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REVIEW ARTICLE

An Analysis of Training of the Remote Medical Provider and Recommended Standards

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ABSTRACT

This article summarizes the mindset, educational requirements, different training aspects, and specific treatment protocols that help establish the Remote Medical Provider (RMP) concept's baseline proficiency criteria and recommended institutional standards and provide a foundation resource for policymakers and academic leaders. The remote medical provider is any level of a practitioner who provides health care or service in a remote setting, defined as isolation from 'routine' healthcare service due to limited resources, physical distance, mission parameters, travel time, or sociopolitical constraints. A remote setting is described within these five disciplines: austere, disaster/humanitarian, expedition, military, and wilderness medicine. The remote medical provider requires a multidisciplinary knowledge base with an advanced skill set to deliver innovative treatment methods with limited diagnostic support or advanced services. The remote medical provider should also be well-versed in both independent duty care and collaborative telehealth - telemedicine. The remote medical provider requires competence in progressively higher levels of care with a seasoned level of understanding, responsibility, and resourcefulness. The remote medical provider needs to have an adaptive mindset, a robust public-global health perspective with cross-cultural understanding, and enduring resilience to the harshness of the environment.

Keywords: austere, disaster, expedition, extreme, humanitarian, military, mindset, prolonged field care, remote, tactical emergency/combat casualty care, training, wilderness medicine.

Introduction

The Australian College of Rural and Remote Medicine helped define urban, rural, and remote medical practices in efforts to improve working and teaching within these geographical and resource-limited differences[1-4]. The remote medical provider (RMP) is any level of a practitioner who provides health care or service in a remote setting, defined as isolation from 'routine' healthcare services due to limited resources, physical distance, mission parameters, travel time, and/or sociopolitical constraints. A remote setting is described within these five disciplines: austere, disaster/humanitarian, expedition, military, and wilderness medicine.

This article will analyze the adaptive mindset, educational requirements, unique training aspects, and foundational skill set within each of these five disciplines: austere, disaster/humanitarian, expedition, military, and wilderness medicine. This analysis will help guide the remote practitioner by better understanding the mindsets, preparedness, degree of knowledge, and the foundational skill requirements within each discipline. The article will also help the inspiring remote practitioner to be better prepared for the exciting and unique challenges of working in these different environments and establish baseline criteria and institutional standards for the RMP concept while providing a foundation resource for policymakers and academic leaders.

Methodology

A comprehensive literature search was conducted using multiple databases. Five databases - PubMed, PubMed Central (PMC), Google Scholar, Cochrane Library, and ScienceDirect, were used in a systematic search. Inclusion criteria were articles published that focused on austere, disaster/ humanitarian, expedition, military, and wilderness medicine. Article selection was based upon publications that met the criteria. Preferred Reporting Items for Systematic Reviews guidelines were utilized using the inclusion criteria. A qualitative literature review of training for the remote medical provider led to the thematic analysis of mindset and the five disciplines in which remote medical providers are most utilized. Thus, the analysis of training within each discipline is addressed.

Mindset

The RMP must first mentally prepare and change how to think about working in austere or remote situations. Working as an RMP, either as a solo practitioner or part of a team, requires an adaptive mindset and skill set that is much different from working in a clinic, hospital, or more resourceful environment. Providing the best health care and services possible is the paramount goal of the RMP. The essence of an adaptive mindset is finding comfort within the uncomfortable, a willingness to not only endure but embrace the potential pain and suffering of harsh situations. Individuals drawn to remote and extreme settings often have specific traits and enduring resilience similar to military special operations forces (SOF). Many SOF or specialized civilian practitioners are routinely tasked to work as an RMP within these five disciplines and are often assessed and selected based on their PAID attributes: Physical fitness and perseverance; Adaptability and aptitude above par; Intellect and ingenuity; Discipline, and determination[5].

Working in a remote setting requires a survival mindset by knowing basic survival skills, which can be remembered using the ACT SWIFTLY mnemonic. (Awareness, Common Sense, Think - Shelter/Fire, Water, Improvise, Food, Travel, Learn the Basics, Your Mindset Matters). The goals to ACT SWIFTLY help keep one's survival priorities in order and are based on the Rules of Three, which states one cannot survive more than 3 seconds without situational awareness or common sense, 3 minutes without oxygen, or with arterial blood loss, 3 hours without shelter, 3 days without water, 3 weeks without food, and 3 months without hope[6].

Situational awareness is an understanding of an environment, its elements, and how it changes with respect to time or other factors. Common sense is the essential ability to perceive, understand, and

judge the current situation appropriately. Both are required to quickly assess the current situation and stop to think about scene safety, security, equipment, personnel, and potential environmental hazards (e.g., avalanche, cliff, rocks, lighting, water-wind-snow storms, or wildlife-human attacks).

Another adaptive mindset goal is visualization and thinking about the worst-case scenario (*Premeditatio Malorum*) prior to the RMP's first field experience. An example in the remote-austere environment may be treating a patient who is having severe respiratory distress due to sepsis and needs rapid sequence induction and intubation (RSII), but there is no reliable electricity for the ventilator, monitoring, or enough medications on hand to sustain long-term RSII[7]. The RMP's ability to improvise or think outside the box is required for low-resource environments[8,9]. In a limited resource environment, improvised medicine can often provide the best care; it only requires know-how to knowledge with imagination and creativity[10,11]. As necessity is the mother of invention, the RMP needs to THINK (*Thinking Hard Inspires New Knowledge)* to encourage an adaptive mindset framework to challenging situations. A recent example is the modernized tourniquet, first designed based on an improvised device that provided circumferential pressure during amputations in the 16th century[11].

