U.S. Navy Aeromedical Missions from 2016–2019 with a Focus on En Route Care Provider Type

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BACKGROUND: En route care (ERC) is a military aeromedical mission designed to transport a patient to a higher level of care. With the exception of one manual, there are no other formal Navy ERC guidelines, leaving the service to provide such missions ad hoc. Based on the authors' review of available literature, it seems no prior research has been done on Navy rescue swimmers performing ERC, though many search and rescue (SAR) missions take place without designated medical personnel. This study specifically examines the type of provider involved in Navy ERC missions and the types of cases involved with the purpose of influencing Navy policy.

METHODS: A cross-sectional study examining 829 air evacuations performed by Navy SAR flight crews from 2016 to 2019 was analyzed.

RESULTS: Of 829 cases reviewed, patients were more likely to be active-duty personnel (51%) than civilian (47%), and there were 2.5 times more male than female patients. There were more trauma (54%) than medical (43%) patients, with Basic Life Support (BLS) level care (60%) delivered twice as often as Advanced Life Support (ALS) (28%). Search and Rescue Medical Technicians (SMTs) and rescue swimmers provided 83% of ERC, with rescue swimmers supporting 33% of all ERC missions alone.

DISCUSSION: The results of this study are in contrast to previous ERC studies, in which rescue swimmer-only transports were excluded from the data. The results raise the question, do rescue swimmers need to be trained to a higher level of care?

KEYWORDS: en-route care, Navy search and rescue, aeromedical evacuation, trauma medicine, critical care transport, combat casualty care, maritime search and rescue, ocean rescue, wilderness medicine.

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En route care (ERC) is a military aeromedical mission designed to transport a patient to a higher level of care. Though ERC delivery is possible by other means, the Navy's most prominent method is by way of helicopter-borne evacuation through search and rescue (SAR). The U.S. Navy currently has six SAR stations as well as several types of maritime platforms from which dedicated SAR missions launch. Navy SAR crews are usually equipped with Sikorsky H-60 helicopters, pilots, rescue swimmers, and, less often, SAR Medical Technicians (SMTs), who are the Navy's flight medics. The pilots and aircrew are highly trained in overwater, desert, and mountain rescue, including helicopter rappel, hoist, and sometimes high-altitude landing. Rescue swimmers, sometimes referred to as Aviation Air Rescue Swimmers, are highly proficient in rescue techniques, primarily through recovering survivors from the water, either by jumping from helicopters or via a hydraulic rescue hoist and then swimming, often for long durations. Even though Navy search and rescue crews are military assets intended for defense purposes only, at times they are also a public health asset to the communities and regions they serve, whether those include U.S. and foreign military personnel or civilian populations.

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With the exception of one manual,[8] there are no formal Navy ERC guidelines within service doctrine, nor is there a formal requirement or Program of Record to support the effort, leaving the service to provide such transport ad hoc. This is based in part on a lack of a clearly defined ERC mission area for the U.S. Navy within the Department of Defense (DoD) Directive 5100.01.[6] Elsewhere, not enough data exist to support policy changes needed in Navy ERC, as a 2017 article[23] is the only definitive paper which evaluates Navy ERC missions in the past 10 yr. This study resumes from the point at which those researchers[23] ended their study. No known literature prior to this is available on rescue swimmers providing ERC, even though many SAR missions fly without an SMT onboard.[23] The Navy Tactics, Techniques, and Procedures Manual 3-50.1, Search and Rescue Operations,[7] governs all aspects of SAR and includes a framework to document patient transports and care rendered.

