

The National EMS Advisory Council

Submitted on May 30, 2012

Committee: Medical Oversight and Research

Title: NEMSIS: Achieving its Full Potential for Advancing Healthcare

Issue Synopsis

A. Problem statement

The National Emergency Medical Services Information System (NEMSIS) serves to standardize the data collected by EMS providers and to aggregate the data at a national level, so that EMS care can be characterized nationwide and so that EMS improvements can be evidence-based. NEMSIS is poised to be the most influential emergency services data set in existence. Commendable strides have been accomplished in developing NEMSIS: the next steps are to ensure that EMS systems and providers have access to and utilize NEMSIS to its full potential. The NEMSAC vision is that NEMSIS will be used to enhance patient care coordination, improve patient care, ensure workforce safety and training, reduce healthcare spending, as well as advise healthcare reform. However, efforts and systems to utilize NEMSIS-compliant data to evaluate and improve the quality of patient care at the local, state and national levels are underdeveloped. Challenges to fully employing NEMSIS for advancing healthcare fall in to the following categories:

- 1.) The lack of understanding and vision of the potential of NEMSIS-compliant data to be utilized for broader health care system improvements,
- 2.) The deficiency of integration and compatibility among state level NEMSIS datasets with some independent healthcare and public safety state data sources, and
- 3.) The scarcity of supporting mechanisms for state and local agencies to benchmark and utilize NEMSIS-compliant data for system and provider performance assessment.

B. Resources/references related to the issue

Dawson DE. National Emergency Medical Services Information System (NEMSIS). *Prehosp Emerg Care*. Jul-Sep 2006;10(3):314-6.

Kemp M. Mapping the future: with NEMSIS, the EMS of tomorrow will be shaped by the data of today. *EMS Mag*. Feb 2009;38(2):48, 50.

Mears G. Avoid information overload. Now that you have data, what do you do with it? *JEMS*. Aug 2009;34(8):12-5.

Newgard CD, Zive D, Malveau S, Leopold R, Worrall W, Sahni R. Developing a statewide emergency medical services database linked to hospital outcomes: a feasibility study. *Prehosp Emerg Care*. Jul-Sep 2011;15(3):303-19.

Shaeffer Z, Gohdes D, Legler J, Taillac P, Larsen B. Monitoring prehospital stroke care in Utah to assess the feasibility of using EMS data for surveillance. *Prev Chronic Dis*. Oct 2009;6(4):A137.

Wang HE, Mann NC, Mears G, Jacobson K, Yealy DM. Out-of-hospital airway management in the United States. *Resuscitation*. Apr 2011;82(4):378-85.

C. Crosswalk with other standards

- The American College of Surgeon's *National Trauma Data Standard (NTDS)* – The NTDS is the data standard for the National Trauma Data Bank. The associated trauma elements characterizing pre-hospital care are harmonized with NEMSIS and the underlying NEMSIS XML.
- The American Heart Association's *Utstein Criteria*, developed to uniformly describe out-of-hospital cardiac arrests, are incorporated into the NEMSIS standard.
- The Emergency Data Exchange Language (EDXL), XML-based messaging standards to facilitate emergency information sharing between government entities was developed in association with the NEMSIS standard.
- The NEMSIS Technical Assistance Center (TAC) has written custom elements to ensure that the entire Cardiac Arrest Registry to Enhance Survival (CARES) dataset is harmonized with the NEMSIS standard.
- The U.S. Fire Administration's *National Fire Incident Reporting System (NFIRS)*– There is an ongoing effort to coordinate NEMSIS and NFIRS, since all fire-based EMS agencies work with both data standards.
- The NEMSIS Version 3 data standard includes stroke and patient outcome scales validated in peer-reviewed literature and commonly used across U.S. hospitals.
- The 2001 National Highway Traffic Safety Administration *National EMS Research Agenda*
- The 1996 National Highway Traffic Safety Administration *National EMS Agenda for the Future*
- The 2007 Institute of Medicine *Future of Emergency Care: EMS at the Crossroads*

D. Analysis

The Development of NEMSIS

Emergency Medical Services (EMS) is the first immediately available point of contact along the spectrum of emergency health care, providing patients with life-saving and stabilizing care as well as transportation to the hospital. Yet, for decades, data characterizing the care offered by EMS have been unavailable, a deficiency that gradually became widely recognized. As early as 1966, the publication “Accidental Death and Disability: The Neglected Disease of Modern Society” highlighted the lack of EMS data. In addition, the EMS Program in the Department of Health, Education and Welfare identified through implementation of the EMS Systems Act in the 1970s that “standardized patient record keeping” should be one of 15 components of a well-functioning EMS system. Other federal agencies and programs, including the Emergency Medical Services for Children (EMSC) and the Institute of Medicine (IOM), have stressed the need for accurate and reliable information that characterizes the quality and timeliness of care offered in the pre-hospital setting.

