

Lessons Learned by Model State EMS Data Systems

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Introduction

In 1966, the white paper *Accidental Death and Disability* was published and called for the need for EMS data. In their review of ambulance services in the United States, the authors concluded that there was “a paucity of information and a limited framework for the collection of data on and the evaluation of current ambulance services.”¹ While technologies and treatments have improved dramatically since the 1960s, the “paucity of data” in EMS continues to challenge the EMS system of care needs. Many agencies collect EMS data, but only a handful of states have been able to develop and implement a comprehensive statewide electronic data collection system necessary for quality analyses that can adequately address statewide EMS decision making and patient care. Nearly forty years have passed and according to the 2003 NHTSA-sponsored EMS Outcomes Project, “no local, state, or federal [EMS] databases were suitable for use due to inconsistent data definitions, inconsistent data formatting, and variation in inclusion criteria.”²

While EMS data system development and data collection remain a challenge on local, state and national levels, several states have made significant progress with their EMS data systems. Because most modernized electronic data systems have only been developed in the last five to seven years, little has been published regarding the states’ development process and the lessons learned from that process. The National EMSC Data Analysis Resource Center (NEDARC) acts as a resource to states as they develop their capacities to collect, analyze, and utilize EMS data. In an effort to help state EMS agencies and personnel better learn from the experiences of state EMS agencies that have implemented EMS data systems, NEDARC staff interviewed data system personnel from five states considered to have “model” systems. The five states, Delaware, Minnesota, Mississippi, North Carolina and Ohio. In January and February of 2005, telephone interviews with the EMS data system manager in each of these states were conducted. The managers were asked questions on 10 major components of EMS data system management: legislation, hardware, software, training, marketing, implementation, maintenance, quality management and reporting, funding, and human resources. The answers were transcribed and returned for review to each data manager to ensure accuracy. This document is a compilation of the major lessons learned by those individuals who have implemented statewide EMS data systems.

Component #1: Legislation

All of the respondents remarked about the importance of having state legislation that supports the EMS data system. They cited two important legislative components that were 1) having a legislative mandate or authority to collect EMS data and 2) having the authority to require EMS agencies to submit their data to the state. The first element is required for a state to have a “mandatory” system, as opposed to only a “voluntary” system, in which agencies are encouraged, but not required to submit their EMS run data

¹ White Paper on Accidental Death and Disability, 1966, page 13.

² EMS Outcomes Project, National Highway Traffic Safety Administration, 2003

to the state. The second element provides assurances to the local level agency that any data they submit will have some protections. Of the five states interviewed, four had a legislative mandate to collect data and one had a voluntary system. Each of the states with a legislative mandate reported that the law or rule had already been established in their state long before the modern data system was planned or developed. This precluded the necessity for them to create new legislation. The state that did not have a legislative mandate encountered difficulties not identified by the other states, specifically the difficulty of obtaining compliance. Because the state's EMS office had no authority to require data submission, a number of agencies would not submit their data. This respondent reported, "You can only go so far with a voluntary system." Similarly, another state said, "There is no way to put together a good system that is purely voluntary - there has to be some sort of mandate for people to submit."

For states that are trying to develop a legislative mandate, planning and consensus building appear to be key steps along this path. One data manager recommended that managers need to plan "how [they] will handle all legislative issues," from establishing buy-in with stakeholders to offering HIPAA (Health Insurance Portability and Accountability Act) privacy protections to providers and agencies. The interviewee also suggested that managers first work to build consensus among the EMS community on the need for the new system.

In summary, states felt that it was important to pursue a legislative mandate to collect EMS data from local agencies and to carefully consider other activities related to the legislative process prior to system development.

