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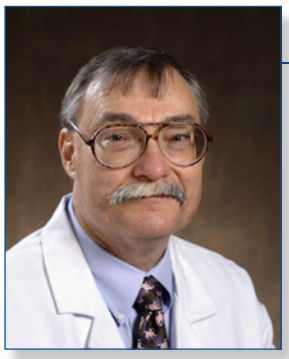

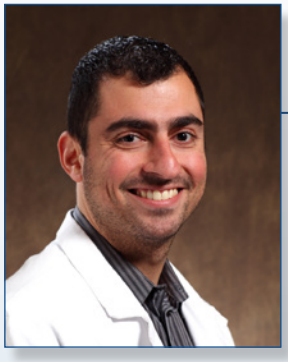

Special Section: Emergency Medical Services (EMS)

More than a ride to the hospital – Examining the continuing evolution of a complex, coordinated response system

KENNETH A. WILLIAMS, MD; FRANCIS SULLIVAN, MD
GUEST EDITORS

Kenneth A. Williams, MD

Francis Sullivan, MD

An emergency call to 911 in most of the United States (other numbers are used internationally) summons aid. First responders from police, fire, and emergency medical services (EMS) agencies respond to the scene, trained to locate, evaluate, treat, and transport the sick and injured to the best definitive care setting. Who are these EMS professionals? How are they trained? How do physicians oversee the EMS system? Do they save lives? How do they transport critically ill and injured patients between hospitals? This issue of the *Rhode Island Medical Journal* addresses these questions.

Emergency medical service is an essential component of the expanding emergency care system in the United States, providing access to life-saving medical care 24/7/365. Emergency Medical Technicians (EMTs), trained at a variety of levels, staff ambulances and work in a variety of other settings. EMTs treat and transport the sick and injured, but they also provide safe scheduled transport for non-ambulatory patients to and from physicians' offices, dialysis facilities, and other medical care settings. In some systems, they have been asked to integrate with the public health system, providing injury prevention screening, follow-up evaluations, and augmenting community primary care. EMS is often taken for granted, but is expected to perform rapidly and professionally in time of need, regardless of the volunteer or paid status of the responding agency and personnel. This evolving resource has already influenced patterns of health care delivery, become a vital public health and disaster response asset, assumed an expanded role in community health, and, yes, saved lives daily in Rhode Island and across the United States.

Maturing over half a century, EMS and EMTs pioneered the concept of physician extenders, made specialized systems of healthcare with "centers of excellence" possible through critical care inter-hospital transport, enabled many life-sustaining and saving treatments such as dialysis and radiation therapy through scheduled transport, and earned respect and recognition as a profession. In this issue of the *Rhode Island Medical Journal*, the authors seek to provide our physician community with a succinct description of the history of EMS, its physician interface, EMT professional education, the practice of inter-hospital critical care transport, and to propose a uniform definition of saving a life in the EMS and emergency medicine environment, the Rhode Island Life Saving Score (RILSS).

Guest Editors

Kenneth A. Williams, MD, is Associate Professor (Clinical) of Emergency Medicine, The Warren Alpert Medical School of Brown University and Physician Medical Consultant, Emergency Medical Services Division, Rhode Island Department of Health.

Francis Sullivan, MD, is Clinical Associate Professor of Emergency Medicine, The Warren Alpert Medical School of Brown University and Medical Director for numerous RI EMS agencies.

Scott Francis, Critical Care Paramedic at LifePACT, passed away unexpectedly as this issue was going to press. Scott is pictured in the enclosed article on Critical Care Transport. Scott exemplified the best of EMS, with his ready smile, calm and humble personality, excellence in patient care and safe emergency driving, and helpful attitude. He is survived by his wife Nancy and sons Aiden and Liam. The guest editors dedicate this special issue to his memory.

An Overview of Prehospital Emergency Medical Services

FRANCIS SULLIVAN, MD; KENNETH A. WILLIAMS, MD; JASON RHODES, MPA, EMT-C

ABSTRACT

Prehospital emergency medical services (EMS) provide lifesaving care daily in the United States. This article outlines the development of this vital public safety endeavor and highlights the characteristics of the Rhode Island system.

KEYWORDS: Prehospital, emergency medical services, ambulance, EMS, Rhode Island

"Is the sand other than the rocks? That is, is the sand perhaps nothing but a great number of very tiny stones? Is the moon a great rock? If we understood rocks, would we also understand the sand and the moon?"

— Richard Feynman, Physicist

"If you know one EMS system, you know one EMS system."

— Anonymous EMS Physician

INTRODUCTION

Emergency Medical Services (EMS) systems represent a complex interplay of personnel, ambulances, equipment, communications mechanisms, training endeavors, business operations, and administrative oversight. How did these systems evolve nationally and in Rhode Island? How is the system managed in Rhode Island? This article addresses these questions.

Prehospital emergency service in Rhode Island shares a common heritage with this vital public safety endeavor elsewhere, and its diversity reflects the many service models present in the United States. EMS development is strongly linked to the lessons of battlefield medical challenges and to major paradigm shifts in the care of the most lethal health threats faced by citizens of the developed world.

The modern era in prehospital care dates to the Napoleonic Wars with the battlefield evacuation and treatment efforts championed by Baron Larrey; similar efforts occurred in the United States during the Civil War. Hospital-based ambulance services developed, as did private enterprises of lesser sophistication. The increasing lethality of warfare in the first two World Wars was coupled with continued emphasis on rapid evacuation, provisional stabilization, and expedited definitive surgery with a resultant mortality reduction. These efforts were redoubled with the air evacuation and forward field hospitals pioneered in the Korean conflict and Vietnam War.[1] The lessons were slow in their civilian sector application as highlighted in the report published in 1966 by the National Academy of Sciences entitled "Accidental Death and Disability: The Neglected Disease of Modern Society." This study demonstrated that many deaths occurring daily could be prevented through a combination of community education, stricter safety standards, and better prehospital treatments. Its publication was a significant event in the development of modern standards of care.[2,3,4]

The federal response was legislation intended to create components of a rational trauma care system, mandating automotive safety standards, remedying non-uniform informal training of ambulance attendants, and supporting medical institutional organization into trauma systems.

Advances in care of cardiac disease, another major public health threat, were occurring concurrently, with the development of specialized coronary care units offering increasingly sophisticated monitoring and interventions. Pioneering efforts of Pantridge in Belfast, Northern Ireland, showed that extending these interventions to field care in ambulances could further reduce mortality. This process of

The so-called 'flying' ambulances were horse-drawn wagons for collecting and carrying the wounded from the battlefield to base hospitals developed by 18th-century French physician Dominique-Jean Larrey in 1797. The transport carried supplies and a doctor, quartermaster, noncommissioned officer, a drummer boy (who carried the bandages), and 24 infantrymen. According to Dr. Larrey's field reports, the transports swooped into the battlefield and collected the wounded in less than 15 minutes.

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This photograph of horse-drawn ambulance carriages was featured in a 1911 photographic history of the Civil War.

moving lifesaving care initially developed in the hospital setting into the field is intuitively appealing and has been a general theme in the development of modern EMS, with predominantly positive results.[5,6,7,8]

EMS Systems Act of 1973

The EMS Systems Act of 1973 was the first important piece of legislation affecting the development of regional emergency and trauma care systems. This act called for creation of a lead agency under the Department of Transportation (DOT), chosen because concern for traumatic highway deaths was a major impetus behind the initiative. The legislation identified 15 components (including trauma systems) to assist local planners in establishing regional EMS programs. This approach to service delivery was viewed as a way of distributing resources equitably while expanding access to health care systems. Substantial funding was devoted to the establishment of an EMS infrastructure in over 300 EMS regions nationwide.[9] Although national standards for EMS personnel training and certification were developed by the US Department of Transportation National Highway Traffic Safety Office (DOT-NHTSA), and national certification programs offered by the National Registry of Emergency Medical Technicians (NREMT), they were subject to modification by local authority.

During this period, studies continued to link poor patient outcomes with delays in both initial and definitive care of injured patients, drawing continued public attention and accelerating progress towards trauma systems development in some areas. Pioneer efforts in cities around the country began projects to staff ambulances with attendants with training similar to military medics. The popular 1970s NBC series *Emergency!,* portraying two fictional Los Angeles "paramedics" responding to a variety of emergencies, also encouraged interest by other communities in establishing equivalent services.[10] (Personal communication, Dr. Ronald Stewart, July 2013. Dr. Stewart served as medical advisor to the show *Emergency!* and subsequently as medical director for paramedic training in Los Angeles, among many other accomplishments.)

