FINAL PROGRESS REPORT

Bridging the Gap between EMS and Health Services Research:

A Conference for Researchers and Practitioners

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Abstract

Purpose: To create stronger links between emergency medical services (EMS) and health services research.

Scope: Due to a long history of organizational and regulatory fragmentation, EMS activity is not well aligned with the broader health system and healthcare policy.

Methods: A committee of experts in EMS, emergency medicine, and health policy guided agenda development and speaker recruitment.

Results: Despite progress in developing an evidence base for EMS practice, progress has been slow and unrecognized outside narrow groups of participants. To generate the attention and resources needed to move forward, the field of EMS must raise its profile among policymakers and the general public. Much needed resources include the creation of EMS research centers that are university based but have strong connections to local EMS authorities and medical directors who are essential for the implementation of evidence-based recommendations. The ability to link EMS data with other healthcare databases is also crucial to improving EMS and its broader visibility. Finally, “on-the-ground” EMS providers expressed a strong interest in learning skills to conduct and evaluate EMS research.

Key Words: Emergency medical services (EMS), prehospital care, emergency care, health services research, health policy

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Purpose

Emergency medical services (EMS) are a vital part of healthcare delivery for the most severely ill and injured patients. EMS providers are needed to respond to recurring medical emergencies as well as mass casualty events, such as natural disasters and terrorist attacks. Despite its importance, EMS is among the least understood and least monitored areas of the health sector.

It has been recognized for some time that the evidence base for EMS activity is extremely limited. In 2001, the National Highway Traffic Safety Administration (NHTSA) and the Health Resources and Services Administration (HRSA) sponsored the development of the National EMS Research Agenda. The agenda, which was later updated and refined, prioritizes research topics and describes the resources needed to build a sustainable EMS research infrastructure.[1,2] The need for dramatic improvements in the EMS research base was strongly reiterated by the Institute of Medicine (IOM) as part of its reporting on the current state of emergency medical care in the US.[3] The lack of a research base has contributed to an EMS system in which quality is highly variable and uncertain, agencies with overlapping responsibilities are not well coordinated, and the costs and benefits of routine EMS activities are unknown.

The need to improve quality, coordination, and system performance is not unique to EMS. To the contrary, this need is recognized in virtually every area of the American health sector.[4] A major enterprise of health services research involves developing and evaluating ways to improve the performance of various healthcare providers including physicians, hospitals, nursing homes, and others. Despite the overlapping concerns between EMS and other parts of the health sector, EMS issues are rarely analyzed by health services researchers. This is unfortunate, because EMS actively is directly affected by broader health system phenomena (e.g., barriers to primary care) and EMS performance can affect health outcomes in other settings (e.g., in-hospital mortality among patients transported by ambulance). As a result, EMS is rarely mentioned in proposals for healthcare reform and is not aligned with broader health system needs. To better align the organization and use of incentives throughout the health sector, it is important to bridge the gap that now exists between specialized EMS research and broader health services research.

To address these issues, the Rutgers Center for State Health Policy (CSHP) convened an invitational conference on July 23, 2009, in New Brunswick, NJ, called "Bridging the Gap between EMS and Health Services Research: A Conference for Researchers and Practitioners." The conference brought together researchers, healthcare quality experts, EMS providers, hospital representatives, and government officials to facilitate improvements in the quality and coordination of EMS systems by creating a stronger link between EMS and health services research.

The specific aims of the conference were to:

1. Create an agenda to integrate EMS research with the broader discipline of health services research.
2. Identify opportunities to link EMS databases with other data used by health services researchers.
3. Identify priority measures of EMS quality with emphasis on measures that contribute to quality assessment across entire episodes of care.
4. Develop methods for turning EMS research into practice by incorporating perspectives and concerns of EMS stakeholders and regulators.
5. Identify lessons learned from recent EMS innovations across the US.

Scope

Background

Many of the problems faced by EMS systems are driven by their long history of fragmentation. EMS systems across the nation can be operated by a wide array of entities including counties, municipalities, fire departments, police departments, private companies, hospitals, or local volunteers. Some communities switch between paid professional and unpaid volunteer EMS providers based on the day of the week or time of the day. Unfortunately, little is known about the relative pros and cons of these disparate models. Moreover, EMS and other emergency responders often lack clear systems of communication and different agencies often use equipment that is incompatible. A series of reports has also highlighted ongoing “turf wars” between fire fighters and EMS providers.[5,6]

Public oversight for EMS activity is also fragmented. At the federal level, oversight responsibility is divided between the National Highway Traffic Safety Administration (NHTSA) and the Department of Health and Human Services. Similar divisions are evident at the state and local levels. In addition, the level and stringency of public oversight varies substantially between and within states.[3] EMS agencies may be held to different standards based on the sponsoring entity. Volunteer EMS agencies, in particular, are often held to different or even nonexistent standards relative to professional agencies.