Special Note: NEDARC has attempted to compile all laws or rules pertaining to data collection and protection for the 56 states and territories. This document is available on the NEDARC website (www.NEDARC.org)

Component #2: Funding

Without funding, a data system cannot be created. Plus, funding is not reserved for the creation or purchase of a software application. Money is needed for maintenance, personnel, upgrades, and hardware in order to maintain the system. Each state emphasized the importance of having a dedicated funding stream to create and maintain the new EMS data system. One interviewee stated that "funding is usually going to be the most difficult piece of developing a data system. Many factors are out of your control," including the bureaucratic process, shifting policies, and the changing legislative landscape.

From our sample of five states, two used existing EMS funding to develop the new system. The remaining three had limited in-house EMS funding, so they needed to secure alternative funding sources. Two of these states received the majority of the funding from their Highway Safety Office through a desire between both parties to collect similar kinds of data. Another state relied on money received from traffic citations to fund the project.

No state used anti-terrorism funding to help develop their data system, even though one interviewee pointed out this is an excellent source of funding.

The ability to procure long-term funding is clearly a requirement for any viable EMS data system. One participant stated, “Successful information systems must become a component of the state information technology structure and maintain their funding and level of support based on their shown value.” Only one state mentioned that there were problems maintaining the long-term funding stream. “Each year we had go back to the Office of Highway Safety for money to replace equipment ...and to [perform] software maintenance.”

In summary, states that are developing new EMS data systems should put careful consideration and effort into securing appropriate funding sources. All respondents were able to fund their systems, but they sometimes had to be creative and explore new partnerships. Additionally, one state learned the inherent problems of not having a dedicated funding stream and the consequences as a result. States should ensure fundings for both development and continued support.

Component #3: Human Resources

Human resources play a major role in developing a new EMS data system. Qualified people are needed for technical development, system, design, program management, training, marketing, and many other areas that are critical to creating an effective EMS data system.

Each interviewee discussed the importance of having a project manager to oversee the day-to-day needs of the new system, particularly during the system’s initial stages. The dedicated manager will help ensure that the system will receive the attention it will need. A number of interviewees stressed the benefit of having an EMS provider as the system’s project manager. This is supported by the fact that none of the states interviewed employed non-providers in this managerial role. Those interviewees that commented stressed the importance of the project manager being capable of speaking the same language as the providers and agencies. An interviewee stated that having an EMS provider as a project manager, “curtailed the typical complaint from agencies that the state does not understand their needs.”

States also discussed the need for long-term planning as the system matures. During the system’s development phase, human resource needs are mostly limited to the project manager and programming staff. After implementation, the needs of the system shift from development to maintenance, and as stated by one interviewee, “additional people will be needed according to the demands of the system.” New priorities could include a technician to support the system and analysts to help turn data into useful information and reports. Additionally, the demand for analysis will likely increase more over time. For instance, as more and more agencies use the system, there will be a desire from agencies for information from the system. Only one participant remarked about the minimum staffing requirements for their system. They stated that having a project manager, an

analyst, and a data coordinator was sufficient for them because they have an annual maintenance contract from their software provider.

As an example for when not enough resources were allocated, one state that developed its system in-house did not have adequate financial resources to hire a programmer. Therefore, this interviewee reported that “routine and small issues became great nuisances because no one was available to fix it in a reasonable amount of time.” The interviewee added that they could not provide serve some of the most basic customer’s needs and thus the state lost face as a result.

Human resources are integral to a successful EMS data system. Human resource management relies on both proper planning and on the flexibility necessary to adapt to evolving system needs. EMS offices need to accurately assess the requisite skills and the time required to manage a new system. Having adequate personnel dedicated to the new system, particularly in the early stages of development, is critical to the success of the system.

Component #4: Hardware

The development of a new EMS data collection system will require detailed hardware considerations. EMS offices need to consider requirements for the data warehouse on the state level, as well as the essential submission tools and data entry equipment on the local level. Additionally, the states need to be cognizant in both areas when looking at and planning for technological advancements that are naturally part of the computer industry.