Health Planning and Resources Development Act of 1974

Nevertheless, this initial legislation failed to adequately stimulate initiatives to sustain EMS funding at the local level. In the Health Planning and Resources Development Act of 1974, regionalization of emergency medical services was designated as a national health care objective. However, by 1981, funding sharply declined when the Omnibus Budget Reconciliation Act consolidated EMS and trauma system funding into the state preventive health block grant program. The intent of the block grant concept was to shift responsibility of funding EMS services to the states while still supporting the lead agencies directing these services. But, since states were given wide discretion regarding use of these funds, many regional EMS programs lost funding and ended, while others responded by increasing their involvement in system development. Uniformly, however, citizen expectations for some minimal level of service were created. Service delivery models that evolved varied from volunteer-staffed units to hospital-based systems to fire department-based or independent public service departments, and the immediate local responsible authority from county or other regional to municipal entities. State governments retained the ultimate oversight responsibility.

PROVIDER EDUCATION AND CERTIFICATION

In concert with this process, the aforementioned DOT-NHTSA training standards and certification levels were developed for personnel, now termed emergency medical technicians (EMTs). The most basic level (EMT-Ambulance) included training in basic first aid, non-invasive airway

and breathing support, treatment of anaphylaxis and hypoglycemia, spinal immobilization and positional prevention and treatment of shock, all in a roughly 100-hour curriculum. An intermediate level (EMT-Intermediate), requiring several hundred more hours of training, added skills in intravenous fluid support and more advanced airway management. The generic term paramedic (EMT-Paramedic) became the formal classification for an advanced level provider capable of providing intravenous support, advanced cardiac rhythm analysis and electrical / pharmacologic therapy, and advanced airway and trauma intervention management. Training requirements for this level were significant, often 1500-2000 hours. However, in keeping with the overall philosophy of latitude in system evolution, these certification levels were subject to local modification.

Since most communities aspired to offer the highest level of care, but many lacked the resources (particularly in volunteer services) to train many providers to the EMT-P level, many systems added treatment skills to the intermediate level but reserved their autonomous practice to the paramedic level. This expansion of intermediate scope of practice under direct medical control was eventually codified in a 1999 DOT-NHTSA intermediate curriculum modification, but much local system heterogeneity still exists for this skill level.[11] Additionally, during this period the development of new airway management adjuncts and of automatic external defibrillator technology brought safe use of these lifesaving skills to the basic EMT scope of practice. National efforts continue to bring uniformity to certification levels, an issue addressed in the companion article in this issue. [12,13,14]

MEDICAL OVERSIGHT

From its inception, prehospital emergency care has clearly been an extension of the practice of medicine into the field. The initial use of battlefield medics, or, in the civilian sector, selective inclusion of nurses or physicians in addition to ambulance attendants provided models that evolved in the United States to formal recognition and training of EMTs with judgment reserved, in varying degrees, by the supervising physician. From pioneering efforts of trauma surgeons and cardiologists in the creation and development of EMS, the responsibility for continuing to guide its daily practice and evolution has largely shifted to physicians trained in emergency medicine, a specialty whose recognition and growth paralleled that of EMS. Medical oversight can be conceptually partitioned into "off-line" and "on-line" medical control, with implications for the practice parameters of the supervised EMTs. Off-line (or indirect) control is the physician involvement in system design, setting of certification and training standards, development of protocols and standing orders, formal quality assurance programs, and EMT education. On-line control is the provision of medical advice for the care of individual patients in the prehospital environment, now accomplished predominantly remotely by cellular telephone or radio, but selectively, in some systems on scene by EMS physicians.

RHODE ISLAND'S EMS SYSTEM

Rhode Island has statewide EMS system administration, with the Department of Health (DOH) empowered by law to establish regulations, create protocols and oversee the system. A highly sophisticated statewide 911 central call center distributes emergency calls to the appropriate public safety dispatch authority. There are approximately 500,000 annually, resulting in about 750,000 referrals to response agencies, as many incidents require multiple resources (eg, police, fire, EMS and power company for a car crash into a utility pole). There are 93 licensed ambulance services in Rhode Island, with 911 response entities predominantly fire service and municipally based. The fire-based system offers personnel depth and resource advantages, as fire apparatus can be dispatched to medical emergencies along with transport ambulances, providing both faster response and the additional resource and manpower that may be required. Three communities provide EMS via a "third" service, independent in administration from the local police or fire department. The more rural areas of the state are predominantly served by largely volunteer rescue agencies augmented by career and per-diem staff. Ambulance services are classified and licensed by the DOH as basic life support (BLS), advanced life support (ALS), or mixed, based upon the training level of the EMTs staffing the ambulance and its equipment. In Rhode Island, the DOH licenses three levels of EMS practitioner – EMT (a national standard certification with 1,585 licensed personnel), EMT-Cardiac, (a level unique to the state but similar to the DOT I-99 Intermediate and the new Advanced EMT with 2,193 licensed personnel), and Paramedic (a national standard certification with 333 licensed personnel). ALS ambulances must be staffed by two providers, one at EMT-C or higher licensure.[15] (Personal Communication, Jason Rhodes, MPA, EMT-C, Chief, Emergency Medical Services Division, RI Department of Health, Aug. 27, 2013)

Current implementation of a new electronic Run Report and data system will facilitate reporting to a national EMS database, NEMSIS; all EMS services in Rhode Island will be mandated to only utilize electronic reporting to the state by January 1, 2014.

EMT training is available through a wealth of programs, from individual volunteer organizations to private business endeavors to community college-based programs. Supervision of these programs must be by an instructor coordinator trained by the Division of Emergency Medical Services at the RI Department of Health (DOH-EMS); each individual training endeavor must be specifically approved.[16] RI EMTs hold independent licensure; they are directly accountable to the DOH-EMS for adherence to the *Rhode Island Prehospital Protocols and Standing Orders*. Practice standard violations are subject to review and disciplinary action by the DOH-EMS.[17]

A standard state-approved EMS Run Report must be completed electronically or manually and filed with DOH-EMS for each completed ambulance call. The data are reviewed for resource allocation, protocol revision, quality assurance programs, and practice standard adherence purposes. Current implementation of a new electronic Run Report and data system will facilitate reporting to a national EMS database, NEMSIS; all EMS services in Rhode Island will be mandated to only utilize electronic reporting to the state by January 1, 2014.[18] A copy is also left with the receiving hospital for inclusion in the medical record.

Programs, training standards, regulations, and protocol revisions are the responsibility of the DOH-EMS, with input from a medical consultant, a specific committee structure, and from an advisory board of individuals representing interest groups within EMS and hospital and professional organizations – the Ambulance Service Advisory Board. The 23 members appointed by the governor offer invaluable perspective on potentially under-recognized implications of proposed administrative changes.[19]

The clinical ecology of Rhode Island features a fortunate geographic distribution of hospitals and EMS units offering ALS care with a centrally located Level 1 Trauma Center, interventional cardiology and stroke centers, pediatric and women's specialty hospitals, and three nearby air-medical systems offering potential transport from the more distant portions of the state. In addition, a centrally located critical care ground transport service is able to perform field mutual aid or concurrent rapid response to local hospitals for transfer to tertiary care.

SUMMARY

EMS in the United States has evolved into a diverse, complex system, with some momentum toward greater uniformity and coordination. Rhode Island EMS provides rapid response from 911 call to the patient's side, with thousands of dedicated providers and hundreds of ambulances providing life-saving care to its citizens.

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Authors

Francis Sullivan, MD, is Clinical Associate Professor of Emergency Medicine, The Warren Alpert Medical School of Brown University and Medical Director for numerous RI EMS agencies.

Kenneth A. Williams, MD, is Associate Professor (Clinical) of Emergency Medicine, The Warren Alpert Medical School of Brown University and Physician Medical Consultant, Emergency Medical Services Division, Rhode Island Department of Health.

Jason Rhodes, MPA, EMT-C is Chief, Emergency Medical Services Division, Rhode Island Department of Health.

Disclosures

The authors have no financial disclosures to report.

Correspondence

Francis Sullivan, MD
Department of Emergency Medicine
55 Claverick Street
Providence, Rhode Island 02903
401-444-5826
fsullivan@lifespan.org

Physician Medical Direction of Emergency Medical Services

FRANCIS SULLIVAN, MD; KENNETH A. WILLIAMS, MD

ABSTRACT

Emergency medical services (EMS) bring the practice of emergency medicine directly to the homes of patients. Physician guidance of system development and provider practice can enhance the quality of care. This article provides an overview of issues in the development of EMS system oversight in the United States in general, and in Rhode Island.