The lack of standardized national EMS data was pressingly important to address in order to increase the quality of patient care and to enhance understanding of the EMS systems in the United States. First, care offered before hospital arrival has been shown to significantly impact patients’ responsiveness to definitive treatments and ultimate health outcomes. The lack of documentation of EMS response, treatment, stabilization, and transport of patients stalls efforts to improve and integrate pre-hospital care with the hospital-based emergency care system. In particular, treatment protocols for “time-sensitive” conditions including cardiac arrest, ST-elevation myocardial infarction (STEMI) and stroke, which are treated in the pre-hospital setting, could be strengthened by being evidenced with EMS data. Second, local EMS system designs, practices, and collected data elements vary widely across the United States, making systems and data impossible to compare. The creation of a standardized nationwide EMS data repository was judged essential for characterizing the national scope, reach, and impact of EMS care.

In response to the call for a comprehensive EMS data system, the National Highway Traffic Safety Administration (NHTSA), in cooperation with the Health Resources and Services Administration (HRSA), provided funding to the National Association of State EMS Officials (NASEMSO) to develop the National EMS Information System (NEMSIS) in 2001. A multidisciplinary national taskforce was formed with the assignment to complete the following four tasks. Subsequently, all 56 states and territories signed a memorandum of agreement, which documented both support for NEMSIS and intent to implement the full NEMSIS dataset, as funding permitted:

1. Develop a revision to NHTSA’s Uniform Pre-hospital EMS Dataset Version 1.0,
2. Incorporate the dataset revision into a standard XML format,
3. Identify a subset of elements that could comprise a national EMS registry, and
4. Define a business plan for the implementation of a national EMS information system.

In 2005, NHTSA, in cooperation with HRSA and the Centers for Disease Control and Prevention (CDC), funded a cooperative agreement to designate a NEMSIS Technical Assistance Center

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(NEMSIS TAC) to facilitate the implementation of the NEMSIS standard into local, state, and national levels of EMS data collection. The primary objectives outlined in the cooperative agreement were as follows:

1. Maintenance and revision of NEMSIS data standard,
2. Development of a software compliance process to ensure proper implementation of NEMSIS XML schemas,
3. Provision of technical assistance to states attempting to incorporate the NEMSIS standard,
4. Incorporation of a “data use agreement” process agreed upon by states submitting records
5. Development of a process to import, clean and maintain a national EMS registry, and
6. Development of a suite of reporting tools, providing access to the national EMS registry.

The support for NEMSIS continued to grow: in 2008, the FICEMS adopted the following position:

“It is the intent of FICEMS that all EMS systems implement electronic documentation systems that use NEMSIS Version 2.2.1 or higher; that all State EMS information systems receive local electronic EMS data via the XML standard; and that all States contribute data to the National EMS Database. Compliance with these three components of the National EMS Information System will result in improved outcomes for those requiring emergency care and will help inform improved development of State, local, tribal, and regional emergency medical services systems. Such uniform data will also support EMS research, injury prevention, and national EMS assessments. Federal funds may be used to support EMS activities in systems operating NEMSIS compliant EMS information systems that are collecting NEMSIS compliant data and participating in the national EMS database. In those situations in which a NEMSIS compliant information system is not yet in place, funds may be used to assist in the establishment of such a system, consistent with the requirements of the specific grant program.”

Recent Accomplishments of NEMSIS

The NEMSIS TAC resides within the University of Utah’s School of Medicine. The NEMSIS TAC protects the integrity of the NEMSIS 2.2.1 standard and recently released Version 3 (V3) of the standard. V 3 enhances the ability to assess EMS performance when addressing time-sensitive illness and injury, ensures that data errors are rectified before an EMS record is completed, and allows for the “real-time” transmission of EMS records to state and national registries. Ninety-three software implementations have been tested for compliance with the NEMSIS 2.2.1 standard. The NEMSIS TAC began compliance testing for V3 in May of 2012. Every state and territory has received technical assistance, and 35 states and territories are actively submitting EMS records to the national repository. Another 15 states and territories have (or are) implementing NEMSIS compliant data systems and an additional eight states are expected to begin contributing to the national registry during 2012. The National EMS Registry is designed as a two-year rolling dataset and currently contains 24.5 million records that are available for analysis by the general public, EMS professionals, and trained investigators.