EMS Data Warehouse

A data warehouse is the central repository for state EMS data. The warehouse consists of one or more servers located at a state or a contractually-run facility. In the interviews, each of the participants remarked about the importance of flexibility when creating the specifications for the EMS data warehouse. Each state has different policies regarding the hardware or software used along with the location of the database. This is also true within the geographic characteristics of a state, where specifications might work well in a rural area but not in an urbanized region. As a result, there is no hardware or software scheme shared between the interviewees.

Another important hardware issue discussed by the interviewees was the importance of having an EMS data system that can be up and running twenty-four hours a day, 365 days a year. Because EMS runs occur at all times, EMS agencies typically need the data collection system to be constantly available. For one interviewee, the Information Technology (IT) office for the state did not understand the need to have such a service and felt that the system could be taken down periodically for service and repairs. This resulted in over fifty hours of system downtime each year, where providers had to wait for the system to come back up before reports could be entered. Another state anticipated a similar problem and placed its servers in two separate locations, which reduces the possibility of a system failure from taking place.

Because technology is continually changing, it is important that the EMS data system is updated at reasonable intervals. EMS personnel and state agencies need to be cognizant of technological advancements that may benefit the system. One state had an experience that illustrates this point, “When we developed our EMS data system there was limited wireless hardware technology. Three years later, a better version of wireless technology allows people to connect from mobile units.” The EMS agency personnel realized the emerging technology would enhance their system and began supporting agencies that were going to the new technology.

Submitting EMS Data Via the Internet

While there are several methods that can be used by EMS agencies to submit data to the state office, internet-based methods appear to be the most commonly used. All of the states use the internet to gather data a state level. Two interviewees used it for transporting the data from one location to another, while another two used it for direct data entry via web pages. The last state used the internet to run a remote data entry application. One state commented that as internet technology advances, it becomes more compatible to the needs of statewide EMS data systems. However, all of the interviewees reported drawbacks with the dependability or speed of the connection between the two sites. This is especially seen in rural areas where dial-up internet is often the only method available for connection. One interviewee suggested that dial-up internet access should not be utilized, saying that “users expect a better response” in the time it takes to submit data. Two other participants echoed this remark when speaking about rural regions of the state. They recommended that states should pursue faster connections such as broadband technology or limit the use of the internet when a static dial-up connection is unreliable. As a way to overcome a poor internet connection, one state implemented data entry just after an EMS incident by placing computers with a faster internet access at the destination hospital; another state entered data into a Tablet PC or other handheld device during the incident and then uploaded the data into the system later.

All the EMS data managers stated that they have integrated internet access capabilities into their data systems, but that they have had to learn to adapt to the inherent technological barriers from poor internet connections to the different demands of urban versus rural EMS systems. The respondents recognized the need for flexibility and to create unique systems that reflect the characteristics (internet capability, state policies, etc.) of their states to facilitate good data collection.

EMS Data Entry Equipment

EMS agencies need reliable equipment for entering data during or after each EMS event. The interviewees employed a variety of methods to support effective data entry. The data entry equipment used by EMS agencies in the states we interviewed ranged, from optical character recognition (OCR) technology through tablet PCs. Depending on the agency, data entry was possible on scene, during transport, at the destination hospital or afterward at the agency’s station. The hardware choices that agencies made depended on a few

factors: 1) the needs and preferences of the local agencies, 2) availability of technology, and 3) funding.

Regardless of the data entry method used, interviewees emphasized the importance of the equipment meeting the reporting needs of the providers. The system should be flexible enough to allow users to adopt the technology that best meets their needs, even if this means allowing multiple forms of data collection methods. States EMS offices play a major role by making data entry and reporting equipment available to EMS providers. Two state offices provided local agencies either the funds to purchase the equipment or supplied the hardware. This type of support proved to be an effective approach at making system implementation more accessible to agencies.

