicine pipeline has innumerable benefits, including built-in mentorship from operationally-seasoned

faculty, military leadership development, proficiency in MHS systems, open communication between GME programs and DoD, and curriculum control to ensure focus on readiness.[20] Military GME programs are also a significant production source of military-related scholarly activity. Over fiscal year 2017/2018, 63% of the publications out of the San Antonio Uniformed Services Health Education Consortium—the largest Air Force GME platform and second largest multiservice GME platform—involved military relevant medical topics.[17] Much of the volume of operational research as well as the relevant skills learned and future innovations secondary to conducting this research would be lost if military GME did not exist.[17,21]

Practically speaking, military GME provides the majority of the military medicine accessions. For example, a presentation by the Air Force Chief of Physician Education noted that the total military GME pipeline included 2875 students, but direct physician access averaged only 20 physicians a year.[22] Even if the decision was made to defer to civilian education, capacity does not exist in civilian GME programs. This is worsened by the increased competitiveness of the GME match with the proliferation of medical schools without concurrent increase in residency spots. The 2018 National Resident Matching Program noted that there were more than 37,103 US and foreign applicants for only 33,000 residency positions, leaving many US applicants unmatched.[17] It is doubtful that the civilian GME programs would be able to absorb the influx of military residents, affecting both the military and civilian medicine pipelines. As a secondary effect, the military treatment centers that house the military GME programs would have to close, with surrounding civilian medical facilities also likely unable to absorb the sudden influx of patients and residents losing the intangible benefits of caring for a military population.[15] This was even recognized by the civilian president of the Accreditation Council for Graduate Medical Education:

> Military physicians must be trained in the systems of care that are operative in military medicine, which is significantly unlike civilian medicine in many ways. It is often practiced in circumstances that are not seen in civilian medicine, within care structures that are not encountered in American medical practice… Military medicine has advanced research into the care of individuals suffering traumatic injury, critical care, rehabilitation medicine, prosthetics, psychiatric care of those traumatized, and closed head injury, to name a just a few. The sacrifices of our active military demand these advances, and the American Public benefit from these advances.[21]

Where deficiencies exist in military GME, it is possible to use the growing military-civilian training institution partnerships. Two prime examples are the just-in-time deployment training done with civilian trauma facilities by the Air Force Center for the Sustainment of Trauma Readiness Skills and the Air Force Special Operations Surgical Team-Special Operations Critical Care Evacuation Team being embedded in civilian facilities to maintain trauma, surgical, and emergency care skills. While military physicians can maintain competencies, at the same time, the civilian sector can benefit from the lessons learned in the military in regard to mass casualty and disaster responses. Fostering military and civilian training agreements can also enhance research opportunities.[1]

Just as the realities of operational medicine frequently require the military physician to think outside the box, the most successful methods of instruction of military medicine tend to be nontraditional. Classroom education should be involved beyond lectures and can include other methods, such as case-based, role-playing, small group discussion, and computer-based teaching. Maintaining flexibility in live vs distance learning as well as synchronous vs asynchronous learning can expand the capacity of available instructors and standardize material over several sites.[23] Asking learners to consider operational concerns, such as whether certain medical conditions would be compatible with military duty in addition to the routine investigation is an easy way to incorporate military training in preexisting medical training.[12] The advancement of technology has made simulation one of the best ways to engage in hands-on learning, whether through computer simulations, animal models, standardized or moulaged patients, or mannequins that can realistically mimic medical or trauma-related conditions.[24] Many times, simulation can be combined

