Establishment of the Clinician-Scientist Investigator Opportunity Network to Develop Military Medical Research Leaders

Lt Col Joseph K. Maddry, USAF, MC[*,†,‡,§]; Amber Mallory, PhD[†]; Allyson A. Araña, PhD[†]; COL Michael J. Morris, MC, USA (Ret.)[§]; Melissa Ann R. Clemons, PhD[†]; Alexander J. Burdette, PhD[†]; Col Mark W. True, USAF, MC (Ret.)[§]; Col Debra Niemeyer, PhD, USAF (Ret.)[†]; Col Erik K. Weitzel, USAF, MC[‖]*

ABSTRACT

Introduction:
The ability of military clinicians to conduct military medical research is often limited because of competing priorities and a lack of research mentorship. The Clinician-Scientist Investigator Opportunity Network (CSION) was developed with the intent of training clinicians how to engage in requirements-driven research within the DoD.

Materials and Methods:
Three to five academic medical faculties were selected from a pool of applicants each year to participate in a 2-year research fellowship. To be eligible for the CSION program, applicants had to meet the following criteria: (1) Completed residency graduate medical education training, (2) not be currently enrolled as a graduate medical education trainee, and (3) obtained permission from their department leadership to focus 25% of their duty hours on CSION participation to include didactic and research efforts. The remaining 75% of fellows' time was dedicated to clinical duties. Monthly didactics, intensive mentorship, and consistent support were offered to each fellow by the CSION leadership team. Metrics were recorded to include both research and clinical productivity.

Results:
Between January 2019 and December 2022, 12 CSION fellows graduated from the program (four in the class of 2020, three in 2021, and five in 2022). From 2019 to 2021, the 12 CSION fellows initiated 204 research protocols, generated 489 publications/presentations, and secured 33 research grants. All graduates of the program remain active in clinical research with multiple graduates currently assigned to research positions.

Conclusions:
The CSION research education program is a 2-year additional duty research fellowship producing clinician-scientists conducting military-relevant medical research and publications and may be considered a low-cost/highly efficient alternative to achieve the reported benefits of the MD–PhD tract. The expansion of the CSION program may improve the quality of military medical research and health care.

INTRODUCTION

The Military Health System is tasked with providing medical care to its current beneficiaries while simultaneously preparing for future military operations.[1] This includes providing care to maintain a healthy military force, beneficiary care, medical education and training and managing combat casualties.[2] To achieve these goals, the U.S. military conducts research, development, testing, and evaluation efforts to ensure the capability to manage future threats to the health of military members and beneficiaries.[3] Based on the authors' cumulative experience of over 100 years, they have observed that research organizations within the military consist extensively of civilian doctorate of philosophy (PhD) scientists and have limited access to clinicians with patient care and combat casualty care experience. Conversely, those with the greatest direct patient care are often absent from the military's medical research and development programs. Although the military develops guidance documents to assist in clarifying needed capabilities to researchers, they do not substitute for real-world experiences.

Although the term scientist often refers to those individuals with a PhD degree,[4] for the purposes of this manuscript, we define clinician-scientists as those clinicians serving as primary investigators on medical research projects. Relative to

[*]United States Army Institute of Surgical Research, Joint Base San Antonio (JBSA) Ft Sam Houston, TX 78234, USA

[†]59th Medical Wing (59 MDW)/Chief Scientist's Office, JBSA Lackland Air Force Base (AFB), TX 78236, USA

[‡]Department of Military and Emergency Medicine, Uniformed Services University, Bethesda, MD 20814, USA

[§]San Antonio Uniformed Services Health Education Consortium (SAUSHEC), Brooke Army Medical Center, JBSA Fort Sam Houston, TX 78234, USA

[‖]Air Force Research Laboratory 711HPW/IR, Wright-Patterson AFB, Dayton, TX 45433, USA

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civilian medical universities, the U.S. military lacks a robust clinician-scientist workforce able to combine firsthand patient care and combat casualty experience with substantial engagement in military medical research.[5–7] This is partially because military clinicians face multiple challenges impeding their ability to conduct research, including patient care, related administrative duties, military training, frequent permanent changes of station, temporary duty assignments, and deployments. As such, many clinicians with an interest in research elect to focus their efforts on clinical care and military administrative duties. Ultimately, this limits the ability of those directly faced with the challenges of military medical and combat casualty care to engage in the research necessary to address the corresponding challenges.[7,8]