A common mistake made by data managers is to disregard certain technologies because they did not work in the past. For instance, one participant explained that their system attempted to establish a statewide EMS data system in 1996 using Pen-top computers. The interviewee stated that the system was a failure, and that it “lasted three months and cost over \$200,000.” Eight years later, however, the interviewee has discovered that similar computer technology is reemerging, and at least one state is successfully using a tablet-PC technology to collect data. The lesson learned is to remember that technology can change for the better over time, and states need to carefully select the technologies that will best serve the providers in their state.

Software

Software is one of the most critical components of a data collection system because it is the tool that everyone in the EMS system will likely use. However, as stated by one interviewee, “designing, developing, and managing EMS data software is more difficult than it appears.” A well-designed software system can create good quality data for analysis and a user-friendly environment for EMS providers; whereas a poorly-designed system will create bad or unusable data and an army of angry providers. Like every other aspect of EMS data system development, careful planning is needed to ensure that the software development process will be successful.

When developing a new data system, states often have a choice between developing the data system software in-house or hiring an outside contractor to create the software. Two of the state data managers we interviewed had developed a software program in-house, and the other three data managers chose to use outside contractors to develop the software. Each participant acknowledged that there is no right or wrong choice and that the decision should be based on a number of factors that vary from state to state.

Here are some the problems that states experienced during software development using each method:

In-House Software Development:

1. Some state offices were rigid in the type of software it would allow its programmers to use, resulting in software that did not fully meet the needs of the system.
2. In-house staff had limited experience in application programming, which limited the capabilities of the software system.
3. One state had a limited time frame to work on the project. Once that period was exhausted, the EMS office was left with some unfinished work. They had little recourse to ask the state programmers to complete the work.
4. State rules and regulations inhibited and slowed down purchasing and other decisions.

Contracted Software Development:

1. Money and financial limitations limited the amount of work than can be completed.
2. A rigid contract did not allow for flexibility in the application development as priorities and needs changed
3. The contractor outsourced parts of the project to other companies, which hindered oversight capabilities and understanding of the program's needs.

Whether the software was developed in-house or by an outside contractor, participants offered the following software-related tips:

1. Realistically evaluate your state's capabilities and bureaucratic conditions, including funding, human resources, IT sophistication, time, and politics. Since software development needs to be somewhat quick and flexible, states should evaluate whether or not the software can be developed skillfully and quickly enough within their governmental entities. One interviewee's state has a process to make such a determination. The state sends in a team to evaluate the needs of the department and then determine whether they can develop the application with their resources.
2. Budget adequately and realistically. Funds will be needed, not only to develop the software, but to make last-minute changes. One state left 10% of their system budget open to user-suggested and other final changes. This could not have been done with unrealistic budgeting.
3. Stay on top of software technology: Using older software technology will shorten the lifespan and features of your product.
4. Be an integral part in the development of the software. Hold regularly-scheduled meetings with the programming staff and create timelines and detailed system dictionaries to guide the software development process.
5. Provide the software for free. Each one of the state data managers interviewed created a system where local agencies were provided with free software for data entry and submission to the state. Providing free software provides solutions to smaller EMS agencies who have limited budgets and reduces the number of complaints regarding the data system being an "unfunded mandate."

Training

Training involves teaching a provider how to use the computerized data entry system. While none of the participants interviewed found training to be a barrier to the implementation of a system, all stated they put considerable resources into the training process. All interviewees reported traveling to locations around the state to provide training for providers and agencies, though there were a number of different methods employed by the states to provide the trainings. Two of the states used presentation-based lectures, while two other states created mobile computer labs with a notebook computer serving as a virtual EMS records server. Two states noted the benefits of creating an intuitive patient care report system for EMS providers. An intuitive system could mean the logical placement of data entry fields to creating a patient care print out suitable for hospital staff to read. Their goal was to create a system that would make an easy transition from paper to electronic entry. Plus, they wanted to make sure that data fields were related to each other. One state accomplished this by creating multiple tabs and following the SOAP (Subjective, Objective, Assessment, Plan) Notes method to complete the patient care report. One of these states noted, “After 2 ½ hours of training and a couple practice reports, the EMT would be proficient with entering a patient care report.”