Because of its fragmented nature, EMS activity is not aligned with broader health system needs, particularly those related to hospital care. Concern has been raised about how well medical information is communicated when patients are transferred from the ambulance to the hospital.[3] For example, physicians in the emergency department (ED) often complete their patients’ evaluation before the patient-care report is completed by EMS personnel.[7] Also, payment for EMS is usually tied to the transportation of patients to hospitals. This often leads to patients being taken to hospitals unnecessarily. In some cases, patients would be better served by receiving treatment from EMS professionals outside of the hospital. Alternatively, patients with less severe conditions might be taken to other ambulatory care providers, such as physicians' offices or health centers, to receive care.

Limiting the volume of patients coming to the ED by ambulance is especially critical at times when local ED's are overcrowded and about to go on ambulance diversion. One study estimated that 11-61% of ambulance transports to the ED are medically unnecessary.[8]

Although definitive national data do not exist, medical errors and complications are likely to be prevalent in EMS due to the hurried environment in which care takes place and the wide variety of conditions that are treated at random intervals. This environment is similar to the hospital ED, where a disproportionate amount of medical errors are known to occur.[4] Unlike their hospital counterparts, EMS providers work in isolated and frequently hazardous settings, rely exclusively on portable equipment, and do not have an "in-house" infrastructure to provide backup resources, patient transfer, and financial support.

Scientific Need

A small but growing number of EMS research studies have been published since the 1970s. Most of this research focuses on specific conditions and interventions such as the use of automated external defibrillators in pre-hospital settings[9] and the value of endotracheal intubation for pediatric airway management.[10,11] Although more work is needed to establish the effectiveness of many EMS treatment protocols,[3] the evidence base for EMS organization and financing is much smaller and it is not well integrated with the broader field of health services research. In addition, the quality of many EMS studies has been called into question. In its National EMS Research Agenda, NHTSA described the current state of research as overly dependent on expert opinion, editorials, and limited case studies with insufficient attention to study design and rigorous data analysis.[1] NHTSA, AHRQ, and the IOM have outlined specific problems that limit sustained production of rigorous EMS research including limited affiliation with academic research centers, relatively few resources devoted to data collection and dissemination, limited knowledge among researchers about the existence and availability of data, few measures of pre-hospital care quality, and few reviewers who understand EMS issues in detail.[1-3, 12]

Although these discussions have been addressed in several publications and conferences, the audiences and the topics addressed have remained fairly specialized within the EMS community. The proposed conference sought to build a much broader understanding of EMS issues and priorities among a wider group of researchers, regulators, and practitioners.

Methods

To guide the development of the conference agenda, the project team organized a planning committee of experts in EMS, emergency medicine, and health policy (Table 1). The committee guided the creation of session topics and the recruitment of speakers.

Table 1: Conference Planning Committee

Name	Affiliation	Title
Derek DeLia, PhD*	Rutgers Center for State Health Policy	Associate Research Professor
Jared Kutzin, RN, EMT, MPH*	University of Massachusetts – Amherst.	Doctoral student
Bruce Siegel, MD	George Washington University	Research Professor, Director of the Urgent Matters Program
Kristine Gebbie, DrPH, RN, FAAN	Columbia University School of Nursing	Professor, Director of the Center for Health Policy
Kevin McGinnis, MPS, EMT-P	National EMS Management Association	Communications Technology Liaison
Charles Pozner, MD	Brigham and Women's Hospital	Medical Director, STRATUS Center for Medical Simulation
Susan D. McHenry	National Highway Traffic Safety Administration	EMS Specialist

* Committee co-chairs.