Additionally, research training opportunities for clinicians are limited. Although research training is frequently incorporated into graduate medical education (GME) and graduate dental education (GDE), this training is limited in quality and quantity because of the significant clinical demands during most GME/GDE residencies and fellowships.[9–13] Limited formal research fellowship opportunities exist; however, such fellowships require the fellow to incur an additional military service obligation, thereby limiting applicants and leaving most research fellowships unfilled. Within the medical research community, mentorship is the primary means to improve career development.[3,4] Therefore, we designed a formal training and mentorship program aimed to provide clinicians who have demonstrated an aptitude for research. The mentorship was provided by experienced military clinicians and PhD scientists, each of whom has been associated with the DoD and recognized as researchers for at least 10 years. By combining inquisitive, research-inclined clinicians with military medical research personnel and resources to enable the execution of requirements-aligned research, we aimed to enable the performance of research and generate deliverables with the potential to improve the care of military beneficiaries and combat casualties. Additionally, we sought to grow the next generation of military clinician-scientists who will subsequently assume research leadership positions throughout the Defense Health Agency (DHA) to shape and mentor research activity in junior faculty and medical/dental training programs.

METHODS

The Clinician-Scientist Investigator Opportunity Network (CSION) was formally launched in 2019. The endeavor consists of a collaboration between the U.S. Army Institute of Surgical Research (USAISR), the 59 Medical Wing Chief Scientist's Office of Science and Technology (59 MDW/ST), and the San Antonio Uniformed Services Education Consortium. The 59 MDW Chief Scientist agreed to sponsor this effort, to include the provision of resources, being in line with the ST Vision, "To grow medical leaders and drive innovations in patient care and readiness." The program is unique in that it is (1) service and corps neutral (i.e., the program is open to all clinical specialties including but not limited to dentists, physicians, psychologists, nurse practitioners, and physician assistants serving in the Army, Air Force, and Navy), (2) has no service obligation, and (3) focused on military requirements–aligned research rather than degree granting. Applicants were solicited from the Joint Base San Antonio medical facilities. To be eligible for the CSION program, applicants had to meet the following criteria: (1) Completed residency GME training or dental school, (2) not be currently enrolled as a GME or GDE trainee, and (3) obtained permission from their department leadership to focus 25% of their duty hours on CSION participation to include didactics and military requirements–aligned research efforts, equating to over 900 hours of duty time dedicated to research during the 2 years. The remaining 75% of fellows' time was dedicated to clinical duties.

Selection of Fellows

Applicants were required to submit a curriculum vitae and a letter of support from their department leadership. Following the submission of these documents, a panel consisting of the CSION Fellowship Director, Deputy Director, and senior scientists and research clinicians interviewed the applicants. The interview questions were unbiased and consistent among interviewees, focusing on the applicants' research interests, their ability to balance clinical and research duties, their aptitude as a researcher, and their future research career goals. This process has been repeated each fall with a class of three to five fellows selected annually. The fellowship is 2 years in duration and starts in January (with the first class starting in 2019) to avoid conflicting with GME and permanent change of station schedules.

Preceptorship Education Topics and Components

The CSION program consists of didactics, mentorship, and administrative support. Didactics includes a 2-hour session of lectures each month focused on various aspects of research (Table I). Lectures are provided by CSION faculty, local and visiting clinicians and scientists, and past and present CSION fellows. Each didactic session includes opportunities to ask questions and discuss potential approaches to address research challenges. These topics can change each year based on the feedback from the CSION fellows at the end of each year. For example, one year may include a session topic on how to write a grant proposal, whereas another year could be focused on how to initiate and execute different DoD-required agreements. The CSION fellowship curriculum was designed to be conducted longitudinally, consistent with the stepwise process in which most research, development, testing, and evaluation–funded research is conducted.