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Reporting tools are available on the NEMSIS website (www.nemsis.org) that access the entire registry and require no specialized training. A de-identified, case-level research dataset is also available to researchers on an annual basis. The 2010 NEMSIS Public-Release Research Dataset is currently available and includes 9,776,094 EMS events submitted by 31 states and territories during the 2010 calendar year.

The NEMSIS TAC has also accepted the charge to prepare the NEMSIS standard for future integration in the larger health care enterprise. As an initial step, the NEMSIS V3 standard has been vetted through Health Level Seven International (HL7), the global authority for standards on interoperability of health information technology, and has been approved as a standard. Currently, the NEMSIS HL7 architecture is entering a “trial use” phase before approval as a “normative” standard and application to the American National Standards Institute (ANSI) for final certification. An HL7 compliant version of NEMSIS V3 is expected to be released in 2014. Federal funding (e.g. Section 408 NHTSA grants for Traffic Records System Improvement) to support the transition to NEMSIS V3 as well as to support the establishment of a NEMSIS compliant system where one is not yet in place will be essential for optimal utilization of the resources and opportunities inherent in NEMSIS for healthcare improvement.

The NEMSAC Vision for NEMSIS to Advance Healthcare

“Meaningful use” of health information technology (HIT) is an umbrella term that is currently used for an identified set of rules and regulations that hospitals and physicians must meet to qualify for federal incentive funding under the American Recovery and Reinvestment Act of 2009 (ARRA). ARRA authorized the Centers for Medicare & Medicaid Services (CMS) to provide reimbursement incentives for professionals and hospitals that become “meaningful users” of certified electronic health record (EHR) technology. Being a “meaningful user” entails using EHR to evaluate and improve the quality of patient care. “Meaningful use” sets goals that pertain to healthcare, not to information technology. The overall goals of “meaningful use” are to use EHR technology to do the following:

1. Improve quality, safety, and efficiency of patient care,
2. Engage patients and families,
3. Improve care coordination,
4. Ensure adequate privacy and security of PHI, and
5. Improve population and public health.

In a vision modeled from the concept of “meaningful use,” NEMSIS V3 presents a wealth of potential for improving healthcare quality through EMS data. NEMSIS harmonizes with hospital HL7 data standards to accomplish the vision set forth in the 1996 EMS Agenda for the Future. The Agenda recognizes that for EMS to fulfill its potential to mitigate illness and injury risk, provide acute illness and injury care and follow-up, monitor community health, and contribute to the treatment of chronic conditions, the following information systems (IS) components are needed, all of which NEMSIS V3 contains:

1. Uniform data elements and definitions,

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2. Mechanisms to generate and transmit valid, reliable, and accurate data,
3. IS capable of describing entire events, and
4. IS integrated with data systems from other healthcare providers, public safety agencies, and the community.

There are innumerable positive outcomes expected to result from applying NEMSIS V3 data to broader health system improvements. Achieving these opportunities will depend on linking data sources and bi-directional sharing of data and information between EMS professionals and other stakeholders, including hospitals, clinics, physicians, public health agencies, payers, accountable care organizations and human services providers via regional health information exchanges (HIE), the National Health Information Network (NHIN) and the planned Human Services Domain of the National Information Exchange Model (NIEM).

The following are examples of beneficial outcomes expected from utilizing NEMSIS V3 data for health system improvements:

Enhanced care coordination

- EMS case coordinators will be able to confidentially, HIPAA-compliantly exchange data with social workers, other case managers, as well as housing, shelter and health navigators (including regional 211 systems) via linkage to the HIE to better coordinate the care of vulnerable patients and those with complex, psychosocial healthcare needs.
- Community-based paramedics will be able to confidentially exchange clinical, patient, and family-centered data with clinicians and human services providers to monitor multiple domains of wellness for patients who desire such supportive services.
- EMS will have the capacity to link prehospital data, based on geolocation technologies found within fire/EMS computer-aided dispatch (CAD) centers, with public health data to identify “hot spots” (e.g., frequent utilizers, high-risk of readmission within 30 days, cardiac arrests, pediatric asthma, etc.) in order to improve preparedness and response systems and to target prevention measures, thereby reducing preventable deaths.
- Regional, state, and national data exchanges will be able to measure and benchmark essential healthcare metrics, including the following: survival from sudden cardiac arrest (SCA); incidence of bystander CPR; outcomes of major trauma, stroke, STEMI, asthma; as well as high-impact chronic diseases, such as heart failure and pneumonia. Such healthcare benchmarks will be created by aggregating data and employing census-tract based analyses to enable the creation of targeted interventions across sectors by attracting focused collaboration to “hot spots” among otherwise competing health plans.
- NEMSIS-compliant EMS data will have enhanced capacity to serve as an early warning tool for via the creation of syndromic dashboards that will enable EMS data to be evaluated and used for “real time” surveillance.