Since 2016, the Naval Medical Research Center has collected over 130,000 ERC reports to incorporate into the Joint Trauma System; however, data concerning what type of clinician is providing the care are not yet captured. There are times when no medical assets are present for patient transport, making the next logical step to be providing rescue swimmers with Tactical Combat Casualty Care (TCCC) training (specifically TCCC tier 2) and emergency medical technician (EMT) certification. According to service doctrine,[6] ERC must involve adequate provider training and standardized critical care equipment for successful patient transport to higher levels of care. This study intends to reinforce the positive direction of the Navy in supporting and funding SAR, and the enlisted men and women performing the ERC mission, through advanced certification. By investing in the formal education of enlisted service members which can be recognized by civilian counterparts, the Navy can improve the readiness, capability, and morale of sailors. This study aims to illuminate the nature of current SAR missions to help identify further gaps since the last report published in 2017.[23]

In 1979, the Chief of Naval Operations established the SAR Model Manager (SARMM) office, which has oversight of SAR training and operations across the Navy and developed the rescue swimmer and SMT roles. Policy changes in more recent years have provided nuances to the use of the Navy's SMTs. During early Operation Iraqi Freedom/Operation Enduring Freedom campaigns, the U.S. Army provided medical evacuation (MEDEVAC), a dedicated medical only platform, and casualty evacuation, transport of opportunity, capability as part of intratheater ERC for the DoD. However, in 2003, the Army handed over both responsibilities to the Navy's medical personnel in the Fleet Marine Force stationed in Kuwait. To support this effort, in 2005, Army-Navy cooperation allowed Navy Hospital Corpsmen to attend the Army Flight Medic Course, which blended a portion of existing Army and Navy training. Noteworthy is the fact that Navy Flight Medic training is not standardized, as Navy SMTs consequently began completing 92 wk of training, while the Fleet Marine Force Hospital Corpsmen only require 30 wk and without any specific flight crew qualification.

In October 2014, the U.S. Army issued a memorandum announcing the deconsolidation of the Flight Medic Course,[5] which was shared by Navy SMTs up to that point. According to the memorandum, dated September 30, 2016, Navy Flight Medic training was to be provided by the Navy itself. This decision was in reaction to a congressional instruction[25] which mandated paramedic certification for all flight medics. In agreeing to fund and build a training curriculum as of 2019, the Navy is complying with the congressional mandate to have its SMTs paramedic qualified;[17] however, as of this publication, this has not yet been implemented.

There is a wealth of literature available from U.S. Army studies related to patient movement, ERC, and critical care medicine in the context of medical and traumatic care in combat and austere settings as the Army is tasked with intratheater ERC.[6] Most prominently, a 2012 U.S. Army study noted the mortality rate of casualties with paramedic-trained flight medics had a 66% survival rate in Afghanistan[13] and, as a result, the Army now mirrors civilian MEDEVAC standards of care by requiring National Registry Paramedic and Critical Care Flight Paramedic certification for all of its Army Flight Medics. From 2008 to 2009, the Army reported that, of 600 evacuation flights in one region during Operation Enduring Freedom, 86% of MEDEVAC cases were trauma-related, 14% were medical, and 62% required a paramedic.[14] This report occurred during wartime from a sister service with a slightly different mission and area of coverage as compared to the Navy, yet it still provides a good benchmark since there is a paucity of data on these missions across several years of related research.

Maddry et al.[15] examined provider-level training and outcomes of patients. Although no significant difference in patient mortality rates were found between provider types, it was clear that providers possessing advanced skills were more likely to actively employ those capabilities during transport.[15] As an example, paramedics were found to be more likely than SMTs without paramedic training to give blood products, ketamine, or other medications in flight to decrease morbidity and complications.[15] In a 2012 study,[13] critical care-trained flight paramedics were associated with a lower estimated risk of 48-h mortality among severely injured combat patients compared to patients under the care of a lower level clinician. A Navy study looking at 84 SMT, ERC Registered Nurse, and physician participants' performance during a patient transport simulation found that 98% of all subjects failed to complete all critical tasks, implying that training is not adequate for ERC in the Navy across all levels.[4] Notably, this study did not have paramedics, who are specially trained for critical patients, which might have made a difference.