Clinical Research Support

Throughout the 2-year CSION fellowship, fellows engaged and collaborated with clinicians and scientists at the USAISR,

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TABLE I. Didactic Topics

1	In Brief/Orientation
2	How to Use Research to Initiate Change in Military Medicine
3	Successful Collaboration Between Active Duty and Civilian Clinicians & Scientist
4	How to Design and Conduct Animal Studies
5	Human Subject Research
6	Intramural and Extramural DoD Research Funding Mechanisms
7	From Mentee to Mentor: Tools for Guiding Others to Success
8	True Stories from a CSION Fellow: Successes and Traps to Avoid
9	Multiple Presentations at the Military Health System Research Symposium
10	Research that Changed Military Practice Products
11–12.	CSION Fellows Presentation of Their Research Projects

Abbreviation: CSION, Clinician-Scientist Investigator Opportunity Network.

59 MDW/ST, and San Antonio Uniformed Services Education Consortium. This collaboration included CSION fellows serving as associate investigators on USAISR and 59 MDW/ST projects as well as USAISR and 59 MDW/ST personnel assisting with those studies for which the fellow was the primary investigator. The USAISR and 59 MDW/ST support included, but was not limited to, assistance with institutional review board protocol development, Institutional Animal Care and Use Committee protocol development, grant writing, budget and contract development, writing of cooperative research and development agreements and other research agreements, purchase of research equipment, legal support, statistical support, grant execution, laboratory support, manuscript writing and publishing, public affairs review, conflict of interest training, protection of intellectual property/patents/royalties, and dissemination of research funding opportunities.

RESULTS

Fellowship Participants and Projects

The initial class of four fellows began in January 2019 and graduated in December 2020 and consisted of an emergency physician, a vascular surgeon, an orthopedic surgeon, and a laryngologist. The second class included an emergency physician/toxicologist, a cardiothoracic surgeon, and a neurointensivist; this class graduated in December 2021. The third class matriculated in January 2021 and graduated in December 2022 and included an emergency physician, an orthopedic surgeon, an otolaryngologist, a urologist, and a sports medicine physician. The current class scheduled to graduate in December 2023 consists of a cardiologist, an infectious disease physician, an otolaryngologist, and a dentist. The most recent class began in January 2023 and includes a psychologist, an obstetrician/gynecologist, a cardiologist, an intensivist, and a vascular surgeon. Fellows' research projects aligned with their area of specialty. For example, the vascular surgeon conducted studies evaluating the use of Resuscitative Endovascular Balloon Occlusion of the Aorta, whereas the otolaryngologist's portfolio focused on the treatment of inhalational burn injuries. Those clinicians assigned to Critical Care Air Transport Teams conducted retrospective research or combat casualties undergoing aeromedical evacuation. Given the recent initiation of the two current classes, our results focus on the experiences from January 2019 through December 2022.

CSION Fellow Productivity

The CSION fellows demonstrated success in completing military requirements–aligned research protocols, generating publications, and submitting research grant applications (Table II). At the end of 2022, the first three CSION classes generated a total of 204 protocols and 234 manuscripts while receiving 33 grants. Most fellows participated in their respective medical department leadership committees, GME training, and medical journal committees.

Career Progression

The 12 CSION graduates to date have demonstrated continued research career progression. Two graduates were selected to participate in the Defense Advanced Research Projects Agency Services Chief Fellowship, whereas multiple graduates were selected for research positions (Table III). All CSION graduates remain actively engaged in clinical research. One CSION fellow has chosen to extend his term as an active duty officer, citing his experience and ability to actively participate in military requirements–aligned medical research as a factor influencing his decision.

DISCUSSION

Addressing future military health care and combat casualty care challenges requires collaboration between military clinicians and researchers, but the pipeline for training and maintaining clinician-scientists within the military is limited. To address this shortfall, we established the CSION program. This program allows for active duty military clinicians to receive training in military requirements–aligned research, grant writing, research funding mechanisms, and manuscript writing and publication. Additionally, it introduces fellows to multiple organizations and personnel that aid in navigating the research, regulatory, and funding processes allowing for the development of collaborative relationships necessary to maximize efficiency within the DHA and DoD research programs. The first three classes have demonstrated considerable success in securing research funding, executing military requirements–aligned research studies, and disseminating their findings. Each of the CSION graduates has continued to execute military requirements–aligned research with the potential to improve military medicine. In addition, the program has resulted in the retention of clinicians as active duty

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TABLE II. CSION Fellow Productivity