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Improved patient care as well as provider safety and training

- Utilization of NEMESIS V3-relevant performance measures integrated with point-of-care access to patient history, allergies, medications, primary providers, case plans, organ donor status, and contemporary Physicians Orders for Life-Sustaining Treatment (POLST) will allow for safer treatment, reduction of medical error, and consideration of patient choice.
- Awareness of patient hospital outcomes will improve EMS training and result in a more educated, cost-effective prehospital healthcare workforce.

Reduced healthcare spending

- High-cost, high needs patients (including frequent utilizers) will be identifiable prior to hospital arrival: it is envisioned to be possible for pre-existing case management files to be retrieved and attached to streaming prehospital electronic health records (EHR) and merged with ED and hospital EHR for immediate and subsequent access. This rapid linkage will provide the treating ED physician with pertinent past history (and even connections to patients' case managers via text, pager, or voice mail alert) to reduce unnecessary testing/imaging and assure more coordinated follow-up with fewer unnecessary admissions.
- On-line medical control will be able to more accurately determine the appropriateness of alternate destinations for prehospital patients, thereby reducing unnecessary ED visits.
- Enhanced connections between EMS and support services for high-risk, high-needs patients, such as aging and independent services and child protective services, will lead to improved follow-up as well as the identification and implementation of measures to prevent injury, thereby lowering the rate of admissions and healthcare costs.

The Potential of NEMESIS in Advising Healthcare Reform

Data-driven decisions are at the heart of healthcare reform. National EMS data, which is NEMESIS compliant, can provide valuable data to contribute to the federal National Quality Strategy (NQS), which is fundamentally “better care, better health and lower cost”. NQS envisions the evolution of “cascading measures, or families of measures” to produce a comprehensive picture of quality throughout the healthcare system. To achieve this vision, the HHS and partners are working aggressively to identify measurement tools that reflect care within and across three core domains: clinician care, hospital care and post-acute care/long-term care. In the past year, the CMS, the National Quality Forum (NQF), and other key entities have analyzed currently endorsed and new metrics of quality for the nation’s healthcare system. The federal government’s deadline to implement these new evidence-based measurement tools, which will link payment to performance, is 2014.

To be eligible for consideration, measurement tools must reflect care within or across in-patient, outpatient, long-term, hospice, cancer, rehabilitation or skilled nursing home settings. In addition, HHS is specifically focusing on assessing the quality of care for federally covered patients disproportionately burdened by chronic diseases, whose care costs the most (i.e., patients

“dually eligible” for Medicaid and Medicare). Person and family-centered care measures are being sought for this patient population whose quality of life may not be accurately reflected by current metrics. NEMESIS will have the capacity to collect and transmit meaningful data that reflect this unmet need, since EMS providers routinely work with vulnerable populations and patients with such chronic diseases. For example, EMS EHR can incorporate new measurement tools that reflect non-traditional (social) determinants of health outcomes.

The value of NEMESIS V3 is also evident within the context of the federal vision of the healthcare workforce. As noted in the November 14, 2011, CMS Health Care Innovation Challenge, the nation’s workforce is projected to become highly focused on prevention, care coordination, care process re-engineering, dissemination of best practices, team-based and community-based care, continuous quality improvement (CQI), and the use of data to support new delivery models. The EMS workforce can play an increasingly important role in such strategic goals. In fact, a current CMS Innovation Center innovations grant specifically identifies the valuable role that community-based paramedics can play in extending available primary care resources in rural communities. In such scenarios, NEMESIS will have the capacity to provide a data linkage between hospitals, providers, medical oversight, as well as accountable care organizations and partner medical homes.

Barriers to Achieving the Vision for NEMESIS to Advance Healthcare

NEMESIS presents a multitude of opportunities for advancing healthcare, but there are national, state, and local-level barriers to utilizing NEMESIS to its full potential.

National level

Many professional organizations and federal agencies are not completely aware of the potential of NEMESIS to integrate multidisciplinary sectors nor of the opportunities NEMESIS V3 provides to assess performance for time sensitive conditions. Therefore, NEMESIS has not been fully utilized to enhance patient safety and increase public health surveillance. From a funding perspective, there is an opportunity for federal agencies to support the transition to NEMESIS V3, the development and establishment of NEMESIS compliant information systems, and the recognition of NEMESIS in emergency care funding streams.