There are countless examples of improvised medicine being used in remote settings, such as cutting the end of a surgical glove off to improvise a Heimlich valve for a tube thoracostomy (chest tube) or improvised three-jar underwater seal system instead of a Pleur-evac[12]. Lives have been saved by using a Foley catheter to tamponade a penetrating neck wound, and by improvising an autologous transfusion system for a massive hemothorax[13,14,15]. Resource limitations for Blood Far Forward have been improvised by unique ways of setting up walking blood banks[16,17,18]. Transporting casualties in extreme environments is often dangerous and requires applying basic survival knowledge such as building improvised outdoor emergency shelters or timely employment of a hypothermia wrap (burrito wrap)[6,19]. Knowing an RMP could be the only trained medical provider watching over the patient(s) for an indeterminate time period, which could range from hours to weeks as the patients' condition deteriorates, requires a resilient (enduring) mindset. A recent example was the 17 days it took to find, rescue, and transport 12 anesthetized football (soccer) students and their coach underwater in the Tham Luang Nang Non cave system[20]. The Thailand cave rescue was effective due to the efforts of a collaborative team of specialized individuals with multidisciplinary backgrounds who used the THINK (out-of-the-box) principles to improvise a successful solution.

The RMP requires a multidisciplinary skill set and the ability to address worst-case scenarios starts with a strong level of competence within the scope of practice established by their medical credentials. The RMP should master the basics of their credentials first, as it is essential to assess competence vs. confidence. A study of the Advanced Cardiac Life Support (ACLS) course showed that participants had very high perceived confidence levels but only a 12% course pass rate for the stable tachyarrhythmia scenario and a 57% course pass rate for the unstable tachyarrhythmia scenario[21]. The RMP requires confidence, but competence is paramount in life-threatening situations, as hands-on skill performance is often done as a solo provider in a remote setting. Therefore, basic life and trauma support courses are considered foundation skills, and the RMP must have mandatory proficiency levels in them before moving on to more advanced courses or gaining additional skill sets. A list of foundation training courses is provided in Table 1.

Table 1. Standard Life and Trauma Support Courses - Recertification is every 2-4 years.

Standard Life and Trauma Support Courses
• Heartsaver First Aid Course: Cardiopulmonary Resuscitation (CPR - AED)
• Basic Life Support (BLS)
• Advanced Life Support (ALS)
• Advanced Burn Life Support (ABLS)
• Advanced Cardiac Life Support (ACLS)
• Advanced Medical Life Support (AMLS)
• Advanced Life Support in Obstetrics (ALSO)
• Pediatric Advanced Life Support (PALS) APLS, PEPP, EPC, ENPC, Euro-PLS
• Basic Trauma Life Support (BTLS) – STOP THE BLEED
• Prehospital Trauma Life Support (PHTLS)
• International Trauma Life Support (ITLS)
• Advanced Trauma Care for Nurses (ATCN)
• Trauma Nurse Care Course (TNCC)
• Advanced Trauma Life Support (ATLS)
• European Trauma Course (ETC)

Military Medicine

Military medicine expands across the spectrum of treating and caring for military members and their families through multitudinous disciplines and occupational specialties. Working as a military remote practitioner can allow for unparalleled training opportunities. Extensive military medical research centers and the demand to care for those tasked to work in austere-remote, disaster-humanitarian, expedition-extreme, or wilderness environments can add to the RMP training capacity[22]. The military RMP mindset must consider worst-case scenarios by imagining the most remote and resourced limited environments, such as a mission to Mars[23]. Using military after-action reviews and building on lessons learned has helped guide medical research with technological advancements in austere and battlefield medicine from the point of injury care, en route care, surgical care, and beyond care.

An after-action review of the battle in Mogadishu (Black Hawk Down) led to the 1996 publication of Tactical Combat Casualty Care (TCCC) and its three phases of care: care under fire (CUF), tactical field care (TFC), and tactical evacuation care (TEC)[24,25]. These tactical protocols have been extended into austere, disaster, expedition, and wilderness medicine[26]. The TCCC principles provide the foundation skill set for the continuum of patient care for Prolonged Field Care (PFC) principles and the Forward Surgical Team (FST) competencies for the austere setting[27,28,29]. The RMP must become competent in using the mnemonics MARCH (massive bleeding, airway, respiration, circulation, head/hypothermia) and PAWS (pain, antibiotics, wounds, splinting) to ensure treatment and proper equipment training requirements, which are the cornerstone of any military trauma course[30,31]. The PFC principle was designed for the RMP by providing guidelines for

minimum, better, and best - knowledge, skill, and equipment for optimal care based on its four stages: Ruck, Truck, House, and Plane (RTHP)[32]. Within the PFC framework, there are 10 core capabilities that an RMP should become proficient at based on the Dreyfus model of skills acquisition[5,33]. Moreover, if the military RMP does not obtain basic proficiency in understanding and performing TCCC principles, they should not be allowed to advance into PFC clinical practice guidelines (CPGs) or advance resuscitative care.[34] One of the most significant innovations to help provide treatment guidelines for the RMP is the numerous CPGs that have been published through the U.S. Joint Trauma System (JTS) Performance Improvement program, as these evidence-based guidelines are designed and built by subject matter experts for austere, remote, and hospital settings[34].

