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St. Louis's Emergency Patient Tracking System (EPTS)

SUMMARY

The St. Louis Metropolitan Medical Response System's (SLMMRS) Emergency Patient Tracking System (EPTS) is designed to enhance care at both Mass Casualty Incidents (MCIs) and smaller incidents by providing "load balancing" information (used to efficiently distribute patients among area hospitals) and tracking critically injured individuals, through the use of mobile technology and online databases. EPTS uses barcode wristbands, wireless scanners, and a secure, Web-enabled database to track patients from accidents or disaster sites to hospitals or other locations (e.g., shelters, morgues). The system allows for real-time patient information sharing between first responders and the receiving hospitals to facilitate resource balancing, and provides a centralized source of patient information. It is currently used daily to track all patients transported by St. Louis City emergency medical services to area hospitals.

BACKGROUND

In 1996, the Department of Health and Human Services Office of Emergency Response originated the Metropolitan Medical Response System (MMRS) program to provide US cities with funding to establish a base level of preparedness for MCIs. SLMMRS was established in 1999 to manage these funds received by St. Louis. SLMMRS works to assist existing responder and medical entities by developing, coordinating, and enhancing emergency preparedness systems in the region. This nonprofit business, licensed in Missouri and Illinois, functions as a public-private partnership with 46 hospitals, emergency response organizations, and public health agencies in 12 counties in Missouri and Illinois (approximately 3 million people).

SLMMRS recognized that the previous system of handling mass casualty triage was often slow, cumbersome, and potentially chaotic. A patient's triage status (and injuries) was written by hand and left on a tag with them (hung around their neck with a string). There was no centralized database of patient information to allow authorities to balance resources and prevent hospital overload. Communication of incident and patient information among ambulances, hospitals, and officials was accomplished with a 30-year-old radio system that struggled to cope during a mass casualty incident.

To solve these problems, a SLMMRS task group, formed in early 2002, envisioned an innovative, technical solution that was first suggested by a local emergency room nurse. Using off-the-shelf scanning and tracking technology, similar to that used by FedEx and United Parcel Service, EPTS was quickly developed as a more efficient and effective method of facilitating patient triage and transports. The system was first field tested in May 2002 and, after additional exercises and testing, became operational in May 2003.

GOALS

The program's goal was to develop and implement a patient tracking system to record, prioritize, track and communicate vital information about victims of incidents ranging from small accidents to MCIs throughout the various stages of emergency response—from the emergency scene to the hospital.

DESCRIPTION

Establish Objectives and Requirements

In early 2002, SLMMRS put together a task group to develop objectives and requirements for the project. The initial focus was on mass casualty care. The task group envisioned using wireless Personal Digital Assistants (PDAs) to scan patients' barcode wristbands in order to populate a secure database with patient information and triage status. To equip larger numbers of emergency medical technicians (EMTs), the use of wireless handsets was suggested as an additional option. As the development of the system progressed, SLMMRS also saw within EPTS the potential to track patients involved in routine, daily emergencies, and so the scope of the program was extended to include this capability.

Design Equipment for Simplicity, Flexibility, and Durability

EPTS has three primary components: EPTS field units, central server, and web pages. The EPTS field units collect the patient information at the incident scene and transmit it back to the central database. The units come in three configurations:

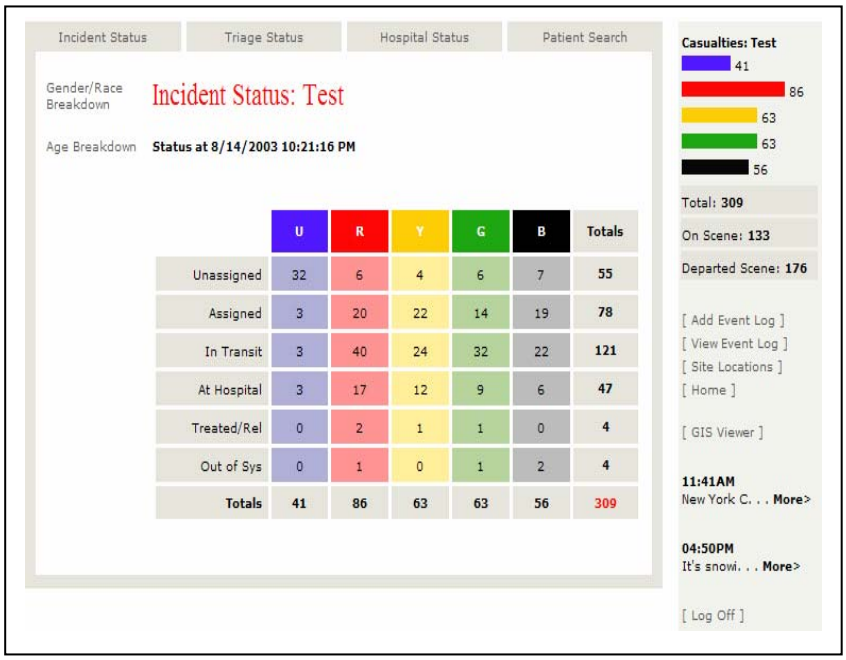
Wireless Handset (EMH)

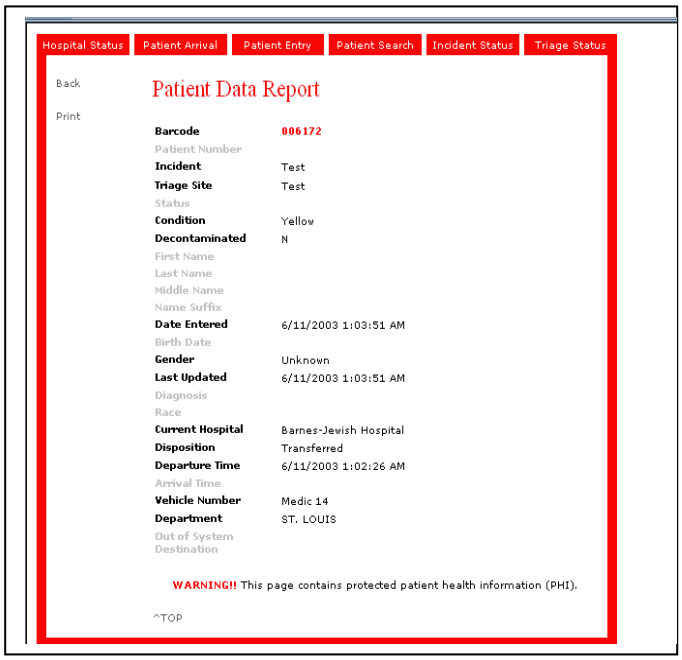
- **EPTS mobile handset (EMH):** The EMH is a wireless phone (Nextel) combined with a barcode scanner (Symbol Technologies). It runs a simple Java application (AirClic) that can record the patient's condition, hospital destination, ID number, and other information. Of the three configurations, the EMH provides the least display and data retrieval capability, but the most flexibility and mobility. It is also the least expensive. This is the primary method used in St. Louis, where every St. Louis City EMT is equipped with a handset.
- **EPTS mobile unit (EMU):** The EMU is a self-contained, portable suite of equipment that includes 4-5 wireless PDAs, a ruggedized wireless laptop, and a wireless access point. It can be taken to the scene and set up quickly to gather patient data and transmit it through a wireless network. In addition to the information that can be entered into the EMHs, the EMUs can also record patients' name, age, sex, race, and other more detailed information. The laptops provide access to the EPTS website from the incident site. Four EMUs were issued to command vehicles in St. Louis.
- **EPTS mobile access (EMA):** The EMA performs the same functions as the EMU. Like the EMU, it contains the wireless PDAs and wireless access point. Instead of containing its own laptop, however, it connects to an existing laptop with wireless Internet access. The EMA is portable or may be permanently installed in an emergency vehicle.

The field units continue to function in the event of a large-scale catastrophe because they do not operate over the public-switched network and because the service provider has the capability to handle a surge. In addition, the field units have a store-and-send function that proves useful when operating in buildings or underground where the signal is weak or non-existent. Portable satellite uplinks are also available if there is an emergency in an area with no direct coverage.