Training attendance practices also varied. One state mandated the training for agencies. This state used a “train the trainer” model by requiring that at least one person from an agency to attend who would then be required to train others within their agency. Two states are integrating future trainings into regional workshops to make attendance more convenient for providers. Continuing education credit was offered by one state for the trainings. Several states remarked on the need for continual training due to changes in the software and or changes in staff at the local level.

Overall, the interviewees reported success with their training methods. No participant mentioned that there needed to be significant improvements in their training methods. This seemed to be a result of states using considerable resources to train the EMS providers.

Marketing

Marketing of the EMS data system is important because providers, agencies, and other customers need to understand the importance and benefits of the computerized system. Good marketing will help increase widespread understanding, buy-in, and support for the system so it can be utilized effectively. All of the participants suggested that their marketing activities began very early in the development process, and felt that this was a key to their system’s success. Because the system depends so much on the local EMS providers who enter the data, one interviewee expressed particular importance on marketing to EMS providers, saying that “if agencies and providers want the system to fail, it will happen.” Each of the interviewees suggested that the marketing approach should be directed at informing the providers “what’s in it for them.” This may include how the system will affect patient care and how it will affect provider recruitment and retention of providers.

Each of the states also discussed the importance of building a network of stakeholders to inform and test the new system. These networks should include a diverse group of individuals, including administrators, providers, analysts, policy makers, hospital personnel, and others that will be impacted by the new computerized system. One interviewee state that they chose not to have any people who were negative of the system present during the initial development, whereas another interviewee stressed it was important to have these “naysayers” present.

One state office used newsletters to advertise the new system and address common concerns from providers. The newsletter was published periodically and provided an on-going timeline of the system’s development. Additionally, the newsletter provided answers to questions posed at meetings or through other communications with the EMS office. Providers remained informed about the data system and its progress without little effort. The newsletter demonstrated the state’s commitment to the new system and the EMS providers.

Other marketing suggestions included:

1. Listen to the providers and enhance the system according to their suggestions. You want to make sure this group is satisfied with the process and feeling that their needs are being addressed.
2. Show target audiences the data after it has been submitted. When potential users see the data being used to improve care and system quality, their buy-in increases exponentially.
3. Never stop marketing. You will want to continue helping EMS providers see the importance of the data system on an ongoing basis.

Overall, the lessons learned are to start marketing early and never stop demonstrating to the providers, “what’s in it for them.”

Implementation

Before any new data system can be implemented statewide, the computerized system should go through an extensive testing phase to determine if the system is reliable, efficient, and ready to accept real data. This phase includes testing by state personnel and local users. Several of the participants remarked on the usefulness of having a limited number of agencies test the new system and make suggestions for improvement. These interviewees felt that this process reduced the number of complaints and problems to a manageable amount. One state mentioned that it “reduced the negative perceptions of the system” because they had time to fix problems found during the testing phase before they had a system-wide impact.

Most states incorporated a mandatory compliance date for use of the new system by local EMS agencies. Three states had a mandatory compliance clause but allowed a buffer period between implementation and compliance (a one-year buffer period was used by two states). One state reported only having five agencies not in compliance after the

deadline. The other state, which enforced financial penalties, had 100% compliance. Another state did not have mandatory compliance and did not use any enforcement. It took over three years after the implementation date to get close to 100% compliance.

Transitioning to a new data system can often create a number of data quality problems. There were two different approaches used by states in managing the quality of data. One state tried to ensure data quality by requiring providers to enter their data into a system that employed edit, content, and spelling checks on the report prior to allowing it to be closed. Therefore the quality of the data had to meet certain standards for each report created. Two states, on the other hand, felt it was important to collect as much data as possible and did not have any quality standards after the initial system implementation. These data managers reported that it was more important to get providers comfortable with submitting data and did not place as much emphasis on the quality of the data. After the submission was consistent, they planned to start enforcing the quality of the data. These two states are now in the initial phases of working on improving quality, so the success of this method could not yet be determined.