The RMP can obtain additional skill sets in multiple specialties with military medicine, such as dive, flight, mountain, desert, and tropical medicine; however, the RMP must ensure their foundation skills are mastered before adding specialties skill sets[35]. Competency in the listed foundation skills (TCCC) must be assessed routinely. If basic hemostasis with direct pressure or an improvised tourniquet cannot be performed to a standard, there is no need to teach how to perform a whole blood transfusion. The opposite is true for RMP critical care teams or trauma surgeons. While critical care teams and trauma surgeons have a high level of advanced skill competency, in the remote setting, they must also be able to perform basic skill sets that are routinely delegated (i.e., starting intravenous lines or calculating drip rates)[9]. Knowledge of when to shift from observation to intervention and back is a valuable skill set. An adaptive mindset must be assessed or learned before facing a unique challenge in a remote setting[36]. Many of the above military RMP foundational and advanced principles are taught as pre-conference courses or during breakout sessions at the annual Special Operations Medical Association (SOMA) - Scientific Assembly. The U.S. military courses are listed in Table 2.

Table 2. United States (U.S.) Defense Medical Readiness Training Institute.

Aerospace – Flight Medicine
• Aerospace Residency (Air Force, Army, Navy, 2 Civilian programs)
• Army Critical Care Flight Paramedic
• Critical Care Air Transport Initial Course
• Army Flight Surgeon Primary Course
Disaster Medicine Program or Courses
• Federal Coordinating Center & Patient Reception Area Course (FCC/PRA)
• Hospital ICS Course (HICS)
• Incident Command System (ICS) Courses
• Public Health Emergency Management (PHEM) Course
• Emergency Preparedness and Response Course (EPRC)
Dive – Hyperbaric Medicine
• Undersea Medical Officer Course (UMO – U.S. Navy)
• Diving Medical Technician Course (DMT)
• Dive Medical Officer / Hyperbaric Medical Officer (DMO/HMO – U.S. Navy/Army)

Combat and Trauma Medicine Courses

- Tactical Combat Casualty Care (TCCC); En Route & Surgical (ERCCC-SCCC)
- Combat Casualty Care Course (C4)
- Combat Paramedic Program 300-F1 (P)
- Special Operations Combat Medic (SOCM)
- Tactical Combat Medical Care Course (TCMC)
- Army Trauma Training Center (ATTC)
- Navy Trauma Training Center (NTTC)
- Air Force - Center for Sustainment of Trauma and Readiness Skills (C-STARS)
- Emergency War Surgery Course(s)

Medical Operations Programs - Courses

- Joint Medical Operations Course (JMOC)
- Joint Medical Planning Tool Course (JMPT)
- Joint Senior Medical Leaders Course (JSMLC)
- Joint Humanitarian Operations Course (JHOC)
- Military Tropical Medicine Course (WRAIR)
- Mountain Medicine Course (U.S. Marine Corps)

Uniformed Services University of the Health Sciences (USUHS)

- Military Mountain Medicine Course (M3C) / U.S.M.C - Mountain Medicine Course
- Cold Weather and Avalanche Course / Dive Medicine Course

Austere Medicine

Austere medicine provides health care or services in plain or harsh environments with limited resources. Austere medicine ultimately entails taking away one's normal comfort level by working in isolation or less-than-ideal conditions (being uncomfortable), with limited resources, personnel, equipment, transportation, or outside the routine health care system. Austere environments can apply to many other disciplines, such as military or tactical medicine in Africa, disaster or humanitarian assistance in Asia, an expedition in Antarctica, or wilderness (tropical) medicine in the Amazon. Furthermore, proactive planning using the 6Ps mnemonic (prior planning & preparation prevents poor performance) can often help organize the RMP working in austere, remote, and disaster environments by focusing on preparation, planning, personal, public health, patient, prognosis, and situational awareness[37].

Training for austere environments should include stress exposure or stress inoculation training. Simply closing one's eyes to perform a task is the simplest form of stress exposure. Stress inoculation training helps build physical and mental resilience and prepares the individual to perform tasks more efficiently and effectively under high-demand or high-stress conditions[38,39]. Furthermore, the RMP must work efficiently and effectively by using the economy of motion (EOM) principles, as the central tenets of the EOM are to limit the loss of energy and resources by arranging and using equipment seamlessly. These principles can be used across the spectrum of medicine, from the operating room to the most austere environment[40]. Therefore, the RMP must seek training opportunities to build enduring resilience through stress exposure-inoculation training while emphasizing motion economy principles. Repetition and regular

assessment of these foundational skills help build both confidence and competence in the RMP and their leadership.

One such area of testing and stress inoculation training is the dangers of transporting a patient in an austere environment, whether being pushed or pulled, going up or down, single or multiple rescuer carries. A fundamental aspect of EOM training is transporting patients in austere conditions, which requires the RMP to think critically about their efficiency of effort. Additionally, vital sign monitoring must be done before, during, and after transporting patients. A foundational skill of any RMP is obtaining basic vital signs in an austere environment, which can provide crucial information, thus allowing trending the patient's condition over time[41]. Building competence in manually assessing vital signs should include a brief mental assessment (alert, verbal, pain, unresponsive), capillary refill, pulse rate, respiratory rate, general well-being (sick or not sick), and pulse oximetry (when available). Secondary vital signs include the Glasgow Coma Scale (GCS) and the use of basic monitoring devices, such as glucose, capnometry, temperature, sphygmomanometer, urine output, and possibly lactate levels[42]. There are numerous ways to improvise in obtaining and trending the vital signs; it only requires an adaptive mindset and basic resourcefulness[36].