KEYWORDS: Medical director, emergency medical services, ambulance

INTRODUCTION

The introductory article for this issue outlines the aspects of physician oversight of emergency medical services (EMS) in the United States and the variations in system evolution that influence the form this involvement takes for individual regions. A common aspect is the recognition that prehospital care is the delegated practice of medicine. EMS providers (EMTs) are the "eyes and hands" of the physician in the field, with physician judgement expressed through system design, guidelines and protocols, and medical control. Physician oversight is partitioned into real time, or direct on-line medical control and off-line, or indirect administrative medical control. Both aspects will be discussed and their Rhode Island expressions described.[1]

On-Line Medical Control

On-line medical control consists of direct communication via cellular telephone or radio between an EMS provider (EMT) and a physician or designee, either in a designated role or the receiving emergency department, to consult about the care of a specific patient. The scope of practice of EMTs is defined by regional or state protocols, standing orders, or a combination. In the protocol system, providers attempt to fit a patient presentation into a predetermined symptom/sign complex and are authorized to progress to a certain point in the care plan that best seems to fit the clinical presentation. Depending upon provider sophistication, they are then required to seek on-line medical control to perform further intervention. In the standing-order system, progression through an entire evaluation and management sequence can occur without on-line medical consultation unless desired by the EMTs. The latter option can be an advantage in low-volume systems with basic provider skills, or in very busy systems with trusted paramedics who need very little routine oversight. The former option allows atypical situations to be discussed and appropriate interventions performed with the potential enhanced safety of immediate and specific on-line physician judgement.[2,3] This on-line control may be supplanted or augmented by organized, or sometimes serendipitous, physician presence at the scene of the call. Such organized physician scene responses have been employed in Pittsburgh, Seattle, and Houston, but are the exception in the United States. Serendipitous presence of an on-scene physician allows medical control to be transferred from the remote on-line physician only if authorized by the latter after direct discussion with the on-scene physician, who often must agree to accompany the patient to the receiving facility.[2,3] Some systems also have "default" provisions for those instances when medical control is unavailable.[4]

Beginning in the 1960s, a national effort to improve trauma care spurred EMS system evolution, organized trauma care, and resulted in consensus field triage guidelines that are applied by EMTs to assist with trauma patient destination decisions. On-line medical control may be required for decision support, but experience has demonstrated that EMT destination judgment is excellent.[5]

Early improvements in cardiac care also helped drive development of EMS systems, and rhythm telemetry to the hospital for cardiac staff interpretation was routine practice until it was determined that EMTs had reached a level of sophistication such that there was no value added by this practice. The development of emphasis on emergent interventions in ST elevation myocardial infarction and availability of 12 lead EKG acquisition and transmission from the field has created a similar situation. System practice varies, from passive transmission, reliance on computer interpretation, provider interpretation, or both to alert the receiving facility emergency department staff, or in some systems, direct notification of interventional cardiology staff. The development of specialized hospital systems for cardiac, and increasingly, for stroke care, has created field destination decisions that are analogous to those for trauma care. On-line medical control continues to play a variable and evolving role in these care systems, but in many cases serves primarily to provide early notification about impending patient arrival.[2,3]

To summarize, on-line control may offer little added value in some cases, but a great deal in others. Physicians familiar with the EMS system are able to assist with patient-care decisions, validate destination choices, and activate specialty teams for certain types of patients through on-line medical control. Patient transport refusals represent both medical and legal hazards for EMTs, and are another example of the benefits of on-line medical control.[6,7]

In Rhode Island, on-line medical control is available to supplement the State of Rhode Island and Providence Plantations Department of Health Division of Emergency Medical Services Prehospital Care Protocols and Standing Orders (RI EMS Protocols), which define the practice parameters for RI EMTs at all practice levels. This hybrid of two approaches (protocols augmented by on-line medical control) melds the distinct advantage of both. The RI EMS Protocol document provides a shared-care model, and undergoes periodic revisions based upon new developments in medical care, resource availability, and overall system changes. In general providers are required to notify the receiving hospital when there is vital sign abnormality, altered mental status, poisoning or overdose, suspected ST elevation myocardial infarction, or suspected stroke, and encouraged to do so when the prehospital caregivers feel a need for additional informational or judgment support. Other cases require routine notification to the receiving hospital emergency department, now performed through a computer system (Patient Tracking System). Many RI EMS Protocols require medical control consultation before advanced treatment occurs, with this requirement occurring earlier at more basic EMT levels. This feature provides physician judgement support as the EMT approaches the upper limits of training sophistication in assessment and intervention. Thus, paramedics (the highest EMT level) are able to deliver care with considerable autonomy, while basic EMTs must seek advice at much lower intervention risk levels. Contact with the receiving hospital is strongly encouraged, but EMTs may request control from any Rhode Island hospital; this provision both provides potentially needed alternatives and allows access to the additional pediatric expertise available from Hasbro Children's Hospital emergency department staff and the OB/GYN staff at Women & Infants Hospital. Communication from field to hospital is predominantly by cellular telephone. The ability to transmit 12 lead EKGs is available in many ambulances. Backup communication systems exist in case of equipment failure, overload, or in a disaster.[8] In addition to EMS hospital contact for mandated or elective medical control, hospital notification occurs via a custom computerized patient tracking and system status management system installed after the Station Fire disaster and the Rhode Island Disaster Initiative project.[9]

Off-Line Medical Control

Off-line medical control encompasses the breadth of physician engagement in the community/EMS/hospital interface. In some areas, this participation has been as extensive as complete EMS system design; more commonly, it includes setting practice parameters, educational oversight, quality assurance activity, and disciplinary action involvement. The role may be more extensive and advisory for a larger scope of authority, for example, that of a state medical director, or limited, depending upon the overarching administrative structure of an EMS agency. The American College of Emergency Physicians, the National Association of EMS Physicians, and the National Association of EMTs have position papers defining the optimal scope of authority and support for medical direction. The minimum qualification criteria for the position include direct experience in prehospital care delivery, familiarity with EMS system design, operation, and administrative and legislative issues, active involvement in training, quality assurance improvement, and on-line medical control.[10,11] This threshold sets a high bar in practice for both initial and ongoing demands for the designated physician. The current specialty organizations have promoted ambitious comprehensive oversight recommendations, further enhanced by the EMS Agenda for the Future.[12] The development of specialized additional post- graduate EMS fellowships has been recently formalized to include an ACGME accreditation process and the first subspecialty examination in emergency medical services for physicians will be offered this year by the American Board of Emergency Medicine.[13] As discussed in the introductory article, the original Emergency Medical Services Act created 303 regions with initial development of medical control left to these local jurisdictions, with further disparate evolution of physician oversight as the funding and local authoritative structure changed.[2,3,14] It remains unclear whether the increasing financial challenges faced by responsible municipal or other governments can sustain, much less, expand, support of physician oversight sufficient to implement the vision.

The state of Rhode Island Department of Health engages an experienced EMS physician consultant to the Division of Emergency Medical Services. Rhode Island, in keeping with its tradition of the 'Independent Man,' independently licenses EMTs at their respective certification levels.[15] This division encourages the involvement of physicians by strongly advising each of the licensed ambulance services to appoint a medical director and requiring identification of a supervising physician for each state-approved educational activity or training endeavor. While in the vast majority of cases this physician involvement is voluntary, and often nominal, in some cases extensive ongoing participation in quality assurance and other areas occurs. Several physicians, representing various specialty fields, serve voluntarily by appointment of the governor on the Rhode Island Ambulance Service Advisory Board. A relatively new state mandate that each service develops a quality-improvement process encourages further physician engagement. Federal and state laws regarding prescription drugs and controlled substances carried in ambulances also imply that the service is arranging acquisition of

these supplies under the license of the medical director. It is likely that this process will evolve toward both greater individual service autonomy and accountability in the future. Also, anticipated regulatory changes would extend the legal immunity protection enjoyed by ambulance services to their medical director. This evolution should support further physician oversight.[16] Many physicians participate in EMT training, as is discussed in the companion article. (Personal Communication. Jason Rhodes, MPA, EMT-C, Chief, Division of EMS, Rhode Island Department of Health. August 27, 2013) Increasingly, national certification bodies in trauma care, cardiac care, and stroke care mandate close liaison with EMS agencies, including outcome feedback.[17,18,19] The Brown University Department of Emergency Medicine fellowship in Emergency Medical Services is currently applying for ACGME accreditation, bringing a new level to EMS physician training in Rhode Island.[20]

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Authors

Francis Sullivan, MD, is Clinical Associate Professor of Emergency Medicine, The Alpert Medical School of Brown University.