The positive outcomes associated with first aid and Basic Life Support (BLS) as lifesaving measures are well-documented[11,12,16] and are part of the chain of survival.[1] However, dramatically high rates of improper first aid have also been reported[20] and underscore the need for standardized levels of care above that of first aid for naval aircrews performing rescue missions. The more prepared rescue swimmers are to handle medical and traumatic emergencies, the better for patient outcome. Cardiac emergencies and other medical indications are some of the most common encounters during rescues at sea, comprising as much as 25% of all cases.[22,24] Requiring EMT certification and TCCC standards for all Navy rescue swimmers is a step in the right direction; however, we must be careful not to overextend such providers, as they are not a substitute for an SMT and may not always safely determine whether or not Advanced Life Support (ALS) is indicated.[3]

A 2017 study[23] addressed 428 ERC cases treated by Navy operational assets from 2012 to 2015. Walrath et al.[23] found that average transport time was 54 (30–78) min and that more than one provider was present 22% of the time. For missions with just one provider, the provider was an SMT 76% of the time.[23] About half of the missions were ALS-related and less than half of the missions were trauma-related.[23] They did not discuss diagnosis categories of patients treated during transport, given that the research team did not have access to original documents, nor did they include rescue swimmers as an ERC provider category. Nonetheless, the study[23] has been an important impetus for the requirement of Navy SMTs to become paramedic certified.

The U.S. Congress mandates that all flight medics be paramedic-qualified.[25] Civilian flight paramedic qualifications consist of the following: state or nationally registered EMT Paramedic certification, 3 yr experience, 60 h of classroom training, 40 h of clinical rotations, 120 h of preceptor-based field training, Advanced Cardiac Life Support (including rapid sequence intubation), trauma life support training, Emergency Medical Services physician direction, consistent documentation, and continuing medical education experiences.[14] According to the Centers for Medicare and Medicaid Services, ALS care requires a paramedic level of training, whereas BLS may be done by an EMT.[2,18]

With respect to the Navy, the SMT provides ERC for routine illness and interventions for emergent patients in flight, during both peacetime and combat operations. SMTs require certifications in Pre-Hospital and International Trauma Life Support, Tactical Combat Casualty Care, Advanced Cardiac Life Support, Pediatric Advanced Life Support (or equivalent), and Basic Life Support for qualification. Naval ERC doctrine is unique in that it specifically designates the SMT for this role and that his or her emergency medical care functions are often independent of a medical officer during ERC missions [Department of the Navy. Naval search and rescue standardization program OPNAVINST 3130.6E. unpublished report; May 3, 2010].

To address the congressional mandate, the current curriculum for SMTs is written to include the new paramedic curriculum, which will include implementing an agreement with a paramedic school and a capstone course to incorporate adequate flight paramedic training. Unfortunately, as the Navy tries to bridge between congressional mandate and practice, there continues to be a gap in care, such that currently not enough SMTs in the Navy are paramedics. Of the nearly 18-mo training curriculum for SMTs, only about 7 wk of training is geared toward emergency medicine.[19] Not only are the SMTs not fully paramedic-qualified, but there are not enough of them for every SAR mission. Limited SMTs leaves rescue swimmers almost solely responsible for patient care in most instances.

Rescue swimmers, first and foremost, are essential military flight crewmembers, but are also required to maintain proficiency in basic emergency care and first aid,[21] which consists of: CPR, bleeding control, treatment for fractures, burns, and shock, and management of acute environmental conditions from heat, cold, or water exposure. There is a total of 38 h of initial medical training given to rescue swimmers (which is primarily trauma-based, though about a third of the training time required for civilian EMT certification),[9] with the remainder of skills coming in the form of field training during operational assignment.

METHODS

Subjects

The sample was composed of 829 ERC SAR encounters, which was all the patient care missions captured by the SARMM from 2016–2019 worldwide. The target population for this study was those military and civilian patients under the care of Navy ERC providers. A sample size for power analysis was not calculated as all available data was used during the time period in question. To maintain sequence and prevent overlap of data, the time period began at the point in which Walrath et al.[23] completed their analysis. This study received institutional review board (IRB) approval from the University of West Florida (Number 2021-029). It also received an IRB exemption from the U.S. Navy. The study protocol was approved by a Naval Aerospace Medical Institute IRB in compliance with all applicable federal regulations governing the protection of human subjects.