APPENDIX Pillars of an Operational Medicine Curriculum

Operational Medicine[25]	Leadership[26]	Research Principles
Military GME exposes trainees to built-in mentors and health care system procedures. Recommendations moving forward are increasing the access of existing operational training and modeling individual GME program curriculums after those that have shown proven success. Creation of operational curriculum should be purposeful and longitudinal, utilizing technology like simulations and remote learning to optimize experiences and better integrate into existing medical curriculum. Formalized training platforms for rotations can be established at operational bases that have unique opportunities with tri-service operations such as Eglin Air Force Base that houses multiple airframes, Air Force Special Operations units, the Navy Explosive Ordnance Branch (EOD) school house, and the Army Ranger Training Battalion. Civilian partnerships can fill the gaps. Early exposure to the operational side will help future military physician leaders have context and improve communication with the line in the future.	A survey of > 2000 faculty and residents noted that only 17% of respondents had a formal leadership curriculum; leadership education should be a purposeful inclusion in any operational curriculum as military physicians are also officers and future stewards of DoD resources; the layout of operational curriculums with field exercises and other simulations allows for the integration of a concurrent leadership training. A USU task force noted core military medicine leadership attributes to foster including: understanding the environment, anticipating and adapting to surprise and uncertainty, ethical decision-making balancing the values of the medical profession with the profession of arms, and thinking strategically in applying health services support to warfighting principles in joint operations.[5] Part of USU's curriculum has grown to include the LEAD program compromised of small group sessions, peer and self-assessment, and military medical field exercises. LEAD's framework focuses on 4 Cs (character, competence, context, and communication.[2] The LEAD program can be duplicated within other operational curriculums. Other leadership training such as the various professional military education programs, the American Associate for Physician Leadership certification, and the Basic Leadership Airman Skills training course should also be discussed as options.[27]	Military GME plays a significant factor in generating military medical research. There needs to be sufficient training in scholarly activity technique, protected time, mentorship, funding, venues to present scholarship, and structural as well as administrative support. DHA centralized leadership may be used to consolidate data from multiple branches and combine research efforts and resources. To overcome some of the barriers to doing military research within GME, recommendations simplifying requirements to streamline the process, facilitating collaboration with the proper supportive infrastructure, and gaining the support of command and the line.[28] Without continuous data collection and evaluation, there is the risk of curriculum development, military medical practice, and policy making stagnation.[18] A benefit of military GME is that the ACGME research requirement could be directed to operational readiness. While not every military doctor is expected to be a well-published researcher, the same analytical thinking will serve well in the improvisation in austere settings, the quality improvement process in garrison, and knowledge on how best to share these advancements. Further research should be done on what the ideal components of an operational curriculum should include, best educational methods for executing these goals, and how to duplicate successes in military GME programs across the Military Health System.

Abbreviations: AGME, Accreditation Council for Graduate Medical Education; DHA, Defense Health Agency; DoD, US Department of Defense; GME, graduate medical education; LEAD, Leadership Education and Development; USU, Uniformed Services University.

with exercises in the field to create a realistic operational environment.[23]

There are 3 pillars of an operational curriculum that should be integrated into the existing residency curriculum—operational medicine, leadership, and research principles (Appendix).

CONCLUSIONS

Judging by the continuing operational tempo and evolution of warfare, maintaining enhanced military medical readiness will remain a priority. Operational medicine is a unique field that requires specialized preparation. Studies have shown that longitudinal deliberately mapped out curriculums are able to be integrated well into the existing medical curriculum. The recommendation moving forward is increasing the access of existing operational training structures that have well established programs and modeling individual GME program curriculums after those that have shown proven success with a focus on the 3 pillars of operational training, leadership, and research.

Acknowledgments

Previously submitted in April 2020 in expanded form as part of graduation requirements for the Masters of Military Arts and Science degree program at Air University, Maxwell Air Force Base in Alabama.

Author disclosures

The author reports no actual or potential conflicts of interest with regard to this article.

Disclaimer

The opinions expressed herein are those of the author and does not necessarily reflect those of *Federal Practitioner,* Frontline Medical Communications Inc., the US Government, or any of its agencies.