Speakers were given general topic areas to address in their assigned sessions. Otherwise, presentation material and organization were left to the judgment of individual speakers. The final session topics and speakers are listed below:

Session 1: Evidence-based Practice in Healthcare and EMS
Daniel Spaite, MD – University of Arizona

Session 2: EMS-Based Health Services Research: Current Practice and Future Goals
Henry Wang, MD – University of Alabama
Richard Narad, DPA, JD – California State University

Session 3: Links between Hospital and EMS Performance
Eliot Lazar, MD – New York Presbyterian Hospital
Rollin Fairbanks, MD, MS, EMT-P, FACEP – University of Rochester School of Medicine

Session 4: Databases for EMS-based Health Services Research: Development & Application of NEMSIS
Greg Mears, MD – University of North Carolina
Friedrich M. von Recklinghausen, MPA, PhD, FRSPH –Dartmouth-Hitchcock Medical Center

Session 5: Using Research to Improve Practice & Policy
Karen Halupke, RN – NJ Department of Health and Senior Services

Michael Mastrianni, EMT-P – NYS Volunteer Ambulance & Rescue Association, Inc.
James Augustine, MD – District of Columbia Fire and EMS Department

Session 6: Conference Lessons & Next Steps
Kevin McGinnis, MPS, EMT-P – EMS Leadership Conference and National EMS Management Association (Moderator)

Results

Evidence-based practice

Dr. Daniel Spaite gave an overview of evidence-based medical practice and how it can be used to improve EMS delivery. Evidence-based medicine is a movement that seeks to replace medical practice based on tradition and local experience with systematic evidence on what works under what circumstances. The movement has evolved slowly in medicine and is only in its nascent stages in EMS. Conference participants suggested that EMS providers are interested in improving the evidence base for their practice but that no infrastructure exists to do so.

For example, the Brain Trauma Foundation periodically updates its hyperventilation guideline for the pre-hospital setting. The guideline, which is currently in its 3rd revision, states that hyperventilation should be avoided in the traumatic brain injury patient. However, many state protocols either don't discuss appropriate treatment or still list hyperventilation as the initial treatment for these patients.

Dr. Spaite emphasized the construction of evidence-based guidelines in EMS. Guideline construction is a long and painstaking process that begins with systematic research and requires critical review of bodies of evidence. Nevertheless, research itself rarely "writes the guideline." Judgment, inference, and opinion are often required to make a final determination. Systematic procedures are required for weighing the strength of available evidence and for grading the strength of a guideline. This is especially important for EMS, because procedures found to be effective in one setting may not be so in a pre-hospital environment. In addition, guidelines with a weak evidence base can be detrimental. As Dr. Spaite pointed out, "bad guidelines can hang around a long time." This underscores the need to update prior guidelines and delay the introduction of a guideline when evidence is insufficient.

In September 2008, the Federal Interagency Committee on EMS (FICEMS) and the National EMS Advisory Council (NEMSAC) sponsored a conference on evidence-based guidelines in EMS to seek consensus from EMS providers, government, and academia on the process of guideline development. The consensus process involves various stages of risk-benefit analysis, critical evaluation of strength of evidence, iterative feedback, and wide dissemination through publication, accreditation rules, and multi-media presentations for multiple audiences. Because EMS is very local in its culture and chains of command, it is essential to get "buy-in" from state and local EMS directors early in the process. Dr. Spaite suggested that evidence-based guidelines be developed on a national level and then tailored for use on the local level by state or regional authorities.

An audience participant also highlighted the need for searchable and user-friendly databases for providers who are not researchers.

EMS-based health services research

Dr. Henry Wang gave a presentation summarizing the literature on endotracheal intubation (ETI) in the pre-hospital setting. This body of research began with investigations into specific clinical issues involving procedure effectiveness and later led to broader investigations of the EMS care system. In general, pre-hospital ETI does not lead to increased survival or improved neurological outcomes. To the contrary, in some cases, pre-hospital ETI is associated with worse patient outcomes. Further research found that tubes are often misplaced by paramedics, a problem that is associated with limited opportunities for paramedics to learn and retain the skills needed to intubate proficiently. This body of research has clear implications for paramedic training and guidelines for when pre-hospital ETI should be provided.

Dr. Richard Narad presented a much broader view of EMS research in the context of public policy. Although the clinical evidence base for EMS remains small, the base for EMS-related policy decisions is much smaller. Key questions to be addressed involve the organization and regulation of EMS systems, promotion of efficiency and accountability, cost control and funding, and public transparency. EMS organization, for example, involves "multicratic organization," which refers to the coordination of disparate groups of people with their own culture, values, and political interests. More specifically, EMS is known for its multiple divisions along professional (i.e., police, fire, medical), organizational (i.e., public versus private), and civic (i.e., professional versus volunteer) dimensions. Research is needed to determine how best to communicate and organize services across these dimensions. Comparative research is also needed to determine which organization structures are most effective and efficient at delivering pre-hospital care. Dr. Narad also highlighted the role of EMS in end-of-life care and how patients receiving advanced life support are often a reflection "EMS saves" – that is, patients near death who were successfully resuscitated by EMS providers. This role highlights the broader concept of EMS as a part of the healthcare continuum, which is currently not well understood.