Patient information is uploaded and transmitted to the EPTS server just outside St. Louis. There is also a backup server. Currently, information entered in the EMHs is sent over the wireless provider's data network first to a separate server operated by one of the corporate partners, and then on to the main EPTS server outside of St. Louis. It is expected that this separate server will soon be cut out of the loop to improve security.

The wireless data network is encrypted and secure, and the web applications and database run behind a firewall to prevent unauthorized access. The dedicated and redundant servers host an Oracle database (with 100 percent off-site online backup) where the incident and patient data reside. The servers also provide the web content, which contains patient and resource-tracking information accessible to trusted users by any HTML browser-capable computer on the Internet. The system complies with the Health Insurance Portability and Accountability Act (HIPAA) requirements that patient information be kept confidential. The information can be adapted to any field situation. It can be sorted by incident, triage level, or hospital, and users can easily search for patient data reports.





Web Page Screen Shots

Accelerate Triage and Transport of Victims

When an incident occurs, it is entered in EPTS, usually by the 911 dispatch center, to provide a reference for subsequent patient data entry. Incidents may also be entered by others, such as officials at the scene or SLMMRS personnel. As patients are evacuated and treated by EMTs, a waterproof patient identification wristband, equipped with barcodes, is affixed to each person being treated.

There are two versions of the wristband, one for routine use and another for MCIs. The routine wristband has a primary barcode and a series of barcoded labels for tagging reports, belongings, clothing, evidence, and other items and associating them with the victim. The MCI wristband has twice as many labels and a series of color-coded barcodes that indicate the priority of the patient. The labels utilize the standard 4-color triage status system:

- **GREEN:** Emergency transportation is not considered necessary at this time.
- **YELLOW:** Injuries are serious, transport can be delayed until after "Red" victims.
- **RED:** Victim's condition is critical, and in need of immediate care and transport.
- **BLACK:** Victim is dead and should be moved to the designated morgue area.

MCI Wristband

At the triage site or accident scene, emergency personnel equipped with wireless handsets scan the barcodes and enter into the system relevant and available information about the patient's location, medical condition, and personal records. Currently, everyone in St. Louis who is transported by city EMS is entered into EPTS. When the crisis wristband is used, the patient's triage status is also entered by scanning the barcode for the appropriate color. This information is then instantly available to the operations center, providing the status of casualties from the incident. Individuals are scanned again upon their departure from the scene, and their status is continually updated during transportation to medical facilities.

Provide Data to Relevant, Trusted Users

In addition to the first responders, the system is accessible to:

- **Dispatch Center:** Dispatch personnel can utilize the data to make informed decisions on the dispatch of emergency response units and to identify appropriate destination hospitals and medical facilities given the status of the patients and the hospital resources available.
- **Emergency Operations Center (EOC):** EPTS can help the EOC achieve its goal of emergency management during an MCI. Officials can track the numbers and conditions of casualties on the website. EPTS allows officials to balance and maximize the region's resources effectively.
- **Hospitals:** Hospitals are able to monitor the incident through EPTS and immediately know the number and condition of patients en route to their facility. Appropriate medical staff and equipment can be prepared for their arrival, as patient medical

condition and initial assessments are available through EPTS. All area hospitals have been equipped with wired barcode scanners, and patients are scanned upon arrival. Data continues to be collected until the patient is released, admitted, or transferred to another hospital. Hospitals also provide feedback about capacity to the operations center so that surges can be tracked and managed.

- **Public Information Officers (PIOs):** PIOs will be able to access and obtain appropriate and accurate numbers and details for use in dealing with the public, during and after an incident.

Test the System

EPTS went through an extensive testing process before it became operational. It was first field tested during a Weapon of Mass Destruction (WMD) incident exercise conducted by the St. Louis City and County emergency response command in May 2002. The exercise simulated a chemical attack with over 100 mock victims. Multiple county and municipal police and fire departments, a mobile command center, a hazardous material team, a bomb unit, and an environmental unit responded to the mock incident. EPTS was deployed at the exercise scene. Although patients were transported to eight local hospitals, because this was the system's first trial, EPTS was only used at St. Louis Children's Hospital. Overall, the system was highly praised.