Substantial advancements and training in austere care have been made with portable monitoring devices such as point-of-care ultrasound (POCUS) devices[43], or smartphones with electrocardiogram attachments as photoplethysmography, which is becoming the standard[44,45]. Laboratory analysis with rapid diagnostic tests (RDT) and smartphone-based imaged devices (SID) are being used to look at bacterial, viral, and parasite detection[45,46]. Among the many analytical tools, paper-based devices (PADs) have become a leading point-of-care (POC) testing alternative[47]. While austere critical care and surgical teams are specifically designed to provide a unique spectrum of care, they require specialized equipment, people, and supplies to meet those objectives[48]. Furthermore, equipment preparation in austere environments is simplified by using the previous mnemonic PAWS: Prevention, Procedures, Analgesics, Antibacterials, Antiseptics, Weather, and Survival Gear[49].

Law enforcement agencies often find themself providing medical care in austere settings while using Tactical Emergency Casualty Care (TECC) principles as their foundational training. Tactical emergency medical service (TEMS)[50] at BLS and ALS levels can find proficiency training (general, environmental, trauma, and force protection protocols and procedures) within the National Park Service (EMS) Protocols and Procedures and the Homeland Security - Austere Emergency Medical (AEMS) Field Guide[51]. Additionally, the JTS Prolonged Casualty Care (PCC) and CPG collection provides evidence-based austere guidelines and best practices to improve prolonged care, as well as the PFC Working Group has created austere planning and evacuation guidelines, with a critical skills list and training recommendations for the austere RMP. Critical care and surgical teams should be trained and proficient in damage control surgery (combat extremity surgery course), non-surgical skills (ultrasound eFAST), and have a working knowledge of tactical field care drugs to be better prepared to support the RMP in austere environments[9]. Additional austere medicine resources can be found online (www.austeremedicineresources.com), but that does not mean the RMP can perform the skill set just because they read it[52,53]. Specialized training under an institutional body is paramount for RMPs practicing medicine outside their usual scope of practice as moral responsibility and medical ethics still hold true in austere environments. See Table 3 for austere U.S. courses and Table 4 for International courses.

Table 3. Austere and Remote Medicine courses and education opportunities-U.S.

National Association of Emergency Medical Technicians (NAEMT)
• Tactical Combat Casualty Care for Medical Personnel (TCCC)
• Tactical Emergency Casualty Care (TECC)
• TECC for Law Enforcement Officers and First Responders (TECC-LEO)
Anyone Not Ready
• Austere Emergency Care Course
• Prolonged Field Care (PFC)
Dartmouth-Hitchcock Medical Center (DHMC)
• Wilderness and Austere Medicine (WAM) Fellowship
Herbal Medics Academy
• Austere Acute Care Medicine
• Austere Trauma Medicine
John Hopkins Medicine University School of Medicine (JHUSOM)
• Austere Medicine/Wilderness Medicine – Medical Students Intro
Portland Community College
• Remote and Industrial Advanced Medic Program (RIAMP)
Remote Medical Training
• Remote Emergency Medical Technician (REMT)
• Remote Medicine for the Advanced Provider (RMAP)
Ragged Edge Solution (RES)
• Austere Emergency Care Course (basic / advance)
• Dark Woods – Prolonged Field Care (PFC)
Specialized Medical Standards (SMS)
• Austere Emergency Care
• Austere Emergency Care – Advanced
Special Operations Aid & Rescue (SOARescue)
• Tactical Medical Practitioner (TMP)
• Extended Austere Provider
• Technical Austere Medical Provider
Tactical Evolution Group (TEG)
• Tactical Medical Provider (TMP)
• Prolonged Field Care (PFC)
Tier 1 Group
• Advanced Combat Trauma Training (ACTT)
• Advanced Combat Medic Course (ACMC)
• Prolonged Field Care Course (PFC)

University of New Mexico (UNM)
• Wilderness and Austere Medicine (WAM) Fellowship
Valkyries Austere Medical Solutions
• Tactical Medical Provider (TMP)
• Advanced Tactical Medical Provider (ATMP)

Table 4. Austere and Remote Medicine courses and education opportunities-International

Austere & Emergency Medicine International
• Austere Medical Training (BLS, Advanced, Medic, Critical Care, Medical Director)
Austere Medical – UK
• Austere Medical Training
Australian College of Rural and Remote Medicine (ACRRM)
• Remote and Offshore Medicine Courses - (i.e., Rural Emergency Skills Training)
The Blizzard Institute - Queen Mary University - UK
• Tactical Military Austere and Operational Medicine – MSc
College of Remote and Offshore Medicine Foundation (CoROM)
• Remote Medical Technician (REMT)
• Remote and Austere Medical Skills Course
• Diploma in Remote Paramedic
• Higher Diploma in Remote Paramedic Practice
• Bachelor of Science in Remote Paramedic Practice (BSc)
• Intensive Care for Austere and Remote Environments (iCARE)
• Master of Science in Austere Critical Care - (MSc)
Iqarus International Ltd – UK
• Medicine in Remote Areas Course
International Society of Remote Medical Practitioners – AUS
• Remote Medical Practitioner
PPA-International Medical – Demark
• Tactical Paramedic
• Accelerated Paramedic Course
• Prolonged Field Care (PFC) – Evacuation Care
The Norwegian RS Sea Rescue Academy – Norway
• Austere Emergency Care course
Triangular Group Academy – Dutch
• Austere (Remote) Medicine course