Kenneth A. Williams, MD, is Associate Professor of Emergency Medicine, The Alpert Medical School of Brown University and Physician Medical Consultant, RI Department of Health, EMS Division.

Disclosures

The authors have no financial disclosures to report.

Correspondence

Francis Sullivan, MD
Department of Emergency Medicine
55 Claverick Street
Providence, Rhode Island 02903
401-444-5826
fsullivan@lifespan.org

Emergency Medical Technician Education and Training

JOSEPH LAURO, MD, NREMT-P; FRANCIS SULLIVAN, MD; KENNETH A. WILLIAMS, MD

ABSTRACT

Emergency Medical Services (EMS) training and education are vital and vibrant aspects of a young and evolving profession. This article provides a perspective on this effort in the United States and reviews current activity in Rhode Island.

KEYWORDS: Prehospital Emergency Care, Emergency Medical Technician

INTRODUCTION

Education of prehospital emergency care personnel is an essential element in the function and growth of the emergency care system. EMS in the United States has largely developed through local interpretation of federal guidelines with training to nationally recognized certification levels derived from curricula developed by the Department of Transportation National Highway Traffic Safety Administration (DOT-NHTSA).[1,2]

EMTs are certified according to training level, with individual states setting standards for this training and certification (or licensure, in some cases). All states have several distinct EMT levels, usually at least three. Although states are not bound by DOT-NHTSA standards, as the EMS system matured, the importance of common training standards was increasingly recognized, and DOT-NHTSA standards are now used in most jurisdictions.[1,2,3] The National Registry of Emergency Medical Technicians (NREMT) is a private organization that offers certification exams based on these education guidelines.[4] Currently, NREMT exams are used by 46 states as the basis for certification at one or more EMT certification levels. The NREMT uses sophisticated computer adaptive software for its cognitive testing, providing excellent information about the student's comprehension of the material. Psychomotor testing occurs at a local level.[5]

Until recently, DOT-NHTSA recognized four EMT training levels: EMT-Basic, EMT–Intermediate 85, EMT-Intermediate 99 (The 85 and 99 referring to curricula released in 1985 and 1999, respectively) and EMT-Paramedic.[2]

The procedures and skills allowed at the four levels differ. The EMT-Basic level (EMT-B, or EMT-Ambulance in some jurisdictions) generally includes non-invasive and lower risk skills such as bleeding control, positive pressure ventilation with a bag valve mask, use of oropharyngeal or nasopharyngeal airways, supplemental oxygen administration, and splinting including spinal immobilization. CPR and automatic external defibrillator use are also part of the EMT-Basic scope of practice. Additional skills possibly allowed, depending on jurisdiction and additional training, include administration of a patient's own medicine, of intramuscular epinephrine, non-intravenous (intramuscular, oral, intranasal) administration of other medications such as glucagon and naloxone, and advanced airway management in cardiac arrest patients. A typical EMT-B course includes approximately 100 hours of classroom and clinical training.[6,7,8]

EMT–Intermediates are providers with training and scope of practice between basic (EMT-B) and paramedic (EMT-P) levels. The NREMT had two distinct intermediate level tests until recently, covering both the 1985 and the expanded scope 1999 DOT-NHTSA curricula. EMT-I/85 is a level including enhanced assessment skills and several more invasive interventions than those allowed at the basic level, including intravenous fluid therapy and advanced airway management, typically including endotracheal intubation in patients with cardiac arrest. EMT-I/99 further extends this scope of practice, necessitating additional instruction in cardiac monitoring and pharmaceutical interventions. However, the wide variety of local interpretations resulted in at least 65 different EMT-Intermediate levels across the nation, with up to several hundred hours of training time required beyond that of the EMT-B program.[9-15]

EMT-Paramedics, commonly referred to as "paramedics" (the only technically correct use of the term in the United States), represent the highest standard level of EMT in the United States.[16] Paramedics receive significant education in anatomy, physiology, and pharmacology; they understand why certain treatments work. By comparison, the EMT-Intermediate curriculum typically focuses more on skill performance than on basic science knowledge. Paramedics bring sophisticated assessment skills to the patient's bedside, and perform a variety of medical procedures such as advanced airway management including intubation and cricothyrotomy, an extensive range of pharmaceutical administration, central IV access, manual defibrillation, and pleural decompression.[2]

In addition to this range of EMT-Basic, Intermediate, and Paramedic levels, a variety of specialty EMT levels developed in some jurisdictions. These include curricula tailored

to specific situations and patient conditions, predominantly directed toward expanded scope of practice for the paramedic level. These additional specialty levels are presented in **Table 1**.[16]

Accordingly, by the late 1990s there were several hundred types of certification for EMS personnel within the United States, many of these recognized by no more than a single jurisdiction, county, or state. This multiplicity of certification / licensure levels, the result of locally interpreted national curriculum guidelines, provided an EMT workforce optimized for local operations, but created issues with training, standardization, and reciprocity. It made large ambulance services (serving multiple jurisdictions) cumbersome to operate, and discouraged workforce mobility. EMTs would often have to take additional training programs and pass specific certification examinations when moving from one state to another, an obstacle for both professional and volunteer providers. Cross-border operations became increasingly problematic, and response of hundreds of ambulances from many states to large scale events, such as Hurricane Katrina, even more challenging due to variations in training, scope of practice, medication availability, and communications failures.

Table 1. EMT Specialty Levels

Advanced Practice Paramedic or Critical Care Paramedic	These paramedics have additional training in the management of critical trauma and medical patients and typically staff inter-facility ground and aeromedical transports. Skills include ventilator management, treatment with a wide variety of medications and blood products, intra-aortic balloon pump monitoring, and specialized hemodynamic monitoring. There are specific training programs appearing for pediatric and neonatal critical care paramedics.
Community Paramedic	Described by some as a public health paramedic, or primary care paramedic, these providers have additional training in prevention, public heath, primary care and health maintenance.
ToxMedic	Very specific training in the treatment and dealing with hazardous materials exposure and poisoning. Often working in support of HAZMAT and military response teams, these paramedics are adept at operations in a variety of high-level personal protective equipment.
Wilderness Paramedic (and other wilderness EMT levels), FireMedic	Trained in search and rescue, survival techniques, definitive and prolonged-care measures, preventive medicine, these providers support wilderness search-and- rescue teams, wildland fire operations, and similar austere and wilderness medical settings.
Tactical or NarcMedic	Supporting certain high-risk law enforcement operations, these paramedics are trained to understand and safely work around (and sometimes) with firearms and other police weapons and tactics. They may integrate with entry teams, respond upon need, or stand by at a safe distance.
Flight Paramedic	Adding aviation and altitude physiology to a Critical Care Paramedic curriculum, flight paramedics typically staff helicopter and fixed-wing transport programs.[16]

NATIONAL EMS SCOPE OF PRACTICE PROJECT

In 2009, the NREMT posted information about transition to a new system of levels for emergency care providers developed by the NHTSA through the National EMS Scope of Practice Project. This extensive project gathered significant data about skill performance, training, value of various interventions, and other factors from a multitude of experts, providers, and educators, and then grouped interventions into EMT levels. The initial goal was that by 2014 these new levels would replace the fragmented system found around the United States. The new classifications are emergency medical responder (EMR, replacing first responder, a provider with a smaller skill set than a basic EMT), emergency medical technician (EMT, replacing EMT-Basic), advanced emergency medical technician (AEMT, replacing EMT-Intermediate 1985 and, in part, 1999), and Paramedic (replacing, in part, EMT-Intermediate 1999 and EMT-Paramedic). Educational requirements for the new levels are similar to prior curricula, but are based on competency, not absolute classroom hours. Slowing this transition process are the momentum of the current system, cost of re-education, and the daunting logistics and human factors involved in simplifying a highly variable system. However, most states, and the NREMT, have now transitioned to the new model, introducing an era with more uniform training at the three new EMT levels.

PRACTICAL ASPECTS OF EMT TRAINING

Training programs vary, provided that each course meets applicable requirements. Recent textbooks and on-line training materials reflect the new EMT levels, streamlining the lesson plan process for instructors. The transition to competency-based curricula cannot

practically eliminate minimum hour commitments for didactic and clinical aspects of training. EMTs still receive at least 100 hours of training, AEMTs have about 400 additional hours, and paramedics are trained for an additional 1,000 hours or more.