EPTS was demonstrated again in July 2002 at a mock airplane crash at St. Louis's Lambert International Airport. EPTS gathered and shared information about patients with the medical officer and the airline's command center within 30 minutes. Twenty crash victims were tracked during a simulated transport to three area hospitals. The airline used the information to crosscheck the passenger manifest and to inform victims' family members.

Finally, EPTS logged in more than 600 patients through nine fire departments and five hospitals during various tests and exercises conducted in March and April 2003. The final exercise prior to launch occurred on April 30, 2003, when 60 patients from multiple sites were taken to four hospitals in St. Louis. The system went live on May 1, 2003.

Start Slowly and Progressively Enhance

St. Louis City and County announced the EPTS Pilot Program on August 5, 2002. Participants in the Pilot Program included City and County fire departments, EMS services, and hospitals. Phase 1 of the Pilot Program provided select deployment and operational use, so that the region could develop experience and confidence in using the system in less demanding scenarios than a disaster. Phase 1's stated goals were to:

- Implement an operational patient tracking system in the field.
- Test use of patient tracking to evaluate operational effectiveness and make improvements.
- Enhance operational readiness through routine, daily use.
- Identify needs for broader deployment and enhancements for Phase 2.

Phase 1 resulted in the equipping of all St. Louis City EMTs with handsets and all City hospitals with EPTS accounts.

The program is currently in Phase 2, which includes the addition of three local counties: St. Louis County, St. Charles County, and St. Clair County. These counties should be integrated by May 2004. In addition, SLMMRS is issuing EPTS equipment to the city's largest private ambulance company. Although the company will have to buy the equipment,

there is an incentive to do so as the system will improve the efficiency of these private ambulances, which depend on patient volume.

Phase 2 will also include several enhancements to the system. Most notably, the handsets have Global Positioning System (GPS) chips that allow the system to track their location on a Geographic Information System (GIS) display, using a MapQuest-style map or a stored, digital, satellite image of the region. SLMMRS does not currently use the mapping function, but it has been identified as a Phase 2 enhancement and should be operational by April 2004. Another feature to be added in Phase 2 is the ability to store patient insurance information.

Any further enhancements will depend on the requirements of the users. Any additional phase will most likely include expansion of the system throughout the 10-county area of eastern Missouri and western Illinois, or even statewide in Missouri.

REQUIREMENTS

Keys to Success

EPTS effectively fills the stated need for this type of system. Its most important feature is its simplicity and intuitive nature. The system is easy to operate and requires little training. Another attractive quality is its low startup and maintenance cost. The key to the future success of EPTS is diligent implementation and use by EMTs. The system relies on the ability and thoroughness of EMTs in properly scanning the correct barcode for all patients. The fact that the system is being used daily for all incidents will ensure that its use becomes second nature for first responders, who will, therefore, be better prepared for a mass-casualty incident.

Resources

Phase 1 of the system, including development and implementation, cost $250,000. The St. Louis Mayor's office and the St. Louis County Executive provided $125,000 each for these initial costs. Additional funding for follow-on costs came from several different sources, including the Department of Homeland Security, the Department of Health and Human Services, and donations from hospitals ($5,000 annually). SLMMRS can accept funds from all these parties because it is a non-profit business, has a charitable foundation, and can act as a quasi-government organization. The maintenance and operating costs of the system are low because the wireless service provider handles all the network issues, while users simply have to purchase the handsets ($100 each) and pay the monthly service plan fees, which amount to approximately $300 per handset per year.

Training

The system's simplicity eliminates the need for large-scale training. It takes about ten minutes to train personnel to use the wireless handsets, and about five minutes to learn how to navigate the EPTS website.

Links

- St. Louis Metropolitan Medical Response System: http://www.slmmrs.org, http://www.stl-starrs.org
- EPTS Overview: http://www.raystl.com/eptsinfo/

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