Disaster Medicine

Disaster medicine involves providing health care and service to natural or human-made (industrial or intentional) disasters while practicing emergency management skills within the four stages of the disaster cycle: preparedness, response, recovery, and mitigation/prevention[54]. Disaster is defined as a disruption of a community's or a society's ability to function normally due to a loss of human, material, or economic impact that exceeds the resources, capability, or capacity of those affected[55,56]. The local volunteer and healthcare teams usually respond first to natural disasters and provide healthcare or services under emergency management principles and the locals' best practices[57]. Emergency management often requires integrating into larger nonmedical multidisciplinary response teams (disasters and public health specialized teams), which can be part of a Community Emergency Response Team (CERT) or National Disaster Medical Assistance Team (DMAT). Core competencies have been established for training and educating members on disaster medicine teams, including preparedness, role identification, situation awareness, communication, personnel safety, surge capacity, understanding clinical management, legal, ethical, and short-term recovery considerations[58].

The National Center for Disaster Medicine and Public Health (NCDMPH) is the U.S. national academic center of excellence for education, training, and research in disaster medicine and public health preparedness. The Federal Emergency Management Agency (FEMA) also provides free online and residential training through the Emergency Management Institute, Center for Domestic Preparedness, and National Training and Education Division, with its standardization by the National Incident Management System[59]. Furthermore, the Hartford Consensus helped develop a preparedness mnemonic for mass casualty incidents and how first responders should react to a THREAT: Threat suppression, Hemorrhage control, Rapid Extrication to safety, Assessment by medical providers, and Transport to definitive care[60]. During mass casualty events, triage is a foundational skill for allocating priority to as many people as possible with limited resources. It is paramount for doing the greatest good for the greatest number. Leveraging bystanders as medical force multipliers is also ideal foundational training in disaster medicine[61].

International Disaster Assistance Response Teams (DART) are part of the U.S. Agency for International Development (USAID) and the Bureau for Humanitarian Assistance, which coordinates humanitarian and natural disaster assistance for hurricanes, earthquakes, volcanoes, drought, and human-made conflicts, including any refugee crisis overseas. The U.S. Department of Defense (DoD) also conducts numerous Foreign Humanitarian Assistance (FHA/JP 3-29), Disaster Response (DR), and Civil-Military Medicine (CMM) in a supporting role to other U.S. agencies (i.e., USAID)[62]. The disaster/humanitarian RMP requires understanding public and global health issues as foundational skill training for any disaster or humanitarian teams working overseas or locally as part of any U.S. National Guard response[51,63,64,65]. As such, the military RMP may be tasked to conduct a Medical Civic Action Program (MEDCAP), which often fails to integrate with host nation (HN) providers and could potentially undermine local medical infrastructure as they rarely provide sustainable improvements[66]. As such, the Medical Seminar (MEDSEM) is a humanitarian medical training program that adds basic education support to the MEDCAP venue, helping promote self-reliance and improving the sustainability of locally-led medical interventions[66]. Disaster/humanitarian programs or activities that provide partnered nations construction, training, planning, and equipment to address disaster risk reduction, mitigation, and preparedness or any health-related projects that include education and health support should be in line with host nation needs and the Defense Security Cooperation Agency[67].

Working as an RMP in disaster environments presents numerous challenges, including limited

resources, complex public and global health demands, and the need to provide evidence-based care. These challenges are further compounded by sociopolitical constraints and linguistic barriers, making effective planning and foundational training essential[68]. Humanitarian medical care is often denied to those most in need during conflicts due to religious, ethnic identity, or political affiliations[69]. A recent study looked into thousands of disaster medicine courses and determined significant gaps remain in levels of learning, subject matter content, best educational approaches, and delivery modalities, particularly for health and public health professionals[70]. Disaster readiness requires straightforward plans that everyone can follow and are standardized, as realistic response training and resource preparation need to occur regularly[71]. Disaster medicine and global health courses are listed in Table 5.

Table 5. Disaster Medicine and Global Health courses and education opportunities.

Standard Disaster – Humanitarian Life Support Courses
• Basic Disaster Life Support
• Advanced Disaster Life Support
• Wilderness Emergency Medical Technician (EMT-W)
• All Hazards Disaster Response (AHDR)
• Advanced HAZMAT Life Support
• Advanced Burn Life Support (ABLS)
• Search and Rescue Technician (SARTECH)
College of Remote and Offshore Medicine Foundation (CoROM)
• Master of Global Health Leadership and Practice (MGH)
Counterterrorism Operation Support (CTOS)
• Response to Radiological/Nuclear Weapons of Mass Destruction Incidents
• Preventive Radiological/Nuclear Detection On-Site Program
Disaster Medicine Institute
• First Responder
• Disaster Management
• Disaster Medicine
• Disaster Preparedness - Response for Chemical, Biological, Radiological, Nuclear, Explosives
Emergency Medicine Residents' Association (EMRA)
• Resource List of over 20 Colleges that offer Disaster Medicine Fellowships for EM residents
European Master in Disaster Medicine
Exeter University Medical School (UEMS) UK
• Postgraduate Diploma in Extreme Medicine (Humanitarian Medicine)