EMT training programs still also vary greatly in format. For example, intensive two-week fast-track programs are available for basic EMTs. Other training programs are months long, up to two years, for paramedics in associate degree programs. In addition to this didactic education, clinical rotations are required. Students must spend time in an ambulance and one or several different hospital services and demonstrate clinical competence in order to be eligible for the certification exam. This clinical time commitment can vary, as indicated, depending on requirements, the level of training sought, and the amount of time it takes an individual student to show competence.[7,9] Accreditation is available for EMT programs from the Committee on Accreditation of Educational Programs for the Emergency Medical Services Professions (CoAEMSP), and is becoming more common.[17] NREMT now requires graduation from an accredited paramedic program as a prerequisite to testing at that level, and is working flexibly with states on bridge programs to facilitate transition to the new levels.

EMT-training programs are offered at a variety of locations: universities, community colleges, technical schools, hospitals or EMS academies.[18,19] Every state has an EMS lead agency, often within the Department of Health, Public Safety, or an equivalent, which regulates and accredits both training programs and the entire EMS system. CoAEMSP requirements for paramedic program accreditation require affiliation with a sponsoring institution, such as a college or academic hospital, eliminating "garage-and-basement" paramedic training programs.

On-line resources are a burgeoning enterprise. A variety of well-established and highly regarded supplemental courses exist as well, such as Basic Trauma Life Support from the American College of Emergency Physicians, Prehospital Trauma Life Support from the American College of Surgeons, Advanced Cardiac Life Support and Pediatric Advanced Life Support from the American Heart Association.[20,21,22] Concepts and approaches from these courses often become incorporated into the initial certification program curricula, both in didactic content and emphasis on skill stations and case or scenario-based teaching. A wealth of topic-specific educational resources is available for continuing education.

Prehospital provider education also includes a minimum number of continuing education (CE) hours required to maintain certification. While the format and specifics may be set at the state or other jurisdiction level, the NREMT now has uniform level-specific requirements.[22] Emergency medicine and EMT-specific journals, educational conferences, and on-line resources may be used to fulfill these requirements.[24-27]

EMT TRAINING IN RHODE ISLAND

EMT training in Rhode Island reflects national diversity, and is transitioning to mirror new national uniformity. The supervision of these programs must be performed by an instructor coordinator trained and authorized by the Division of Emergency Medical Services at the RI Department of Health and each individual training endeavor must be specifically approved. Entry level EMT-B training entails completion of a 110-hour didactic and practical course, including ED and field observation, passing the NREMT cognitive exam and a local psychomotor exam. Transition to the new EMT curriculum is in process. This basic EMT training is currently available through a wealth of programs, from individual volunteer organizations to private business endeavors to community college-based programs. EMT-C, a skill level unique to Rhode Island but very similar in scope to the DOT-NHTSA I-99 curriculum, requires prior EMT-B certification and completion of an additional 160 hours of training as well as a supervised clinical practicum in intravenous access. Transition to the new Advanced EMT curriculum is underway. EMT-P training requires over 500 hours of classroom training, plus extensive hospital rotations in obstetrics, intensive care, and emergency settings, as well as a field internship. Like EMT-B, RI paramedics take the NREMT exam, and transition to the new Paramedic curriculum is also in progress. Several paramedic training programs exist within RI. College credit earned can be used toward a degree. An undergraduate major in emergency management is also offered.

The RI Department of Health currently mandates continuing education through refresher programs for maintenance of EMT–B and C licensure. The EMT-P license renewal process via the NREMT requires documentation of continuing education hours, which may be obtained at a refresher program or at many other educational opportunities, including on-line sources.[23] For example, Rhode Island Hospital and its Lifespan affiliates, along with the University Emergency Medicine Foundation have sponsored Rescue Rounds since 1999. This monthly EMT CME program, certified by the Office of Emergency Medical Services of Massachusetts for EMTs of all levels, offers credits toward license renewal for prehospital providers both from Rhode Island and neighboring states.

Several other local hospitals offer similar EMT educational opportunities. The RI Metro EMS Chief's Organization sponsors an annual educational conference. In addition, the Department of Surgery, Division of Trauma and Critical Care at Rhode Island Hospital sponsors several annual trauma seminars. Hospital interventional cardiology programs and stroke centers have provided prehospital directed education focused on acute cardiac and stroke care. The EMS for Children program, managed by the Division of EMS of the RI Department of Health, has created an ongoing pediatric educational program for EMTs. This program has recently added web-based

access to the series, expanding its accessibility to the EMT community and with continuing education credits obtained through Brown University. The Division of EMS also provides educational programs to introduce protocol changes or with any new program initiative. (Personal communication, Jason Rhodes, Chief, Division of EMS, Rhode Island Department of Health. August 27, 2013.) All of these efforts help unite and educate Rhode Island's EMTs.

SUMMARY

Emergency Medical Technician training and education in Rhode Island apply national and state programs appropriately to meet distinct local needs. Dedicated professionals provide both initial certification instruction and ongoing teaching in a wide variety of continuing education programs.

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Authors

Joseph Lauro, MD, NREMT-P, is Clinical Assistant Professor of Emergency Medicine, The Warren Alpert Medical School of Brown University.

Francis Sullivan, MD, is Clinical Associate Professor of Emergency Medicine, The Warren Alpert Medical School of Brown University.

Kenneth Williams, MD, is Associate Professor of Emergency Medicine, The Warren Alpert Medical School of Brown University.

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Correspondence

Joseph Lauro, MD, NREMT-P
Department of Emergency Medicine
55 Claverick Street
Providence, Rhode Island 02903
401-444-5826
jlauro@lifespan.org

The Rhode Island Life Saving Score (RILSS) – A Proposed Life-Saving Definition for EMS and Emergency Medicine

KENNETH A. WILLIAMS, MD; FRANCIS M. SULLIVAN, MD

PREFACE

"Unresponsive, pulse 120, respiratory rate 3, pulse oximetry 73%. BVM with 100% oxygen, naloxone given." He opens his eyes.
We save another life.
"What are you doing?" he asks. "I was taking a nap!"
— Anonymous Rhode Island EMT

ABSTRACT

Emergency Medical Services (EMS) and Emergency Medicine staff are often described as life-saving providers, but there is no generally accepted objective definition of a life saved by these providers. Therefore, a proposed definition is described. Development of this definition began with conceptual rules, followed by a survey of physician EMS medical directors, and then by the development of a tool to implement the definition, and measure its validity and reliability through a review of 100 critical care transport EMS patient charts.

KEYWORDS: emergency medical services, mortality

BACKGROUND

Lives are saved in ambulances and emergency departments every day. However, there is no standard definition of a life saved during emergency care. Emergency departments and ambulance services tend to describe their efforts in terms of volume statistics, percent of patients admitted to hospital, and demographics of patients. Other than for cardiac arrest, where the Utstein criteria[1] provide a standardized template, there is no template or definition that can be used objectively by emergency care providers to quantify lives saved during emergency care. This paper proposes such a definition.

METHODS

The Rhode Island Hospital IRB approved this study. Conceptual rules were derived using a modified Delphi method. Medical director surveys were performed using Illume web-based survey software (Illume, DatStat, Seattle, WA) and an email distribution list provided by the National Association of EMS Officials (www.NASEMSO.org Medical Director Council). Data were converted to Excel (Microsoft Corp., Redmond, WA) for analysis. Simple arithmetic analysis (averages, sums) was performed in Excel. Interobserver reliability calculations were performed by a statistical consultant, Jason Machan, PhD, using SAS version 9.3 (The SAS Institute, Cary, NC).

Conceptual Rules

We began by drafting proposed conceptual rules. These are detailed in **Figure 1**. They included the need to be able to apply the definition during the period of patient care. While other specialties have continued contact with patients and can perform prolonged follow-up inquiries, such as determining 5-year survival rates after cancer treatment, EMS and emergency medicine are often precluded from obtaining such follow up. In addition, emergency patients often have discrete life-threatening events that are independent of future health problems. They may also have several life-threatening events (e.g., recurring hypoglycemia, arrhythmias, or opiate overdose) over a period of several years, and intervention at each constitutes a discrete life-saving event. Other criteria included simple application by the emergency personnel who wish to apply the definition (i.e., a form or list that can be completed during observation of care or chart review, not a complex algorithm requiring data

Figure 1.