Procedure

This was a cross-sectional study of all U.S. Navy search and rescue missions from 2016–2019. The authors extended and expanded upon the database used in previous research[23] to include descriptive statistics: the total number of patients transported, percentages of Advanced Life Support vs. Basic Life Support transports, time of transport, and type of ERC provider for the transport. Reported are the total number of patients transported, types of patients transported, and interventions used by type of ERC provider for the transport during 2016–2019. The authors also sought to understand what sorts of ERC missions are flown by Navy personnel and whether there is a difference in the type of transport or interventions performed between such providers in the Navy SAR community.

The first author completed a review of 1398 SAR reports from 2016–2019 from the U.S. Navy SARMM database. Excluded from the study were any SAR missions not involving any patient care. Those included 372 missions which were

Table I. Type of Patient vs. Type of Provider.

	OVERALL	TEAM	FS	OTHER	SMT/PARAMEDIC	RESCUE SWIMMER	*P*-VALUE
N	829	97	26	9	417	274	
Age	33	33	26	27	37	26	0.000
(range)	(24–50)	(23.25–42.75)	(20–30)	(23.75–32.5)	(26–58)	(22–35)	
Male % (*N*)	55 (459)	70 (68)	46 (12)	56 (5)	63 (262)	40 (110)	0.291
Female % (*N*)	23 (187)	22 (21)	35 (9)	11 (1)	25 (103)	18 (50)	0.291
Civilian % (*N*)	47 (391)	30 (29)	8 (2)	22 (2)	71 (294)	22 (59)	0.000
Military % (*N*)	52 (431)	69 (67)	92 (24)	78 (7)	28 (119)	78 (213)	0.000
Trauma % (*N*)	55 (453)	52 (50)	38 (10)	—	65 (273	43 (119)	0.002
Medical % (*N*)	44 (364)	48 (47)	62 (16)	100 (9)	33 (138)	54 (149)	0.002

FS: flight surgeon; SMT: search and rescue medical technician.

aborted or otherwise canceled, 22 that involved a patient who was already deceased, and 175 other missions that transported people without care rendered, which is often seen in, for example, natural disasters. This left 829 ERC missions in a wide range of settings. These reports are completed by SAR crews after each mission with an accompanying medical report, which is required if medical care was given during transport. Missions ranged from rescues at sea, moving critically ill civilians at remote hospitals to more definitive care sites, mountain rescues in Washington State, or helping border control efforts in Arizona. There were nearly 200 evacuations originating from a ship, many of which were due to trauma. Until recently, the only record of care by provider for ERC has been collected by the SARMM from SAR missions. Now, mission data are being collected at the Joint Trauma System, though only for the purposes of cataloging trauma case data.

ERC provider type was examined in five categories: Overall/Total; Team of two or more providers; Flight Surgeon only; SMT or Paramedic only; and other (Registered Nurse, Advanced Practice Nurse, Physician Assistant, Independent Duty Corpsman) or Rescue Swimmer. The dependent variables consisted of type of transport and interventions performed. Type of transport is determined by medical or trauma, civilian or military, age and gender of patient, and diagnosis categories. Diagnoses are grouped into eight main categories: psychiatric, cardiac/stroke, orthopedics/trauma/fall/TBI, environmental (e.g., dehydration, water related, heat/cold injury), aviation-related, medical other, OB/GYN, or abdominal pain/appendicitis. Interventions performed are recorded as: ALS/BLS, IV/IO, airway, oxygen, meds, monitor, and ambulatory status. Age was collected as a continuous variable. All other binomial variables (i.e., gender, patient type, and interventions) as well as diagnosis groups were collected as categorical variables. These data measures are the same ones used in a similar study 4 yr ago,[23] specifically to be able to compare the two studies, thus allowing a comparison over time.