	Class of 2019–2020				Class of 2020–2021			Class of 2021–2022					Total
Member ID	1	2	3	4	5	6	7	8	9	10	11	12	$n = 12$
Research activities													
Human protocols	12	65	8	5	38	4	2	0	12	8	15	3	172
Animal protocols	5	2	2	5	5	4	2	0	0	3	0	4	32
Products													
Abstracts, oral podium presentations, and posters	27	110	8	24	12	0	8	17	14	15	3	2	240
Manuscripts	23	43	61	27	13	1	6	28	7	2	7	16	234
Book chapters	0	0	2	6	6	0	0	1	0	0	0	0	15
Grants													
Submitted	10	85	10	3	31	4	13	0	9	4	3	9	181
Awarded	0	8	1	0	11	4	4	0	0	1	1	3	33
Percent funded	0%	9%	10%	0%	35%	100%	31%	0%	0%	25%	33%	33%	18%
Leadership and scholarly duties													
Department leadership/ATO/task area manager	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	75%
Committee involvement	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	75%
Teaching	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
Editor/reviewer/editorial board	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	92%
Possess academic appointment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
Military duties													
Months deployed during the fellowship	0	0	0	2.1	9.2	0	0	0	0	0.2	0.9	7.1	19.5

Abbreviation: ATO, Area Task Officer.

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TABLE III. CSION Graduate Career Progression

Graduate 1	Serves as a research leader and mentor in the Department of Surgery
Graduate 2	Selected for DARPA Services Chief Fellowship; assigned as Capability Area Manager at the USAISR
Graduate 3	Assigned as SAUSHEC Orthopedics Department Assistant Program Director for Research
Graduate 4	Assigned to USAISR
Graduate 5	Assigned as Director of 59 MDW/ST En Route Care Research Center
Graduate 6	Selected for DARPA Services Chief Fellowship; assigned to 59 MDW/ST as Medical Director of Joint Integrated Clinical Medicine Research Portfolio
Graduate 7	Assigned as Director of 59 MDW/ST Surgical and Technological Advancements for Traumatic Injury in Combat Program
Graduate 8	Assigned as Director of 59 MDW/ST Clinical and Operational Space Medicine Innovation Consortium Program
Graduate 9	Serves as SAUSHEC Urology Department Assistant Program Director for Research
Graduate 10	Serves as a research mentor for Trainee Health and Versatile Injury Prevention and Embedded Reconditioning and Medical Director for Trainee Health and Fitness/Readiness division of the 59 MDW/ST Diagnostics Research Program
Graduate 11	Serves as Laboratory Director of Restorative Endeavor for Service Members Through Optimization of Reconstruction -Fuse lab and as a research mentor for USUHS medical student orthopedic research fellowship
Graduate 12	Serves as SAUSHEC Otolaryngology Residency Program Director

Abbreviations: DARPA, Defense Advanced Research Projects Agency; USAISR, U.S. Army Institute of Surgical Research; SAUSHEC, San Antonio Uniformed Services Health Education Consortium; 59 MDW/ST, 59th Medical Wing Chief Scientist's Office, Science and Technology; USUHS, Uniformed Services University of the Health Sciences.

service members, which fulfills the overarching goal of the program to "grow medical leaders."

The clinician-scientist hybrid career is valuable for increasing translational outputs from a traditional research pipeline.[14] The CSION fellowship was designed to similarly increase translational research productivity for combat casualty, medical readiness/sustainment, and DHA beneficiary care research with a shortened training time investment. Although the Uniformed Services University has a traditional MD-PhD pathway, the majority of combat casualty care research is published by clinicians without a PhD degree.[15] CSION provides a more efficient methodology to achieve the systemic benefits that have been historically attributed to the hybrid career pathway of the MD-PhD.[8,9] Instead of having individuals complete three or more additional years of training to obtain a PhD degree, mentorship by clinicians who have demonstrated success in clinical research in combination with DoD PhD scientists may provide a modality to increase the number of clinician researchers as well as their research quality.[10] Additionally, it allows those clinicians with past and current deployment experience to use lessons learned and challenges faced to guide their hypotheses and research portfolio while the remaining clinicians at the military treatment facility engaged in patient care.