Presentations by Dr. Wang and Dr. Narad provided concrete examples for a broader discussion held throughout the day about methodologies used in EMS-based health services research. The research on pre-hospital ETI, for example, is based on a variety of methodologies including but not limited to clinical trials. Clinical trials are considered the gold standard in most medical research but they are difficult to employ in EMS settings due to problems of obtaining informed consent and other barriers. Though it is possible to address these barriers, Dr. Spaite described clinical trials in EMS as yielding "little bang for the buck" due to the high costs involved. Instead the evidence base for EMS is more likely to come from retrospective studies and the mining of databases from disease registries, administrative and medical records, and other sources. This type of research requires a specific set of skills based in social science, epidemiology, and econometrics.

Moreover, as discussed in a later presentation by Dr. Greg Mears, the ability to link EMS data to other health system databases is fundamental to the conduct of EMS-based health services research.

Links between hospital and EMS performance

Dr. Rollin Fairbanks presented research on the application of human factors engineering to EMS. The Institute of Medicine (IOM) published its seminal report on medical errors in 2000.[13] Despite its call for a 50% reduction in error within 5 years, very little has changed. Dr. Fairbanks emphasized the need to "reduce harm" rather than "eliminate error." Elimination of error is ultimately impossible and can lead to negative consequences, such as misallocation of resources, frustration among providers, and even greater harm to patients. Dr. Fairbanks emphasized the use of lessons from other high-risk industries such as aviation and nuclear power, where the goal is to reduce the occurrence of human error and mitigate the effects of unavoidable error. For example, defibrillators are typically designed in such a way that 50% of paramedics inadvertently delivered an unsynchronized counter-shock for SVT (super ventricular tachycardia).[14-16] Moreover, 71% of paramedics were unaware that this was happening. In addition to product design, Dr. Fairbanks emphasized the need for EMS to recognize three gradations of human error (normal error, at-risk behavior, and reckless behavior) and the need to report and respond differently in each case. Although these concepts will be very new to the current practice of EMS, error reporting and harm reduction strategies remain underdeveloped and challenging for the broader health sector as well.

Dr. Eliot Lazar discussed healthcare quality in hospitals and EMS. Although a fairly large cadre of quality experts exists, very few of them focus on quality in EMS. This has left EMS with very few measures of quality and those that do exist are not fully standardized in the way they are defined and measured. Nevertheless, research on hospital quality offers a framework and lessons that can be used as a foundation for developing systems of quality improvement in EMS. In light of the volume-outcome relationship that has been established for several medical procedures, Dr. Lazar suggest the inclusion of volume in addition to structure, process, and outcome as part of the Donabedian model for evaluating healthcare performance. This would include specific volume indicators, such as procedures per hospital, per physician, per EMT, and per ambulance company.

As quality measures for EMS emerge, they will confront issues common to hospital quality data. In particular, hospital-level quality data still not as effective as it could be. Consumers struggle with what they are supposed to do with the information. In EMS, choice of provider may be much more constrained than choice of hospital. Impacts of quality reporting in EMS may be driven more by peer pressure and regulation. Dr. Lazar also noted that the public's perception of hospital ED and EMS capabilities are much higher than the reality. Widespread quality reporting may lead people to adjust their expectations.

Databases for EMS-based health services research

Dr. Greg Mears provided an update on the National EMS Information System (NEMSIS) led by the National Association of State EMS Officials (NASEMSO). NEMSIS was developed to address the major absence of data for EMS surveillance and improvement. The long-term goal of this system is to produce fully coordinated and comprehensive EMS systems that are data driven and evidence based. Specific long-term applications envisioned for NEMSIS include EMS education standards, performance evaluation, research, reimbursement, and contribution to patient electronic medical records.

NEMSIS development began in 2001 and early implementation began in 2005 with the creation of the NEMSIS Technical Assistance Center at the University of Utah. Currently, 23 states have generated more than 7 million records containing 68 data elements. Current data can be used for descriptive analysis, benchmarking across states, and aggregate summaries of information. Subsets of the data (approximately 2.8 million records) are available online through a public query tool at www.nemsis.org. More detailed data are available to researchers under special conditions to maintain confidentiality.