Statistical Analysis

Data was exported to the Statistical Package for Social Sciences (SPSS) v25 (IBM, Inc., Armonk, NY, USA), which was used for all analysis except sample size and transport time. In order to complete statistical analysis, each variable was run independently with missing data removed, creating a new *N* for each analysis. ERC categories with expected values <5 were eliminated to remove potential bias for significance.

Categorical data were reported as frequencies and percentages, whereas continuous variables were reported as medians, including transport time (via interquartile range). A five-way comparison was completed across ERC provider types for each categorical dependent variable using a Chi-squared test. For the one continuous variable of age, ANOVA was performed. This helped determine the association, if any, with the type of patient and the interventions performed according to the type of ERC provider. A $P < 0.05$ was considered significant.

RESULTS

Of 829 cases reviewed, median transport time was 35 min (2–370 min); median age of patients was 33 yr old (range of 1–95 yr); transport involved active-duty personnel in 51% of cases and civilian in 47%; and there were 2.5 times more male than female patients. There were nearly equal amounts of trauma (54%) and medical (43%) patients transported, though BLS-level care (60%) was required twice as much as ALS (28%). Missions were staffed by an individual provider 87% of the time (SMT 50%, Flight Surgeon 3%, Other 1%, Rescue Swimmer 33%), with SMTs and rescue swimmers providing 83% of all ERC missions. Teams consisting of more than one type of provider comprised only 12% of missions. There were six missions with an undocumented ERC provider type that were included in the descriptive data but were eliminated for statistical analysis. SMTs transported older patients in general compared to other ERC providers and those patients were more likely to be civilian. Further details, such as types of patients, interventions performed, and diagnoses of patients by ERC provider type, are listed in **Table I**, **Table II**, and **Table III**.

The types of patients transferred and the interventions provided in flight are associated with ERC clinician type. An analysis of age via ANOVA showed significant differences ($P < 0.0001$) by provider type, with SMTs providing ERC to older patients. Chi-squared analysis was completed for all other variables, showing statistical significance in all categories except for Gender, which was evenly distributed among provider types, and Airway, which was too rare an intervention to be significant for any ERC provider.

Table II. Diagnostic Category vs. Provider Type.

	OVERALL	TEAM	FS	OTHER	SMT/PARAMEDIC	RESCUE SWIMMER	*P*-VALUE
Psychiatric % (*N*)	4 (30)	3 (3)	8 (2)	14 (1)	1 (6)	7 (18)	0.000
Cardiac/stroke % (*N*)	12 (92)	24 (23)	15 (4)	14 (1)	12 (50)	5 (14)	0.000
Orthopedics/trauma % (*N*)	37 (294)	37 (36)	30 (8)	—	45 (185)	25 (63)	0.000
Environmental % (*N*)	14 (114)	4 (4)	—	—	18 (75)	14 (35)	0.000
Aviation-related % (*N*)	5 (41)	11 (11)	12 (3)	—	3 (11)	6 (16)	0.000
Medical other % (*N*)	19 (155)	17 (16)	19 (5)	57 (4)	15 (61)	26 (66)	0.000
OB/GYN % (*N*)	2 (17)	1 (1)	12 (3)	—	3 (11)	1 (2)	0.000
Abdominal pain / appendicitis % (*N*)	7 (59)	3 (3)	4 (1)	14 (1)	3 (11)	16 (42)	0.000
Total diagnoses	802	97	26	7	410	256	

FS: flight surgeon; SMT: search and rescue medical technician.