Federal Emergency Management Agency

- National Preparedness Course Catalog (numerous online courses)
- FEMA Higher Education College List (over 200+ college courses listed)

London School of Hygiene and Tropical Medicine

- Masters in Humanitarian Crisis / Tropical Medicine & International Health

Oak Ridge Institute for Science and Education

- Radiation Emergency Assistance Center/Training Site (REAC/TS)

National Library of Medicine Disaster

- Disaster Information Management Research Center (DIMRC)

Master of Public Health (MPHonline)

- Resource List of Master of Public Health - Disaster - Emergency Management - Colleges

Stanford School of Medicine

- Disaster Medicine Training
- International Humanitarian Aid Skills Course – Global Surgery

TRAIN National Learning Network

- Online Public Health Training Site

University of Lynchburg

- Emergency Management - Global Health (DMSc)

University of Plymouth (U.K)

- Global Health (MSc)

Worshipful Society of Apothecaries (U.K.)

- Conflict & Catastrophe Medicine Course
- Diploma In The Medical Care Of Catastrophes

Expedition Medicine

The Royal Geographical Society defines an expedition as an organized journey to anywhere remote or challenging with purposeful intent. Expedition medicine is further defined as providing health care or services as part of a team that plans to conduct research, discovery, or explore extreme environments. The RMP's role is to provide medical support and service to the expeditionary team, supporting the mission's health and success in any remote environment. An expeditionary RMP needs to have an adaptive mindset, survival skill set, and pre-hospital care competencies similar to the military to preclude mission failure on their part as team members, especially given the harsh environment associated with the expedition[36,72,73]. Expedition medic is a recognizable term under the World Extreme Medicine (WEM) based in the United Kingdom (UK), which coined the term extreme medicine[74]; such as the Wilderness Medicine Society (WMS), has defined the discipline of wilderness medicine in the U.S[75].

H.R. Guly's summary article discusses the roles of the expedition doctor by looking at lessons learned from 100 years ago, including planning, equipment, medications, treatment, and roles as a

team player, all of which still hold valid with 21st-century expeditions[76]. As a medical team member of an expedition, it is the responsibility of the RMP to ensure the physical and psychological fitness of all expedition members. Prior planning and medically training members are essential elements to working as an RMP on an expedition. Ensuring all team members are proficient in self-administered first aid and capable of supporting other providers, while also practicing transport and evacuation procedures within the expedition environment, is fundamental to effective planning, team morale, and cohesive operations. Understanding the geographic expedition's location should be carefully researched by conducting an area study. An area study should consider the population, culture, customs, politics, climate, diseases, sanitation, and hospitals. The RMP can gain valuable team experience (understanding human factors) by volunteering for any of the numerous charity organizations[77].

The expedition RMP also needs excellent communication skills as it is integral to developing meaningful and trustworthy relationships between team members. Competent communication between the RMP, their patient(s), and the consultant(s) enhances the ability to understand the diagnosis and treat the patient effectively[78]. This skillful art of telehealth or telemedicine allows the RMP to provide a higher level of care through telecommunications technologies[79]. Telemedicine can provide remote evaluation, diagnosis, treatment, and expert consultation by asynchronous one-way delayed communication via text or email or synchronous two-way real-time communication via phone or video teleconference[80]. Advanced telemedicine has significantly enhanced the RMP capabilities. However, telemedicine is not a substitute for deploying without anticipated medical resources or optimizing foundational training[80]. As one of the ten core capabilities within PFC doctrine is efficient, reliable, and consistent teleconsultation, this foundational skill set requires routine practice as strong communication will further enhance an expedition RMP interoperability with their teammates and insure mission success[81].

The wide array of expedition environments helps determine additional specialized training requirements for the RMP. Learning specific survival skills will enhance the RMP role as a valuable team member. Marine and dive medicine have their aquatic challenges, while the desert and polar expeditions will require additional training in those specific survivalist skills. Traveling to space requires aeromedicine training while traveling through the jungle involves a basic understanding of the local flora and fauna. An example is the International Society of Tropical Medicine which provides a resource site for training opportunities such as a Diploma in Tropical Medicine. While expeditions in mountain environments are extremely challenging[82], high altitude and mountain foundational skills acknowledged by the International Society of Mountain Medicine are taught within the Diploma in Mountain Medicine (DiMM) course[83]. Expedition medicine programs are provided for undergraduate training in the UK for students exploring an expeditionary RMP role[84]. The ultimate goal for the expedition RMP is to train to be an asset to the expedition, thus precluding being a hindrance to overall mission success or its objectives[85]. Expedition Medicine courses and education opportunities are listed in Table 6.

Table 6. Expedition Medicine courses and education opportunities - International and U.S.