Dr. Mears provided a series of current NEMSIS applications in North Carolina. For example, NEMSIS is used to link EMS response times with county-level demographics and mortality from injury or cardiovascular disease. The system is also used to benchmark time between 911 call and first defibrillation for patients in cardiac arrest. NEMSIS also feeds into the state's syndromic surveillance system for tracking the H1N1 virus and other infectious diseases.

NEMSIS data currently allow for descriptive and correlational analyses. While useful, these analyses often generate as many research questions as answers. As data collection and refinement continue, NEMSIS is expected to support more causal modeling and analysis. Dr. Mears also pointed out that the ability to link NEMSIS to other databases is essential for maximizing the usefulness of the database and of EMS research in general, an idea that was reinforced throughout the day's discussion. By the end of 2009, North Carolina is expected to link NEMSIS with a variety of disease registries, hospital discharge data, and medical examiners data.

Dr. Friedrich von Recklinghausen presented information about the Trauma and EMS Information System (TEMSIS) created in New Hampshire. In 2005, this system began to collect EMS information electronically for use by policymakers and stakeholders. Initial funding was provided by HRSA for planning and NHTSA for implementation. A key to the system's development was the solicitation of input from multiple stakeholders. TEMSIS was developed collaboratively by approximately 50 stakeholder groups that included EMS providers, hospitals, public health officials, health statistics agencies, highway safety authorities, and academic institutions. It was viewed from the beginning that stakeholder input and collaboration were vital for setting up the data infrastructure, maintaining wide participation, and agreement to use and accept findings from the data. Dr. Recklinghausen illustrated how TEMSIS is currently used to provide information about EMS activities in New Hampshire.

Applications include profiling EMS provider credentials, tracking service times by scene and medical event, and the use of billing information for financial planning. Hospitals use TEMSIS to understand the use of pre-hospital care protocols for patients transported to the ED. Other applications involve local epidemiology of injury and demand for EMS services. These applications have isolated causes of traffic accidents, such as large moose populations, weather events, and changes in fuel prices. Others have focused on policy changes, such as pre-hospital intubation protocols and seat belt laws. TEMSIS is also used as a source of information for grant funding and EMS reimbursement. Much of the TEMSIS data links with the national NEMSIS database. New Hampshire's TEMSIS database was the second state database in the nation to start submitting data to NEMSIS and can be used to help develop budgets, benchmark performance, develop protocols, measure performance and patient outcomes, and compare EMS regions.

Using Research to Improve Practice & Policy

Karen Halupke of the New Jersey Office of EMS discussed the state's EMS Systemwide Review, which was commissioned in January 2006 and led to a final report in August 2007. The report produced 55 recommendations, many of which overlap with the National EMS Agenda for the Future produced in 2001.[1] Most recommendations place the state Office of EMS in the central role of coordinating, facilitating, and disseminating EMS research and data collection. Ms. Halupke suggested that the spreading of these functions across multiple agencies would make it impossible to achieve the needed EMS improvements. Specific recommendations include the creation of a statewide database using NEMSIS and the use of electronic patient care reports that are consistent across the state.

Historically, volunteer EMS agencies in New Jersey have not been subject to the same level of regulatory oversight as professional agencies. Many of the new recommendations, however, specify that no exemptions should be made for volunteer providers. The state's Department of Health and Senior Services (which houses the Office of EMS) plans to mandate the use of electronic patient care reporting by all EMS providers regardless of professional or volunteer status.

The New Jersey report also urges more coordination with the state's hospital ED's to ensure that pre-hospital information is integrated into patient records. Currently, EMS providers typically provide paper reports, which are often ignored or discarded by ED staff. Ms. Halupke emphasized the need for "data to flow both ways" between hospitals and EMS to improve emergency medical care.

Michael Mastrianni discussed his experiences with volunteer EMS providers in New York State and the barriers these providers face in terms of improving the quality and efficiency of their services. Coordination of effort is hampered by the wide variety of agency types, including the emergence of hybrid agencies in which paid providers take calls during the day and volunteers provide coverage overnight. New York's volunteer agencies remain paper-based reporting systems. Some agencies enter reported information into a database if resources are available. Moreover, reporting responsibilities are often dispersed and uncoordinated. For example, if multiple agencies respond to a call, several reports may be filed for the same episode. Alternatively, information may not be reported if each provider assumes someone else is doing the reporting.