References

1. US Government Accountability Office. Defense Health Care: DoD's proposed plan for oversight of gradu-

ate medical education program. Published March 2019. Accessed September 24, 2021. https://www.gao.gov/assets/700/698075.pdf
2. De Lorenzo RA. Accreditation status of U.S. military graduate medical education programs. *Mil Med*. 2008;173(7):635-640. doi:10.7205/milmed.173.7.635
3. John SK, Bishop JM, Hidreth LA, et al; Institute for Defense Analysis. Analysis of DoD accession alternatives for military physicians: readiness value and cost. Published October 2019. Accessed September 24, 2021. https://www.ida.org/-/media/feature/publications/a/an/analysis-of-dod-accession-alternatives-for-military-physicians-readiness-value-and-cost/p-10815.ashx.
4. O'Connor FG, Grunberg N, Kellermann AL, Schoomaker E. Leadership education and development at the Uniformed Services University. *Mil Med.* 2015;180(suppl 4):147-152. doi:10.7205/MILMED-D-14-00563
5. Suls H, Karnei K, Gardner JW, Fogarty JP, Llewellyn CH. The extent of military medicine topics taught in military family practice residency programs: Part II, a survey of residency graduates from 1987-1990. *Mil Med*. 1997;162(6):428-434. doi:10.1093/milmed/162.6.428
6. Salerno S, Cash B, Cranston M, Schoomaker E. Perceptions of current and recent military internal medicine residents on operational medicine, managed care, graduate medical education, and continued military service. *Mil Med*. 1998;163(6):392-397. doi:10.1093/milmed/163.6.392
7. Roop SA, Murray CK, Pugh AM, Phillips YY, Bolan CD. Operational medicine experience integrated into a military internal medicine residency curriculum. *Mil Med*. 2001;166(1):34-39. doi:10.1093/milmed/166.1.34
8. Perkins JG, Roy MJ, Bolan CD, Phillips YY. Operational experiences during medical residency: perspectives from the Walter Reed Army Medical CenterDepartmentofMedicine.*MilMed.*2001;166(12):1038-1045. doi:10.1093/milmed/166.12.1038
9. Murray CK, Reynolds JC, Boyer DA, et al. Development of a deployment course for graduating military internal medicine residents. *Mil Med*. 2006;171(10):933-936. doi:10.7205/milmed.171.10.933. doi:10.7205/milmed.171.10.933
10. Picho K, Gilliland WR, Artino AR Jr, et al. Assessing curriculum effectiveness: a survey of Uniformed Services University medical school graduates. *Mil Med.* 2015;180(suppl 4):113-128. doi:10.7205/MILMED-D-14-00570
11. Jacobson MD: Operational Aerospace medicine collaborative programs: past, present, and future. US Air Force School of Aerospace Medicine Presentation. November 1, 2018.
12. Roy MJ, Brietzke S, Hemmer P, Pangaro L, Goldstein R. Teaching military medicine: enhancing military relevance within the fabric of current medical training. *Mil Med*. 2002;167(4):277-280. doi:10.1093/miled.milmed.167.4.277
13. Durning SJ, Dong T, LaRochelle JL, et al. The long-term career outcome study: lessons learned and implications for educational practice. *Mil Med.* 2015;180(suppl 4):164-170. doi:10.7205/MILMED-D-14-00574
14. Keating EG, Brauner MK, Galway LA, Mele JD, Burks JJ, Saloner B. The Air Force Medical Corps' status and how its physicians respond to multiyear special pay. *Mil Med.* 2009;174(11):1155-1162. doi:10.7205/milmed-d-01-4309
15. Mundell BF. Retention of military physicians: the differential effects of practice opportunities across the three services. RAND Corporation; 2010:74-77. Accessed September 24, 2021. https://www.rand.org/pubs/rgs_dissertations/RGSD275.html
16. Nagy CJ. The importance of a military-unique curriculum in active duty graduate medical education. *Mil Med.* 2012;177(3):243-244. doi:10.7205/milmed-d-11-00280
17. True M: The value of military graduate medical education. SAUSHEC interim dean talking paper. November 2, 2018.
18. Hatzfeld JJ, Khalili RA, Hendrickson TL, Reilly PA. Publishing military medical research: appreciating the process. *Mil Med*. 2016;181(suppl 5):5-6. doi:10.7205/MILMED-D-15-00517
19. Sauer SW, Robinson JB, Smith MP, et al. Lessons learned: saving lives on the battlefield. *J Spec Oper Med.* 2016;15(2). 25-41.
20. Tankersley MS: Air Force Physician Education Branch response to GME questions. Talking Paper. Feb 23, 2015.
21. Nasca TJ. [Letter] Published October 26, 2019. Accessed September 24, 2021. https://www.moaa.org/uploadedfiles/nasca-to-kellerman-a--cordts-p-2019-10-26.pdf
22. Forgione MA: USAF-SAM GME Brief. Air Force Personnel Center. October 2018.
23. Turner M, Wilson C, Gausman K, Roy MJ. Optimal methods of learning for military medical education. *Mil Med*. 2003;168(suppl 9):46-50. doi:10.1093/milmed/168.suppl_1.46
24. Goolsby C, Deering S. Hybrid simulation during military medical student field training--a novel curriculum. *Mil Med.* 2013;178(7):742-745. doi:10.7205/MILMED-D-12-00541
25. Hartzell JD, Yu CE, Cohee BM, Nelson MR, Wilson RL. Moving beyond accidental leadership: a graduate medical education leadership curriculum needs assessment. *Mil Med*. 2017;182(7):e1815-e1822. doi:10.7205/MILMED-D-16-00365
26. Barry ES, Dong T, Durning SJ, Schreiber-Gregory D, Torre D, Grunberg NE. Medical Student Leader Performance in an Applied Medical Field Practicum. *Mil Med*. 2019;184(11-12):653-660. doi:10.1093/milmed/usz121
27. Air Force Medical Corps Development Team: Medical corps integrated OPS career path. MC Pyramids 2019 Presentation. January 18, 2019. https://kx.health.mil [Non-public source, not verified]
28. Polski MM: Back to basics—research design for the operational level of war. *Naval War College Rev*. 2019;72(3):1-23. https://digital-commons.usnwc.edu/nwc-review/vol72/iss3/6.