Adventure Medic (AM) / Secret Compass

- Resource list of adventure, wilderness, expedition, humanitarian, and travel medicine sites
- Resource list of educational, courses and qualifications - more specific to International

Australian College of Tropical Medicine

- Faculty of Expedition and Wilderness Medicine
- Faculty of Travel Medicine

College of Remote and Offshore Medicine Foundation (CoROM)

- Tropical, Travel and Expedition Medical Skills Course
- Postgraduate Diploma in Tropical Medicine & Health

Diving Medical Advisory Committee (DMAC)

- Approved resource list of Level 1 courses - (Medical Examiner of Divers)
- Approved resource list of Level 2 courses - (Diving Medical Physician)
- Training Objectives for a Diving Medicine

Desert Mountain Medicine (U.S.) / Endeavour Medical / Prometheus Medical

- Expedition Medicine course

Exeter University Medical School (UEMS) UK

- Postgraduate Certificate in Extreme Medicine
- Postgraduate Diploma in Extreme Medicine (Jungle Medicine)
- Postgraduate Diploma in Extreme Medicine (Polar Medicine)
- Postgraduate Diploma in Extreme Medicine (Desert Medicine)
- MSc in Extreme Medicine
- Undergraduate intercalated year course in Extreme Medicine

Expedition Care Program

- Remote Area Medical Management - Expedition Care Program Medic Course

International Climbing and Mountaineering Federation (UIAA)

- Resource list of mountain medicine, expedition, wilderness, and rescue courses

James Cook University (Aus)

- Master of Rural and Remote Medicine

Tropical Medicine and Hygiene in London / Liverpool / Glasgow

- Diploma in Tropical Medicine and Hygiene
- Professional Diploma in Tropical Nursing

Royal College of Physicians and Surgeons of Glasgow

- International Diploma in Expedition and Wilderness Medicine
- Diploma in Tropical Medicine and Hygiene (Multiple Locations)

The Royal College of Surgeons of Edinburgh

- Diploma of Remote & Offshore Medicine

University of Colorado / University of Utah / University of New Mexico (U.S.)

- Mountain Medicine, Tropical Medicine, Polar Medicine, Space & Extreme Medicine courses

University of South Wales

- Diploma Extreme and Wilderness Medicine
- Extreme and Wilderness Medicine (MSc)

University of Texas Southwestern Medical Center (U.S.)

- Medicine in Extreme Environments

University of Tasmania

- Graduate Certificate, Diploma, Master of Healthcare in Remote and Extreme Environments

Wilderness Medical Training

- Advance Medicine (Introductory - Explorer course)
- Expedition Medic Course - Mountain Medicine Course
- Expedition Medicine (Winter) - Expedition Medicine & Field Skills (Summer) Courses

World Extreme Medicine (WEM) - Training Courses

- Alpine Medicine (Slovenia) - Mountain Medicine (Nepal) - Polar Medicine (Norway)
- Desert Medicine (Oman) - Jungle Medicine (Costa Rica) - Conservation Medicine (Namibia)
- Dive Medicine ((Florida) - Ocean Medicine (Brixham) - Search & Rescue (Northumberland)
- Expedition and Wilderness Medicine (Multiple Locations)
- Extreme Medicine for Nurse - Paramedics - Allied Health Providers (Corfe Castle)

Wilderness Medicine

Wilderness medicine provides health care or services in multidisciplinary fields of medicine, which are often austere with limited resources and remote from traditional practices. Auerbach's definitive textbook on Wilderness Medicine 7th edition provides an array of topics from altitude medicine to zoonoses, expanding the multidisciplinary approach to RMPs in Wilderness Medicine[86]. In the late Dr. Paul Auerbach's words, "*Wilderness medicine takes everything we have learned and then adds to it the spice of life*"[86]. In essence, the RMP needs specialized wilderness training to help build their foundation knowledge, skills, and attitude by providing multidisciplinary remote practice competence through innovative treatment methods. Since the late 1980s, the WMS has published CPGs to help provide the best practices and guidelines for handling wilderness-related trauma and environmental illnesses and managing medical problems in the wilderness[87].

Wilderness medicine foundational skills have evolved from the 'cut and suck' snake bite treatment to evidence-based practices, such as the Wilderness First Aid course[88] to developing consensus of core content for advanced wilderness EMS provider courses such as Wilderness Emergency Medical Responder (WEMR), Wilderness Emergency Medical Technician (WEMT), Wilderness Advanced Emergency Medical Technician (WAEMT), and Wilderness Paramedic (WParamedic)[89]. In 2001, the Montana Family Medicine Practice Residency developed the first model for wilderness medicine programs[90,91]. Subsequently, an in-depth look into the core content for other wilderness medicine fellowships was also published[92,93]. The Fellowship of the Academy of Wilderness Medicine (FAWM) was established in 2005 by the WMS, which helped establish an internationally recognized qualification in wilderness medicine core activities. Since then, wilderness medicine and its core curriculum have

expanded into more than half of the emergency medicine courses in the U.S[94,95]. As expedition or extreme medicine is the preferred medical term used in Europe, and the King's College London Student Union was the first to run a FAWM-approved WMS course in the U.K[96]. Introductory and wilderness foundational skill set courses for licensed medical professionals, include the Wilderness Advanced Life Support (WALS) or Wilderness Life Support: Medical Professional (WLS: MP, previously AWLS), as these are numerous other introductory courses taught around the world as continuing medical education (CME)[49,97].