Conceptual Life-Saving Score Rules
1. The definition must be based on objective actions, such as procedures performed or treatments given, and causally linked objective outcomes, such as survival or improved vital signs / accepted clinical measures. It must not be based on theoretical evaluations of thought, differential diagnosis, or subjective efforts.
2. The definition must measure the effects of emergency care independent of subsequent intervening events. In other words, the goal is measurement of lives saved during a discrete emergency care encounter, regardless of the effects of later illness or injury, or the efforts of subsequent providers.
3. The definition must be practical to apply and useful. It must not over or underestimate the number of lives saved, and therefore must, at face value, be consistent with saving a life. Practical application demands that the definition be easy to use by emergency providers and their managers.

from future care), the need for the definition to be objective and therefore reliable when measured by different observers, and the need for the definition to be valid in the sense that it must not over or underestimate the number of lives saved as judged by a panel of EMS experts.

Initial Proposed Definition

From these conceptual rules we proposed a definition, shown in **Figure 2**. This general definition was based on the division of emergency patients into several categories, paralleling common triage categories. We defined our categories based on a combination of acuity and severity, with critical patients most in need of life-saving care having both conditions that would result in death if untreated, and conditions where such treatment must be delivered in seconds to minutes in order to save a life. One example is defibrillation to treat cardiac arrest caused by ventricular fibrillation. The next category again included conditions that would be life threatening, but that emergent threat to life would take hours or days to develop and could be mitigated by an intervention during the contact period. An example is treatment of sepsis with antibiotics and fluids in compliance with goal-directed therapy, preventing septic shock and subsequent death. The third category of patients has urgent conditions or behaviors that are potentially life threatening, but that threat to life occurs more than days in the future (weeks or longer). An example would be counseling an athlete to wear a protective helmet during future sporting events.

Figure 2.

Initial Proposed Definition of an EMS Life Saved
A life is saved if EMS or other emergency providers perform a procedure or apply a therapy that:
(1) Results in patient improvement from a condition that is critical or emergent, as defined by likely death if untreated within seconds to minutes (critical) or hours to days (emergent), or prevents death at some future time through a change in behavior or health and
(2) Maintenance of that improvement is maintained until discharge or transfer of patient care to subsequent providers.

Expert Panel Survey

We surveyed physician EMS directors from every state in the country and several territories to determine the validity of our definition with an expert panel, using the Medical Director Council email list provided by the National Association of EMS Officials (www.NASEMSO.org). The survey consisted of a list of proposed actions within the three categories described above: critical, emergent, and urgent. For each action we listed a proposed condition, the therapeutic action, and a proposed improved state. The subjects were asked to score whether they felt each individual action set constituted a life saved if the process proceeded as described. We achieved a good return from these surveys, and good group agreement about the critical and emergent action lists. However, the group felt that the urgent list, due to the vague and unspecified future threat to life, should not be included in the definition of life-saving actions by emergency care providers. This group of experts is well aware of the important progress being made by injury prevention, behavior modification, teachable moment, abuse recognition and prevention, and other similar efforts in emergency care, but was uncomfortable validating the interventions by these groups as immediately life-saving.

Resultant definition

Therefore, the resultant definition includes only critical (death within seconds to minutes, if untreated) or emergent (death within hours to days if untreated) conditions, and objective therapies that stabilize or improve these conditions during provider contact time. This revised definition is shown in **Figure 3** as the Rhode Island Life Saved Score (RILSS).

Figure 3.

Revised Definition: The Rhode Island Life Saved Score (RILSS)
A life is saved if EMS or other emergency providers perform a procedure or apply a therapy that:
(1) Results in patient improvement from a condition that is critical or emergent, as defined by likely death if untreated within seconds to minutes (critical) or hours to days (emergent), and
((2) Maintenance of that improvement is maintained until discharge or transfer of patient care to subsequent providers.

Tool Development and Reliability Testing

From the RILSS definition and the survey tool, we developed a preliminary form that could be used by an emergency provider to score whether or not a particular patient received life-saving care. This form, attached as **Figure 4**, lists interventions and instructs the scoring provider to count the patient as having had their life saved if one or more of these interventions were applied for an appropriate indication and resulted in stabilization or improvement in the patient's condition.

Reliability testing was sought by having four emergency medicine attendings independently score the same 100 consecutive adult transport charts provided by the LifePACT critical care transport service at Rhode Island Hospital. Almost all of these patients are transferred between hospitals, and are admitted to intensive care or procedural settings such as cardiac catheterization or interventional radiology laboratories, or the operating room. Therefore, they constitute a group of patients with a likely high concentration of life-saving activities. We sought to determine if our score had good interobserver reliability, and if it appeared valid given the acute and severe conditions present in this patient population.

Figure 4. Rhode Island Life Saved Score (RILSS) Tool

PRE-CONDITION	INTERVENTION	RESULT	PRESENT?
CRITICAL			
Cardiac arrest	Resuscitation (PALS*, ACLS, ATLS)	Return of spontaneous circulation (ROSC)	[ ]
Ventricular fibrillation	Defibrillation	ROSC	[ ]
Pulseless ventricular tachycardia	Defibrillation / cardioversion	ROSC	[ ]
Unstable tachycardia (Rapid Afib, SVT)	Electrical/Chemical cardioversion OR rate control	ROSC or improved HR/BP	[ ]
Unstable bradycardia	Transcutaneous pacing or med for rate control	Pacer capture or improved HR/BP	[ ]
Pericardial tamponade	Pericardiocentesis	Improved MAP, resolved tamponade	[ ]
Respiratory arrest or failure	Advanced airway management (intubation, LMA, etc.)	Sufficient oxygenation/ventilation	[ ]
Respiratory failure or sedation or paralysis causing respiratory insufficiency	Advanced airway or ventilation or CPAP/BiPAP (continuation)	Adequate ventilation and oxygenation	[ ]
Airway obstruction / Choking	Removal of foreign body/establish patient airway	Sufficient oxygenation/ventilation	[ ]
Anaphylaxis	Epinephrine and/or advanced airway control	Resolution of reaction	[ ]
Tension pneumothorax	Needle decompression/tube thoracotomy	Adequate ventilation, oxygenation, and BP	[ ]
Opiate overdose with respiratory compromise	Naloxone, Naltrexone	Adequate respiration and ventilation	[ ]
EMERGENT			
Infection or sepsis	IV fluids, Anti-infective agent +/- surgery	Improved perfusion, reduction in SIRS criteria / shock	[ ]
Shock (diverse causes including septic, traumatic, hemorrhagic, neurogenic, cardiogenic, anaphylactic)	IV fluids or pressors or removal of causative medication or agent or emergency thoracotomy	Improve MAP and tissue perfusion	[ ]
Ruptured AAA	Application of pneumatic anti-shock garment, shock treatment	Improved clinical condition	[ ]
Significant anemia +/- Hemorrhage	Blood transfusion	Adequate blood volume	[ ]
Anticoagulation With Hemorrhage	Reversal of anticoagulation (FFP, Vit K, etc.)	Hemostasis	[ ]
Toxic or hazardous material exposure (+/-shock or other associated critical condition)	Removal of exposure or application of antidote, decontamination	Improved clinical condition	[ ]
Life threatening circumstances (entrapment, hazardous material exposure)	Rescue and removal from environment	Improved safety	[ ]
Symptomatic hypoglycemia	D50 or other dextrose/glucose/ glucagon	Normal glucose level	[ ]

*Rhode Island Life Saved Score (RILSS) Tool Abbreviation Key

AAA	Abdominal Aortic Aneurysm
ACLS	Advanced Cardiac Life Support course, American Heart Association
Afib	Atrial fibrillation
ATLS	Advanced Trauma Life Support course, American College of Surgeons
BiPAP	Bilevel Positive Airway Pressure
BP	Blood Pressure
CPAP	Continuous Positive Airway Pressure
D50	Dextrose 50% water
FFP	Fresh Frozen Plasma
HR	Heart Rate
IV	Intravenous
LMA	Laryngeal Mask Airway
MAP	Mean Arterial Pressure
PALS	Pediatric Advanced Life Support course, American Heart Association
ROSC	Return of Spontaneous Circulation
SIRS	Systemic Inflammatory Response Syndrome
SVT	Supraventricular tachycardia
Vit K	Vitamin K

RESULTS

The expert panel survey revealed agreement about the conceptual score construct and the specific critical and emergent life-saving actions. The chart audit revealed excellent agreement between observers regarding which patients received life-saving interventions. The overall Fleiss-Cohen weighted kappa was 0.83 (0.78-0.87), with no differences across pairings (p=0.5980) (SAS version 9.3, The SAS Institute, Cary, NC). Approximately one half (48.75%) of patients had at least one life-saving procedure performed (range 0-4 life-saving procedures per patient), confirming validity of the score as a reasonable measure of life-saving activity in this select population. Therefore, the RILSS Tool and definition are both valid and reliable when used to assess a critical care transport EMS patient population.