Volunteer agencies generally struggle to maintain resources for everyday operations (e.g., gas, supplies), making it impossible to develop their own data collection platforms. Other organizations such as state agencies or hospitals are needed to take the lead on data collection and reporting. Mr. Mastrianni also pointed out that the processes of Basic Life Support (BLS) services are more difficult to measure than those for Advanced Life Support (ALS) services, because BLS care is often less complex and less invasive than ALS care. Many BLS agencies provide minimal amounts of treatment and focus heavily on rapid transport to more advanced care in a hospital setting and therefore the data collection points are fewer and seemingly less useful. However, with data collection could come a larger scope of practice if treatments and outcomes were monitored through a data collection system.

Dr. James Augustine discussed the concept of a regional accountable emergency system (RAES) and its application in Washington, DC. The goals of a RAES include improving service to communities and patients, attracting and retaining emergency service professionals, and improving interactions among all components of the emergency medical system. Achieving these requires an understanding of how emergency care fits into the broader US health system. EMS and hospital ED's have become the default systems for urgent and unscheduled care. This is especially true for the growing population of individuals with chronic illness who have repeated medical episodes. This population in some ways reflects the success of modern medical care in saving and lengthening lives. But this success has come at a price of added stress on emergency medical systems. A more recent trend involves the growth in highly specialized facilities (i.e., "focused factories") designed to provide high-quality care to patients with very specific medical needs (e.g., cardiac surgery center). Alongside this trend is a rise in the number of patients using the emergency medical system for conditions that are more complex or less easily classified into one focused category. It is not uncommon today for EMS providers to encounter patients on a litany of medications for a multitude of conditions being treated by more than two doctors. Many of the illnesses present in today's society no longer lead to mortality the way they did in the past, but are today being managed as chronic conditions. Examples include cancer patients who are no longer spending weeks in the hospital receiving chemotherapy but who are instead receiving treatments as outpatients and returning to the community to continue living their lives.

Similarly, planning in other medical facilities is often based on the expected availability of emergency care. Patients discharged from the hospital often are told to go to the ED or call 911 if certain problems arise. Nursing home staffs also rely heavily on the availability of emergency services for their residents, as do primary care physicians who are either ill equipped or too busy to see patients who call or present with medical conditions that may require further evaluation and intervention. As Dr. Augustine pointed out, "everyone calls 911 and the problem goes away."
The creation of well functioning RAES's, therefore, depends on understanding and responding to these broader issues in the American health sector.

For example, Dr.Augustine described the Washington, DC, Street Calls Program, which was implemented in March 2008. Each month the top 25 EMS users are identified and the Street Calls Team (consisting of paramedics, an EMT, a nurse practitioner, and a physician assistant) visits these individuals at their home to gather information the individuals' access to primary care, economic resources, social support systems, and other factors that could impact their reliance on 911. Patients with a variety of health and social needs ranging from alcoholism to dementia are connected with services more appropriate to their needs. Early results from the program based on matched pairs of Street Calls participants and controls found a 53% reduction in EMS transports.

More broadly, Dr. Augustine raised the prospect of EMS being more involved in demand management and home care for patients with chronic illnesses. This activity could improve patient care and help hospital ED's better manage their patient flow. This idea would require tighter connections between EMS, hospitals, and other parts of the health sector, including public health agencies and practitioners.

Conference Lessons & Next Steps

Kevin McGinnis moderated the last session, which summarized lessons and next steps from the meeting. Mr. McGinnis noted that prior efforts to improve EMS research and practice (e.g., NHTSA and IOM reports) have been slow to stimulate needed changes. There are several reasons for this. Despite the publication of these reports, EMS issues are not well known to policymakers who have the power to direct vital resources for EMS research and organizational change. Similarly, these issues are not well known to the general public who could pressure their elected officials to take action.

Because EMS remains a low-profile issue, researchers feel pressure to "bury" EMS in other projects with greater availability of funding through the NIH and other funders of research. This burying, however, perpetuates the isolation and lack of visibility of EMS research. In addition, EMS providers are currently not well-positioned to effectively use or influence rigorous research in their field.

There was broad consensus that the field of EMS needs to improve its image among policymakers and the general public, primarily through the emphasis of patient care over patient transport. Expanding the implementation and usability of evidence-based practice and rigorous patient safety protocols would do much to promote the skill and professionalism of EMS personnel.

Participants emphasized the fact that EMS remains deprived of the necessary resources to promote improvements in EMS practice. Because it cuts across so many different areas, EMS does not fit into any specific disease category that characterizes much of the research funded through NIH. It was noted in discussion that AHRQ can play a role in the development and dissemination of EMS evidenced-based guidelines and other best practices through its support for Evidence-Based Practice Centers. Although these centers currently emphasize specific clinical categories (e.g., diabetes, obesity), an EMS practice center could potentially be organized around healthcare organization and financing strategies to recognize the generalist nature of pre-hospital care.