Overall, these state experiences suggest that the data system implementation process should involve extensive and thorough testing from a variety of users, should incorporate mandatory and enforced compliance dates, and should make efforts to address and improve data quality.

Maintenance

Once a system has been deployed, the maintenance phase begins. Interviewees discussed that fact that maintaining not only involves the assurance of proper system performance, but also includes the need to make additional changes over time, such as improving hardware, fixing bugs, integrating with new systems, and creating enhancements for the existing system.

During the maintenance phase states still need to adapt their data systems to the ever-evolving changes in technology. One state realized a paper-based optical character recognition (OCR) collection method was not working because each paper report needed to be proofed by the data entry clerk to correct unrecognized characters. Because it was not timely or cost effective to proofread over a million incident reports each year, the state changed to a Palm-based solution that bypassed the need for proofreading each incident report. Another state realized the limitations of an entirely web-based form and created a stand-alone application that operates on a tablet PC.

Provider feedback is especially important during the maintenance phase. One state allowed 10% of the programming time for “last-minute” suggestions made by providers. Another state incorporated a method to receive suggestions through the software application, where providers can type in the suggestion or problem and have it sent to the management and programming staff. Both reported that these were effective and important methods for keeping the system useful for providers.

Overall, participants stressed that maintenance should involve ongoing evaluation and enhancements, should address the evolving changes in technology, and should respond to the feedback of providers.

Reporting

Reporting involves turning the collected EMS data into useful information for the state and the providers. Since EMS record systems are relatively new, most states are in the process of developing or refining their reporting methods. Most provide a series of “canned” reports covering areas that had been requested or thought to be desired by agencies. Other reporting methods include the customers calling upon the state to produce individualized reports.

Since this area is relatively young, there are still a number of lessons to be learned and experiences to be shared. This does not mean that a state should wait to begin developing a reporting system. One state remarked, “As soon as you begin planning the development of the system, you need to plan for providing information back to the providers.” Agencies and providers put a lot of effort into filling out data, and they need to know what is in it for them.

Conclusion

Overall, the five data managers interviewed for this document had many suggestions to make their system work. While there were some shared concepts, each state used planning and flexibility in an attempt to create the best system for their system. For each state, the planning began as early as possible in each major area of their data system. Most started by looking at their legislation or rules to ensure they had the authority collect data and provide protections to the data. For aspects like software, hardware, maintenance and implementation, most states reported the results from the participation from stakeholders or end-users of the system. These users of the data system will inevitably lead to the success or demise of the system. The end-user’s input provided guidance in the development and maintenance of the system and provided insight that the personnel at the state level might not have recognized themselves. As for flexibility, each participant reported that applying a “one size fits all” application with “canned” hardware would not work. The interviewees also shared that some concepts, while good in design, might not work as successfully as envisioned. States going forth with the development of their own system will need to understand most of the needs of the providers. This includes:

- The technology available in urban vs. rural vs. frontier regions.
- The best way to create a system for both paid and volunteer providers.
- On-going changes in technology to improve methods to collect and report data.
- The necessity to add resources (human and financial) to ensure the survivability and advancement of the system.

As a final note, there has been a great deal of change in the world of EMS software. Until the National EMS Information System (www.NEMSIS.org) project was created, each agency or commercial software vendor was on their own to create a good product. As a result, there were good, mediocre, and bad products. With the new NHTSA standard and over 50 states and territories agreeing to use the new standard, there will be better products on the market. Additionally, the majority of the commercial EMS software vendors are creating products that utilize the new NHTSA standard. For these vendors, they will have a marketable product that can span across state borders, something that has seldom been done before. State wanting to develop a system should go to the NEMSIS website often and join the listserv to receive periodic updates. There are many more lessons to be learned.