DISCUSSION

The RILSS definition (**Figure 3**) and final scoring tool, presented as **Figure 5**, allow EMS and other emergency care providers to quantify their life-saving activities in addition to measures counted by current methods (return of spontaneous circulation after cardiac arrest). This proposed Rhode Island Life Saved Score (RILSS) can be used in EMS and emergency care quality improvement efforts, objective descriptions of EMS service performance and activities, and for comparison between patient populations served. Weaknesses of our score include inability to predict long-term survival (arguably irrelevant to EMS providers) and lack of large-scale validation in 911 and emergency department settings. Future study should refine the score and tool, and seek validation in other settings.

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Authors

Kenneth A Williams, MD, is an Associate Professor in the Department of Emergency Medicine, at The Warren Alpert Medical School of Brown University.

Francis M. Sullivan, MD, is a Clinical Associate Professor in the Department of Emergency Medicine at The Warren Alpert Medical School of Brown University.

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The authors have no financial disclosures to report

Correspondence

Kenneth A Williams, MD
Department of Emergency Medicine
55 Claverick St., First Floor
Providence, RI 02903
Phone: 401-444-2739
Fax: 401-444-5166
kwilliamsMD@gmail.com

Critical Care Transport

KENNETH A. WILLIAMS, MD; FRANCIS M. SULLIVAN, MD

ABSTRACT

Critical care transport (CCT) is the segment of the Emergency Medical Services (EMS) system that transports patients who are critically ill or injured. Nearly 1,000 medical helicopters affiliated with over 300 transport programs, hundreds of fixed-wing aircraft, and many, many ground ambulances assisting adult, pediatric and neonatal CCT teams are operating in the United States.[1] This article reviews the history of and indications for CCT, team qualifications, vehicle options, safety, CCT system design, and physician involvement in CCT. It concludes with a brief review of CCT services in Rhode Island.

KEYWORDS: emergency medical services, helicopter, ambulance

INTRODUCTION

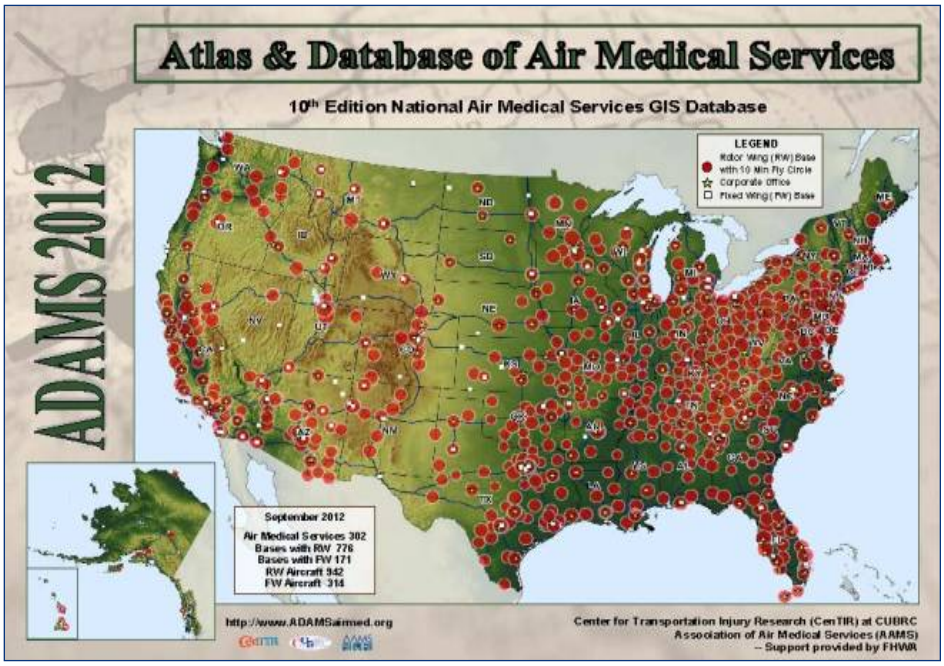
The popular impression of a helicopter ambulance landing on the highway to transport a victim from the crash scene to the trauma center is an inadequate picture of critical care transport (CCT) services. Nearly 1,000 medical helicopters affiliated with over 300 transport programs, hundreds of fixed-wing aircraft, and many, many ground ambulances assisting adult, pediatric and neonatal CCT teams are operating in the United States.[1] (**Figure 1**) Together, these services transport over 550,000 patients annually by aircraft, and an unknown but likely larger number by ground ambulance, including about 68,000 neonates.[2] However, the vast majority of these CCT patients are transported between hospitals, not from the scene of injury or illness to the hospital. A full understanding of critical care transport includes both scene and interhospital transports.

Critical care transport is the segment of the Emergency Medical Services (EMS) system that transports patients who are critically ill or injured. These patients are unstable, or are likely to become unstable, during transport. Specialized staff training, scope of practice, and equipment, often accompanied by purpose-built ambulances (air or ground), facilitate safe CCT operations and account for an equivalent description, specialty care transport (SCT). This article reviews the history of and indications for CCT, team qualifications, vehicle options, safety, CCT system design, and physician involvement in CCT. It concludes with a brief review of CCT services in Rhode Island.

History

The first pediatric hospital in the United States, Children's Hospital of Philadelphia, began operations in 1855, and the first neonatal ICU opened in 1961 at Vanderbilt University.[3]

Figure 1. National View of 15-Minute Rotor Wing Response Areas as of September 2012.



Status as of September 2012. http://www.aams.org/AAMS/Media_Room/ADAMS_Database/aams/MediaRoom/ADAMSDatabase/ADAMS_Database.aspx?hkey=4cccf748-2bc7-4bb9-b41a-c710366c51dc. (Accessed August 20, 2013) The map above shows the locations of Air Medical rotor and fixed wing bases providing emergency response to medical & trauma scenes. The blue circles are 10-minute rotor wing fly circles around each base. These circles represent a nominal 15-minute response area (5 minute for RW launch + 10 minutes flight time). The white squares represent fixed wing bases.

Hospitals and systems dedicated to specialized care of trauma patients first developed in the United States in the 1960s and 1970s.[4] More recently, specialized centers for cardiac, stroke, burn, organ transplantation, and other resource and time-intensive medical problems have developed. This concentration of tertiary care and specialty services at designated hospitals necessitates transport of patients from other hospitals, and argues for direct transport from the scene to specialty centers, bypassing other hospitals in some cases. For patients who meet criteria, direct transport for trauma,[5] ST segment elevation myocardial infarction (STEMI),[6] and stroke patients[7] is advantageous.

Ambulance systems dedicated to delivering patients to these specialty centers from referral hospitals began to appear in the 1970s and 1980s, paralleling the development of many hospital specialty systems. The first civilian hospital-based helicopter program in the US began operations in 1972, modeled after military helicopter medical operations that started in 1944.[8] Rapid growth in the helicopter ambulance segment occurred early, and then again in the 1990s when reimbursement adjustments made for-profit services viable. Many CCT teams use ground ambulances for all transports, and some use both ground and air ambulances.

Due to this combination of increased ambulance service capability and the concentration of specialty medical services at the center of "hub-and-spoke" system models, it became possible to safely transport critically ill and injured patients from outlying facilities and scenes to lifesaving care at these specialty centers. Thus, patients who had been "too sick to transfer" became "too sick to stay" as CCT teams became available.

CCT Team Composition

CCT team composition varies, requiring a blend of EMS, emergency department, and intensive care unit skills and therefore significant training beyond each provider's baseline in most cases. There is general agreement that CCT patients should be attended by a minimum of two providers while a third team member drives or pilots the ambulance. The most common CCT team composition is nurse/paramedic, but nurse/respiratory therapist, paramedic/physician, and other crew compositions exist.

In many cases, particularly where call volume is low (i.e., less than 1 mission every 24 hours), CCT teams are "unit-based," meaning that they are situationally assembled from staff already performing clinical tasks on a patient care unit (typically an ICU or ED), or are on call from home. This provides efficient use of resources, but response time is delayed while team members sign out patient care to their peers or drive to the hospital. In addition, if system volume increases, this model can lead to inefficient staff use and animosity, as CCT team members are often absent from expected unit duties. Other CCT teams are "dedicated," meaning that CCT is their primary assignment. Team members, if located at a hospital or other clinical setting (instead of an airport, fire station, or other non-clinical site), can assist with clinical tasks but avoid assignments that are difficult to leave promptly. Dedicated CCT teams respond rapidly to missions, have time to maintain their vehicles and their own clinical competence while being perceived as extra help in patient care units when the system is managed properly.