Participants also discussed the possibility of creating "self-sufficient" processes modeled after CPR guidelines produced by the American Heart Association (AHA). The AHA uses fees from certification courses to continually update and fund research in cardiac care. Similar processes might be used to help support the development and dissemination of other pre-hospital evidence-based guidelines.

Conference attendance and evaluations

The conference was attended by 59 stakeholders, policymakers, and researchers from organizations such as the National Highway Traffic Safety Administration, Children's National Medical Center, US Dept of Health and Human Services, UC-San Francisco Medical Center, Our Lady of Lourdes Hospital, and Tufts Medical Center. Given the location, many attendees came from NJ medical and EMS organizations and NJ state government.

Conference participants showed great enthusiasm for the day's agenda and many indicated a desire to build on the work of the conference in the future (as discussed above). Table 2 shows summary statistics for conference evaluations that were completed by 36 participants. All responses were coded on a 5-point scale in which 1 indicates "poor" and 5 indicates "excellent." In written comments, several participants noted the value of having a diverse group of participants (i.e., EMS and non-EMS) for interaction and networking.

Table 2: Conference evaluations

Components	**Mean**
Importance of the topics covered	4.71
Organization of the day	4.59
Usefulness of information provided	4.62
Event accommodations	4.82
Presenters/sessions	**Mean**
Daniel Spaite	4.68
Henry Wang	4.64
Richard Narad	3.97
Eliot Lazar	4.53
Rollin Fairbanks	4.67
Greg Mears	4.41
Friedrich von Recklinghausen	4.21
Karen Halupke	4.19
Michael Mastrianni	3.60
James Augustine	4.73
Conference Lessons and Next Steps	4.42

Although the conference sought to attract 80-100 participants, many invitees cited lack of travel funds and travel restrictions (particularly within state governments) as barriers to attendance.

These barriers appear to be common in the recent economic recession, as attendance has been less than usual at other health and medical conferences.[17] Though some conferences provide funding for participants, this strategy would have been applicable to only a small number of participants, undermining the goal of reaching a broad audience. In retrospect, it would have been useful to arrange for a conference simulcast over the internet or create a podcast for later viewing. Some who could not attend due to travel constraints expressed interest in these technologies.

Although efforts were made to reach a broad audience through research and professional associations, some participants felt the conference was not well advertised, particularly to "on-the-ground" EMS providers. Despite the strong representation of EMS personnel in attendance, greater emphasis on local EMS networks, rather than state or national ones, may have attracted more EMS providers.

Conclusions

Aim 1: Research agenda

The outlines of an EMS research agenda began to emerge from the conference. The ultimate goal of this agenda is to improve the quality, safety, and efficiency of EMS. This would include but not be limited to the development of evidence-based guidelines and patient safety protocols. To generate the attention and resources needed to move forward, the field of EMS must raise its profile among policymakers and the general public. As mentioned by Dr. Mears, the NEMSIS team had the opportunity to meet with health policy advisors in the Obama Administration. Although this meeting has thus far not translated into specific health reforms related to EMS, continued interaction with health policy officials is likely to increase the attention given to the field.

The general public is very often removed from issues of quality and efficiency of EMS operations. Periodic exceptions are noted when a local ambulance company is under threat of closing (regardless of its quality or the availability of nearby alternatives). To increase public interest, EMS researchers must generate vehicles for the dissemination of findings beyond a research audience to reach the general public. These vehicles may include issue briefs, fact sheets, or announcements to the general media.

Given the wide reach of EMS, strong interdisciplinary collaboration is vital for the production and dissemination of EMS research. This includes linkages between EMS and other medical providers as well academic collaborators. This collaboration may be fostered best through the creation of research centers focused on EMS issues. These centers would include experts in medicine, health policy, public health, social science and economics, epidemiology, traffic safety, and data analysis. Some centers would serve as a focal point for the creation and dissemination of evidence-based guidelines. Others would focus on broader health system issues such as the ability of EMS to interact with patients outside of the health system (e.g., in patients' homes) and the role of EMS in healthcare delivery reform.

Conference participants also emphasized the local nature of EMS and the role of local authorities and medical directors in setting protocols that are ultimately followed.

EMS research centers and other collaborations must be equipped to interact with local leaders to encourage their participation and endorsement of research findings.