DISCUSSION

The purpose of this study was to define the prevalence of ERC patient types and interventions against the most common providers in the naval ERC setting. In so doing, this study has also added a wider, more specific definition of ERC provider, as the rescue swimmer was not accounted for previously.[23] Patient diagnosis categories were added to this study, as that information was not available in a prior study,[23] but could have provided valuable insight for policy making, one of the end goals of this research. Adding this level of analysis helps identify manning and training gaps for sailors and gives insight on what to expect in the field. It will also help reinforce clinical practice guidelines and policies being developed by the ERC Clinical Community Sub-Committee. This sets the stage for additional iterations of research devoted to military and naval ERC. Although total missions nearly doubled, when comparing patient demographic information from this study to a 2017 study,[23] it remains greatly unchanged. The amount of overall interventions has changed since then, decreasing in all categories. This could be partly due to including rescue swimmers, who fly with limited supplies, to the overall ERC provider total. One can argue that, while operational tempo has decreased since the 2017 study,[23] there were twice as many patients moved. Even accounting for the 274 rescue swimmer missions (not included in previous research), this does not make up the difference in total patients moved between studies. The totals of those moved by a team and flight surgeon (from 93 to 97 and 25 to 26) are similar over time, there was a decrease in the other category of providers (from 44 to 9), not quite doubling with respect to SMT-only missions (from 252 to 417).

This study showed a higher variability in transport time than the previous study, with some flights being over 6 h. Very short missions were often associated with swimmer only missions, which required less care and were previously uncaptured in prior studies. Given the high number of undocumented gender (22%), no clear conclusion can be made about gender and transport. Like previous research,[23] we also found that SMTs transported older patients in comparison to other ERC providers. Perhaps the most striking of the results is that an overwhelming majority of ERC is completed by enlisted personnel, with the rescue swimmer and SMT performing 83% of missions. Furthermore, previous conclusions[23] were that: SMTs provide care most often, less than half of cases are traumatic, and more than half required advanced life support. This is in contrast to the present study's findings when adding the additional category of rescue swimmer as an ERC provider. The data showed trauma as more common and less than one-third of patients receiving ALS. Swimmers save and care for a wide variety of patients whose clinical presentations are by no means limited to environmental injury or the rescuers' level of training. This report clearly shows Navy rescue swimmers are moving several different types of medical patients and often without any designated medical provider on board. Great strides have been made in advancing the knowledge and skills of SAR Medical Technicians, and similar measures must be taken in terms of furthering the basic medical care that rescue swimmers could provide.

Table III. Interventions vs. Provider Type.

	OVERALL	TEAM	FS	OTHER	SMT/PARAMEDIC	RESCUE SWIMMER	*P*-VALUE
BLS % (*N*)	60 (500)	32 (31)	54 (14)	33 (3)	59 (244)	74 (203)	0.000
ALS % (*N*)	28 (236)	57 (55)	35 (9)	33 (3)	39 (162)	2 (6)	0.000
Ambulatory % (*N*)	43 (356)	23 (22)	42 (11)	44 (4)	33 (138)	65 (177)	0.000
Airway % (*N*)	4 (34)	4 (4)	7 (2)	—	12 (27)	—	0.710
Oxygen % (*N*)	19 (161)	45 (44)	19 (5)	11 (1)	24 (99)	4 (11)	0.000
IV/IO % (*N*)	39 (325)	73 (71)	35 (9)	44 (4)	52 (215)	9 (24)	0.000
Medication % (*N*)	28 (228)	52 (50)	27 (7)	22 (2)	34 (140)	10 (27)	0.000
Monitor % (*N*)	33 (277)	64 (62)	27 (7)	33 (3)	45 (189)	5 (14)	0.000

FS: flight surgeon; SMT: search and rescue medical technician.

Another aspect of this study is noting the diagnoses of patients who were moved. Orthopedic/traumatic emergencies made up 35.4% of all missions, followed by "medical other" (18.7%), environmental (13.7), cardiac/stroke (11.1%), abdominal pain (7.4%), aviation-related (4.9%), psychiatric (3.6%), and last OB/GYN (2%). This further reinforces the congressional mandate for SMTs to be paramedic-trained and suggests rescue swimmers should become EMT-certified as they are moving patients with medical and traumatic presentations that exceed their knowledge and skill.

There are several limitations to this research, one being the constraints of a cross-sectional design, such that an author is unable to draw conclusions about cause and effect.[21] Selection bias was not a factor though, since all ERC reports available during the period in question were analyzed. Another weakness is that, due to differences across branches of the U.S. military, these results might not be applicable to U.S. Army or U.S. Air Force ERC missions, though there might be some application for rescue missions performed by the U.S. Coast Guard.