CCT Vehicles

Some CCT teams are self-contained; they provide all staff and equipment necessary for patient care, and contract with an ambulance provider or general CCT team to provide an adequate vehicle and support for each mission. Many neonatal and pediatric transport teams, and subspecialty (transplant, stroke, intra-aortic balloon pump, etc.) teams use this system. In other cases, CCT teams use custom-designed air or ground vehicles. Ground CCT vehicles tend to be large ambulances, providing room for multiple providers, centrally-mounted patient cot, significant electrical power for CCT equipment, often via an accessory generator, point-of-care testing equipment, medication refrigerator and fluid warmer, intravenous pumps, ventilator, and other typical equipment. By comparison, most air medical helicopters offer small patient care areas and more limited equipment space, necessitating more patient "packaging" prior to transport.[9]

Location

Many CCT patients have conditions that are both time and level of care critical. Therefore, CCT services should be located where they can provide both rapid and high-quality care. Unfortunately, these can be conflicting requirements. Transport time is reduced if the team is located close to the referral source (scene or hospital), but care quality is best maintained by frequent experience and training, both most often available at the receiving specialty care center. In addition, a single CCT team based at a receiving center would have to be replaced by multiple "satellite" teams to reduce transport time from all geographic directions, increasing system cost and training complexity. An efficient alternative is a combination of centrally located ground (covering the local area) and helicopter air (covering more distant referrals) CCT teams, augmented by 911 EMS systems that include specialty destination protocols and mechanisms to intercept CCT teams while en route to the specialty center when indicated.[10] Unfortunately, there is insufficient regulatory control of CCT providers in the United States to organize such an efficient system. In particular, there is considerable inequity in the distribution of helicopter CCT programs (**Figure 1).**[11] However, there are efforts to accredit CCT programs, primarily by the Commission on Accreditation of Medical Transport Systems[12] and by the Commission on Accreditation of Ambulance Services.[13]

Safety

CCT operations must prioritize patient, provider, and public safety. Safety is enhanced by proper design, restraint of people

and objects inside the ambulance, and careful vehicle operation. Helicopters must meet stringent design and restraint requirements, vehicle maintenance and pilot qualifications, and yet there have been a concerning number of crashes and deaths involving helicopter ambulances.[14] Ground ambulances in the United States are not so vigorously regulated regarding design and equipment / personnel restraint, or driver training, but crashes, although much more frequent, are less likely to cause serious injury or death. Nevertheless, there is significant need for improved ground ambulance design and operational safety.[15] In addition, there is concern that some areas of the country have too many CCT systems, particularly those operating helicopter ambulances, and that these systems are often not utilized properly.[16] In New England, by contrast, appropriate utilization is almost universal.[17]

Indications for CCT

Three decisions guide the use of a CCT team to transport a patient.

1] Does the CCT team vehicle provide unique advantages? For example, helicopter or fixed- wing aircraft, or a custom ground ambulance with bariatric capabilities, may be indicated depending on patient location, weather, or size, regardless of clinical needs.

2] Does the patient need, or potentially need, the specialized capabilities of the CCT team? Patients who are unstable, require significant respiratory support, are receiving multiple intravenous medications, and/or who have a condition that may deteriorate during transport (e.g., acute myocardial infarction, intracranial hemorrhage, gastrointestinal hemorrhage, sepsis) may be best served by a CCT team.

3] Is there a better alternative to the CCT team? For example, in some cases the time necessary for the CCT team to arrive at the referring facility may be prolonged and the referring facility can better serve the patient by sending hospital staff (properly trained and equipped) in a rapidly available local ambulance. In other cases, telemedicine or teleradiology may facilitate consultation and reduce the need for transport. In many areas, there are several CCT systems available. "Shopping" for a CCT system when the weather precludes safe transport (air or ground) is not advised, and a better alternative is local patient stabilization until safe transport is possible.

In summary, CCT is indicated when a patient needs the team's vehicle, crew, or both, and there is no better safe transport alternative.

Physicians and CCT

Physicians interact with CCT services in three ways:

1] Physicians may use CCT services to send or receive a patient. Although specialty dependent, most physicians should be aware of CCT services in their area, the qualifications and capabilities of their crews, and the vehicle types available to them. This familiarity will improve interaction with the CCT system, speed patient transport, and assure compliance with EMTALA and other regulations.

2] Some CCT teams include physicians as crew members. These transport physicians must be aware of the unique circumstances involved in critical care transport, including medical management, vehicle operations and altitude

Figure 2. LifePACT 1 at RIH Anderson Emergency Center.

Figure 3. LifePACT 2 at Hasbro Children's Hospital.

Figure 4. LifePACT 1 & 2 at RIH Anderson Emergency Center.

Figure 6. Rhode Island Congressional delegation dedicates LifePACT 1.

Figure 5. LifePACT 1 interior, with high fidelity simulation manikin and Paramedic Scott Francis.

Figure 7. UMASS LifeFlight and Boston Med Flight helicopters land at Rhode Island Hospital.

physiology (if aircraft are involved), the EMS systems in the operational area, and relevant protocols, regulations, and laws. At Rhode Island Hospital / Hasbro Children's Hospital, senior emergency medicine residents, EMS fellows, and pediatric residents serve as transport physicians aboard LifePACT, the hospital's critical care transport program and the only physician-staffed pediatric and adult CCT program in New England. These transport physicians are supervised by emergency physician or pediatric intensivist medical directors depending on patient age and condition.

3] CCT systems, given their complex and high level of care, require physician oversight. All CCT teams should have a physician medical director who is thoroughly familiar with all aspects of CCT operations, including the topics listed above. In addition, the CCT medical director must be a good leader, be able to facilitate research and quality assurance activities, represent the CCT system as indicated, and have authority to manage system medical operations. The Air Medical Physician Association (www.AMPA.org) and the National Association of EMS Physicians (www.NAEMSP.org) provide significant support and resources for physicians interested in CCT systems, including courses for medical directors and suggested curricula.

CCT in RI

Rhode Island has two critical care transport teams. Women & Infant's Hospital operates a unit-based NICU team, staffed by a neonatologist and a respiratory therapist. They bring a neonatal isolette, patient support equipment, and all necessary medications on ambulances provided by a contracted provider. The W&I NICU team serves an established catchment area around Providence. Rhode Island Hospital / Hasbro Children's Hospital operates LifePACT (mentioned briefly above), a dedicated pediatric and adult critical care transport team. LifePACT has two custom ambulances staffed by specially trained paramedics, nurses, physicians, and respiratory therapists as indicated. (**Figures 2-6**) The LifePACT team members are dedicated to transport duty 24/7/365, and between missions they inventory equipment, maintain competency, perform quality assurance and training functions,

and support Express Care (transfer and access center) and the RIH MedCom Center (paramedic-staffed EMS communications center). LifePACT serves all hospitals in Rhode Island, and surrounding areas in Connecticut and Massachusetts as requested, transporting an average of 4 patients every day. Three helicopter CCT services (Hartford LifeStar, UMASS Memorial LifeFlight, and Boston MedFlight) border Rhode Island, and provide support when requested by Rhode Island EMS agencies and hospitals. (**Figure 7**)

SUMMARY

Critical Care Transport (CCT) is an important part of the health care system, safely providing the ability to move critically ill or injured unstable patients between hospitals (and occasionally from the incident scene to an appropriate hospital). While there are hundreds of CCT programs in the United States, operating nearly 1,000 medical helicopters and many other specialized ground and air ambulances, there are only 2 CCT services based in Rhode Island, one providing neonatal transport, and the other pediatric and adult transport. There is no helicopter CCT program based in Rhode Island.

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Authors

Kenneth A Williams, MD, Associate Professor, Department of Emergency Medicine, The Warren Alpert Medical School of Brown University.

Francis M. Sullivan, MD, Clinical Associate Professor, Department of Emergency Medicine, The Warren Alpert Medical School of Brown University.

Correspondence

Kenneth A. Williams, MD
Department of Emergency Medicine
55 Claverick St., First Floor
Providence, RI 02903
401-444-2739
Fax 401-444-5166
kwilliamsMD@gmail.com