Bridging the gap between EMS and other areas of health services research would also benefit from standardization of terminology. It was noted during the conference that EMS publications are marked by multiple terms such as emergency care, prehospital emergency care, emergency medical services, or out-of-hospital care. More precise and standardized usage would make EMS research easier to find in literature searches and raise the field's visibility among medical and health services researchers who specialize in other areas.

The issues raised in the conference are critical to improving medical care for many AHRQ priority populations. Individuals who are severely ill and others with chronic illness will are often dependent on ambulance transportation to the hospital. Elderly (i.e., 65 and over) patients are also disproportionate users of EMS, as they account for 2/3 of patients arriving at hospital EDs by ambulance.[18] Although children account for a much smaller share of total EMS volume, the IOM recently identified pediatric EMS and hospital emergency care as high priorities for new research and quality improvement.[19] In addition, the problems of ED overcrowding and ambulance diversion are especially severe in inner city hospitals.[20] As a result, improvements in EMS and the coordination of pre-hospital and ED care can help strengthen these facilities, which serve as the healthcare safety net for poor and uninsured patients.

Aim 2: Database linking

The ability to link EMS data with other databases was emphasized by several presenters as crucial to improving EMS and its broader visibility. NEMSIS currently supports some linkages to hospital discharges and disease registries as well as area demographic data. Expanding these opportunities should be a high priority for the EMS research community. As illustrated by Dr. Wang's presentation, linkages between EMS and other relevant databases are possible. Because these kinds of linkages are resource intensive, though, they remain quite rare. To maximize the return on investment in data linkages, researchers should seek ways to create linked databases that will support multiple studies over time.

Aim 3: Priority measures

No set of specific EMS priority measures emerged from the conference. As outlined in Dr. Spaite's presentation, some progress is expected in the near future on evidence-based guidelines for EMS processes of care. Little is underway, however, in terms of EMS system performance. Ultimately, the key performance measures of any part of the health system involve years of productive life or quality-adjusted life gained and the costs of achieving these outcomes. A potentially fruitful area of focus concerns the role of EMS and the emergency medical system in responding to chronic illness and the growing demand for unscheduled care.

Aim 4: Perspectives of stakeholders and regulators

Many attendees expressed their desire to become more involved in EMS research but were unsure of how to become involved and whether they were qualified to do so. The EMS providers in attendance stated their desire to be educated about general research topics and trained in research skills. They recommended the development of continuing education programs that teach the basics of conducting research and understanding research studies. If implemented, this recommendation could serve as a catalyst for collaborations between EMS providers and EMS researchers in the local community. The creation of a skilled cadre of provider/researchers will enhance visibility and respect for the field of EMS.

Attendees also recommended the inclusion of research concepts in the basic education of EMS providers. This is especially important for the communication and implementation of evidence-based guidelines. EMS providers trained in this way may be more likely to contribute to guideline development as well. These recommendations overlap to a large extent with those of the National Highway Traffic Safety Administration.[21]

In addition to education, EMS providers who are interested in research need to form partnerships with experienced researchers in emergency medicine, health services research, and other related fields. These partnerships may begin with mentoring relationships and evolve into more equal collaborations as the cadre of EMS researchers grows. Clear partnerships would also address a concern expressed by some in attendance that EMS personnel do not enjoy sufficient credit/authorship when they are involved in research and data collection.

Although a fair amount of research in EMS is conducted currently, there is concern about the quality and rigor of that research. Occasionally, a rigorous EMS study with strong connections to other fields of medicine (e.g., cardiac or emergency care) is published in a medical journal. Research with a more narrow EMS focus is mostly published in *Prehospital Emergency Care*, which is peer reviewed, or *Journal of Emergency Medical Services* (JEMS), which is a trade publication. Though conference participants endorsed a greater commitment to rigorous peer-reviewed publication, EMS providers pointed out that they would not have the time or training to read and critically evaluate technical research articles. A publication with easy-to-read summaries of peer-reviewed studies may provide a much needed link between researchers and providers. Research summaries published by AHRQ or the National Bureau of Economic Research (NBER) may serve as models for communicating research findings to non-research audiences whom researchers ultimately hope to influence.

Aim 5: EMS innovations

Speakers and attendees focused most of their attention on processes to conduct and support EMS research and mechanisms to implement evidence-based recommendations. Nevertheless, programs such as Street Calls and applications like TEMSIS may serve as building blocks for future innovation.

Publications and Products

Conference presentations have been currently posted on the CSHP website (http://www.cshp.rutgers.edu/). A manuscript summarizing conference findings is under review at *Prehospital Emergency Care*. The Project Officer will be notified of any pending publication.

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