Wilderness medicine training has vastly expanded over the past 50 years, from providing rudimentary medical care for troubled teens in the 1970s, to developing leadership schools in the outdoors in the 1980s, to delivering medical seminars for medical students in the 1990s[98]. Additionally, numerous wilderness medicine articles and CPGs have refined what it means to practice wilderness medicine, including preparation, prevention, planning, treatment protocols, and evacuation methods[75,99,100]. Many environmental exposure training aspects of wilderness medicine have also evolved into simulation training using high-fidelity manikins, live actors with moulage, to 'cut suits' for trauma, including stress inoculation training[101,102]. Whether the wilderness practitioner is scheduled to go on an archeology dig, volunteer for an NGO, or fly on a mission to orbit or beyond, wilderness medicine training topics are expansive enough to cover the RMP foundational skill set requirements[85,103]. The list of wilderness medicine courses and CME opportunities is listed in Table 7.

Table 7. Wilderness Medicine courses and education opportunities - U.S and International.

Wilderness Medicine Courses
• Wilderness First Aid (WFA)
• Wilderness Advanced First Aid (WAFA)
• Wilderness First Responder (WFR)
• Wilderness Emergency Medical Responder (WEMR)
• Wilderness Emergency Medical Technician (WEMT)
• Wilderness Advanced Emergency Medical Technician (WAEMT),
• Wilderness Paramedic (WParamedic)
• Wilderness for the Professional Practitioner (WMPP)
• Wilderness Upgrade for the Medical Professionals (WUMP)
• Wilderness Advanced Life Support (WALS)
• Wilderness Life Support: Medical Professional (WLS: MP previously AWLS)
AERIE Backcountry Medicine
• Resource List of 6 Medical courses offered from WFA, WAFA, WFR, WEMT
Bio - Bio Expeditions
• Continued Medical Education Courses specific to Wilderness / Veterinary Medicine
ExpedMed Expedition & Wilderness CME
• Continued Medical Education courses specific to Expedition and Wilderness Medicine
Exeter University Medical School (UEMS) UK

- Postgraduate Certificate in Extreme Medicine and Wilderness Medicine

Desert Mountain Medicine

- Resource List of 8 Medical courses offered from WFA, WAFA, WEMT, Expedition Medicine

Diver Alert Network

- Diving Emergency Specialist
- Diver Medical Technician (DMT)

National Outdoor Leadership School (NOLS)

- Resource List of 8 Medical courses offered - WFA, WATA, WFR, WEMT, WMPP, WUMP

Outward Bounds

- Resource List of which Medical Course is Right For Me? - posted 09/09/21

SOLO

- Resource List of 10 Medical courses offered from WFA, WFR, WEMT,

Society for Academic Emergency Medicine (SAEM)

- Resource List of Medical Student Rotations in Wilderness Medicine Fellowships
- Resource List of 17 colleges offering Wilderness & Austere Medicine Fellowships
- Resource List of Continued Medical Education courses specific to Wilderness Medicine

Society of Wilderness and Remote Medicine - Advanced Practice Providers

- Resource List of Wilderness and Remote Medicine opportunities for the NP and PA

Undersea & Hyperbaric Medical Society (UHMS)

- Program for Advanced Training in Hyperbaric (PATH)
- Physician Training in Diving

Virginia Tech - Carilion Clinic

- Wilderness Medicine for NP & PA Fellowship

Wilderness Medicine

- Continued Medical Education Conference Summer / Winter specific to Wilderness Medicine
- Continued Medical Education courses specific to Wilderness Medicine

Wild Med Adventures

- Continued Medical Education courses specific to Wilderness Medicine

Wilderness Medicine Associates - International

- Resource List of 15 Medical courses offered from WFA, WAFA, WEMT, WALS

Wilderness Medicine Society (WMS)

- Continued Medical Education Conference Summer / Winter specific to Wilderness Medicine
- Diploma in Diving and Marine Medicine (DiDMM)

- Diploma in Mountain Medicine (DiMM)
- Fellowship of the Academy of Wilderness Medicine (FAWM)

Wilderness Medicine Training Center (WMTC) - International

- Resource List of 5 Medical courses offered from WFA, WAFA, WEMT,

World Extreme Medicine (WEM)

- World Extreme Medicine Conference - Continued Medical Education - annually in the U.K.
- Fellowship of Extreme and Wilderness Medicine (FEWM).

Conclusion

As remote medical providers' training expands into many different arrays of critical topics and interests, it is impossible to cover them all in this article. Policymakers and instructors who provide routine and advanced medical training for the RMP should provide a solid understanding of the foundational skills previously discussed within the five remote medicine disciplines: austere, disaster/ humanitarian, expedition, military, and wilderness medicine. The RMP needs multidisciplinary knowledge, skills, and attitude to practice advanced skills while using innovative treatment methods with limited diagnostic or technical support, regardless of discipline. The RMP, whether working independently or as part of a team, requires flexibility with an adaptive mindset, a robust public-global health perspective, and a cross-cultural understanding of their environment. Accordingly, RMP training must be realistic and represent each of the five disciplines' uniqueness. Each remote discipline offers different learning parameters based on situational awareness, worst-case scenarios, and specialized categories, such as building enduring resilience, triage, scope of practice, and medical ethics. The RMP needs to know when to evacuate or stay, when to observe or intervene, and when to improvise. These are all valuable and foundational skills to develop and hone before facing them in a remote setting. No singular course can cover all the environmental situations an RMP may encounter or provide all the training and skill sets required to ensure competence in each discipline. This analysis provides a robust list of resources for academic and diploma opportunities for the medic, nurse, NP/PA, or physician working within these five disciplines. Further research is still needed to establish remote medical guidelines, best practices for training, and specialized skills required to ensure competence within each discipline.

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