Inconsistent use of forms by rescue crews as well as differences in charting methodology and patient report writing presented difficulty in data collection. The Navy has several different forms, not all of which are filled out completely by crews. Additionally, the SAR Form 3-50-1 does not adequately cover medical indications, assessment, treatment, or other important narratives. Medical documentation is only as good as the level of training and care taken by the one doing it. Without proper documentation, it is difficult to assess more in-depth medical information on acuity, actual diagnosis, or whether or not standard level of care was met. The Navy has since appointed SAR medical directors for both Helicopter Sea Combat Wing, U.S. Atlantic Fleet, and Helicopter Sea Combat Wing, U.S. Pacific Fleet, and subsequent emphasis on improved documentation and standardization. Inconsistent documentation, although addressed, was not yet seen in practice by the time of this study.[10]

Though the design was not a very expensive undertaking, due to the nature of secondary data and the analysis by a very small staff, the possibility for human error still remains. A complete review of all the data points and narratives was completed quickly, in a matter of 2 mo, which made the task very attractive. This could be improved by using the robust data gathered by the Joint Trauma System for future studies, which now note provider type and capture some outcome data.

Due to the quality of medical and rescue report documentation and study design, the rescue platforms, points of origin, destination, and classification of mission type were not captured in this data set. It is possible that an analysis of those factors might be useful for training purposes and should be considered in future studies.

The U.S. Navy is a provider of medical care worldwide[23] and, as U.S. Navy aircraft continue to operate in combat environments, the need for advanced medical capability will expand. However, combat is only a small fraction of the caseload. Navies that support airborne ERC capability are unique in that maritime environments frequently involve long transports of medical and traumatic cases[22,23] in poor weather conditions, and sometimes to facilities other than a hospital, such as ship-to-ship transfers to a large, medically based ship. The most common reason for evacuation on the seas remains medically based[23] and, in some cases, as a result of cardiac emergencies.[22] The U.S. Navy routinely performs humanitarian missions and, even more frequently, opportune rescues and evacuations[23] take place on the high seas, with unskilled, nonmedical personnel aboard the rescue aircraft, as mentioned in this report.

With the updated information in this study, the ERC Clinical Community Sub-Committee can influence policies set by the U.S. Navy Bureau of Medicine and Surgery through research-based evidence. If the Navy has improved ERC capacity, then not only does the Department of Defense achieve better care for its members, but a higher level of care is available to the surrounding community as well, thus further ensuring readiness.

It is clear from the review of reports across the 3-yr period that enlisted personnel and, specifically, nonmedically trained rescue swimmers continue to provide a significant amount of ERC, even more than what was thought previously. Time is often of the essence in emergency medicine and so is adequate treatment en route to higher levels of care in emergency transport. Thus, the finding that rescuers perform a significant portion of ERC missions illustrates an even larger space in the continuum of care for patients undergoing movement in naval settings. Having found that rescue swimmers are performing care outside their skill level raises the question of whether increased funding would be beneficial. There is a steady expansion of literature pointing to the need for Navy medicine to address the service gap identified in its ERC program. The findings of this study reinforce the Navy's efforts to bring a paramedic capability to its SMTs, but underscore the need for advanced medical capability in its rescue swimmer community. The data and results were reported to the Navy's ERC Subcommittee, who will use the findings to make evidence-based recommendation for Navy ERC policy.

There are multiple paths for additional research in ERC, all of which would greatly improve the current state of provisions of care and patient movement in austere, maritime, or otherwise naval environments. With the new inclusion of ERC provider type added to the Joint Trauma System, it may be possible, for the first time, to get a larger sample as well as assess for outcome in future studies. Accessing greater quantities of data from ground and ship-based communities could provide more compelling numbers in the overall patient population, drive higher quality statistical procedure, and lend insight into how ERC affects patients. Misfortune on the high seas can be a dangerous circumstance and having adequate levels of medical training for responding personnel is paramount to protecting the life of survivors.

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