Table II shows considerable variability between fellows with some individuals achieving very high productivity. This finding is partly due to the fact that some fellows collaborate with other personnel within the USAISR and 59 MDW/ST. In these circumstances, fellows received assistance from full-time PhD scientists, research nurses, and program managers, exponentially increasing the productivity and ensuring the execution of research despite competing clinical duties and deployments. CSION also allows for greater collaboration between DHA, civilian universities, and industry. During their CSION fellowship, clinicians are afforded the opportunity to interact with members of the research and biotechnology industry including business administrators, engineers, program managers, and regulatory compliance experts. Exposure early in their careers allows graduates to foster these relationships with industry to meet military health care needs. CSION graduates can serve as expert consultants to industries engaged in the development of future military medicine technologies.

CSION graduates provide an opportunity to improve GME research. Learning how to conduct medical research requires a large quantity of trial and error. Unfortunately, the current requirement of many residency programs for clinicians to complete one research project during the residency often results in the resident experiencing a frustrating and prolonged process of trial and error with no further future research opportunities to implement the lessons learned from the previous experience.[16] Multiple CSION graduates currently support GME students as research mentors. This mentorship allows for research experience to guide GME students in securing funding, avoiding common errors in conducting military requirements–aligned research, navigating the regulatory requirements of research, and motivating the ultimate publication of study results.

The CSION program provides a possible recruitment and retention tool, as clinicians are allowed to engage in research with DoD funding as part of their primary duties.[5] Within the military health care setting, clinicians interested in pursuing research face multiple unique challenges including finding and maintaining research mentors, military-specific duties (i.e., physical fitness, deployments, and duty assignment changes), and engagement in direct clinical care. However, research within the civilian health care presents its own unique challenges. These include substantial undergraduate and medical education debt and the need to engage in revenue-generating patient care activities.[5,7,8] Additionally, familiarity with military requirements–aligned research affords the clinician-scientist the intrinsically rewarding experience of conducting research with the potential to decrease combat mortality and improve the quality of life of service

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members and beneficiaries. Future studies will need to evaluate the impact of CSION participation on recruitment, career progression, and retention.

The CSION program has multiple limitations. The program does not have a designated line of funding. Therefore, CSION leadership must actively advocate with industry partners, research foundations, the Uniformed Services University, and the DHA to secure grant funding for CSION fellows. Similarly, the program does not have full-time personnel assigned to run the program. CSION leadership has taken it upon themselves to assume the extra duty of running the CSION program, and the loss of key personnel could significantly impact the program. Although the Henry M. Jackson Foundation for the Advancement of Military Medicine, Incorporated, donated a total of $49,900 as seedling grant funding to support two of the fellows and The Geneva Foundation has provided a part-time program manager, no programmatic funding is budgeted for CSION. Failure to secure programmatic funding, decreases in DHA grant funding, or departure of CSION personnel could leave the program unfunded and unstaffed. In the future, we hope to secure an annual budget of $500,000 from the DHA Research and Development Directorate to fund a full-time program manager and a Government Services Deputy Director to assist in leading the CSION program as well as over $1 million in DHA grant funding to fund the fellows' studies.

Despite these challenges, the CSION program has generated three classes of productive military clinical researchers, and CSION leadership remains dedicated to improving and solidifying the CSION fellowship. This new clinician-scientist "dyad" deserves further assessment as a less costly and faster means for a health system to achieve the myriad of benefits, as well as expand the program to other clinicians (i.e., dentists), which have previously been achieved from the MD-PhD pathway. CSION leadership continues to advocate for financial resources and manning with the hopes of eventually securing programmatic funding and full-time personnel assignments. Continued execution of the program will allow for a larger pool of military clinician-scientists addressing the challenges faced by the DHA. The expansion of this program to other DHA GME locations may allow for the continued development of military clinician-scientist, clinically relevant military requirements–aligned DHA research, and improved military medical care.

CONCLUSION

The CSION provides medical research training for military clinicians. To date, CSION fellows have conducted military-relevant requirements-aligned translational medical research, secured grant funding, produced multiple publications, and secured research leadership assignments. Continuation and expansion of the CSION program may improve the quality of military health care and produce the next generation of DHA research leaders.

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All authors have no conflicts of interest to declare.

DATA AVAILABILITY

The data underlying this article will be shared on reasonable request to the corresponding author.

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