State level

In most state systems, NEMESIS data remain unlinked with many other state data resources, such as information from emergency departments, police reports, and hospital datasets, thereby limiting comprehensive understanding of emergency health incidents and application of accurate care protocols. The underutilization of NEMESIS compliant data in public health and public safety surveillance is also often due to the absence of political or administrative mechanisms to support such application. There are also opportunities to develop mechanisms to evaluate state NEMESIS data for quality, surveillance, performance, and compliance utilizing real-time dashboards.

Local level

Local NEMSIS data are often not benchmarked with state or national NEMSIS data measures. Data quality control is also a serious concern at the local level: documentation of the EMS run and assessment of provider performance measures is the foundation for an EMS database that accurately characterizes prehospital response. There is uncertainty regarding the level of knowledge of local providers regarding the potential of NEMSIS and how local EMS event documentation can serve to enhance a myriad of prevention, safety, and surveillance initiatives at the state and national levels. There is also little understanding of how local ambulance agencies collect and use data, which can affect the development of benchmarking and the best utilization of EMS data at the local level.

E. Committee conclusion

Comprehensive EMS data are the framework upon which rational decisions are made. The implementation of NEMSIS has served to address an important, long-standing call for quality, comprehensive documentation of EMS response, treatment, stabilization, and transport of patients. There is a wealth of potential opportunity for NEMSIS to positively influence not just EMS, but the broader healthcare enterprise through the following outcomes: improved patient care, enhanced patient care coordination, ensured EMS workforce safety and training, reduced healthcare spending and advised healthcare reform. However, this vision has not been fully realized nor have the necessary supporting mechanisms been available at the national, state, and local levels for EMS stakeholders to achieve the potential of NEMSIS to improve healthcare quality.

Recommended Actions/Strategies:

The NEMSIS should be supported as the continued, recognized, official national standard for EMS data. Efforts should be made to mitigate the challenges to utilizing NEMSIS for healthcare improvement through the following tasks:

The National Highway Traffic Safety Administration

- **Recommendation #1:** The NHTSA should identify and disseminate EMS performance measures that utilize NEMSIS compliant data. Such efforts should build upon existing performance measures documents, adding measures that are relevant to NEMSIS V3 and time sensitive conditions and including examples of how national and professional organizations could use and assess each performance measure.
- **Recommendation #2:** The NHTSA should develop mechanisms to assist local agencies in employing NEMSIS performance measures. These mechanisms should include a performance measure toolkit, including “provider reports” that characterize documentation errors, procedure performance, and patient status upon ED discharge (and outcomes) as well as technical benchmarking guidance for software developers that facilitate the importation of state and national information to be compared with local data.

- **Recommendation #3:** The NHTSA should develop efficient mechanisms (e.g., dashboards) for state EMS data to be evaluated and used for quality improvement, “real-time” surveillance, and compliance with NEMSIS.
- **Recommendation #4:** The NHTSA should publicize a vision for utilizing NEMSIS for health system improvements and research, including best practices for implementation, collection, and utilization of EMS data (i.e., an “EMS Data Collection Agenda for the Future”), highlighting successful programs/attributes of state systems that are integrating EMS data to serve local and state public health and public safety needs.

The Federal Interagency Committee on EMS

- **Recommendation #5:** The FICEMS should lead the effort in supporting States in devising technical and political solutions that permit state datasets (i.e., healthcare, traffic, public health) to be “linked” with NEMSIS-compliant data to enrich the descriptions and to understand the determinants of “healthcare events” experienced by individual patients or related to disaster situations.
- **Recommendation #6:** The FICEMS should support the development of administrative and political (e.g., sample state legislation) strategies that facilitate the use of NEMSIS data in public health/ public safety surveillance.
- **Recommendation #7:** The FICEMS should work with member agencies to revisit opportunities for incorporating language into federal grant guidance that aligns with the FICEMS position statement set forth in 2008, calling for federal funding to support the establishment and development of NEMSIS compliant information systems in addition to the transition to NEMSIS V3.
- **Recommendation #8:** The FICEMS should work with its member agencies to consider how NEMSIS compliant data and information systems could be utilized to respond to the Gap Analysis of EMS Related Research as well as to achieve program objectives when developing strategic direction or grant guidance related to emergency care topics, including preparedness and mass casualty incidents.