

Prehospital to Emergency Department Data Exchange - a SAFR Transition of Care

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Project Overview

Electronic health records and the digital revolution are dramatically changing the way healthcare is delivered in this country. In fact, over the past decade, the Federal government, through the Office of the National Coordinator for Health Information Technology (ONC) has led major initiatives to foster electronic record adoption at hospitals and clinics across the country, including all 6 UC medical centers. Because electronic patient data can be shared among providers, physicians and nurses, it has the potential to vastly improve care, reduce errors, and enhance patient safety across the continuum of care. Efforts today focus on creating Health Information Exchanges (HIEs) in local regions and across larger areas (such as all of UC medical center sites), so that critical information such as medications, allergies, disease conditions are known by providers whenever caring for patients¹.

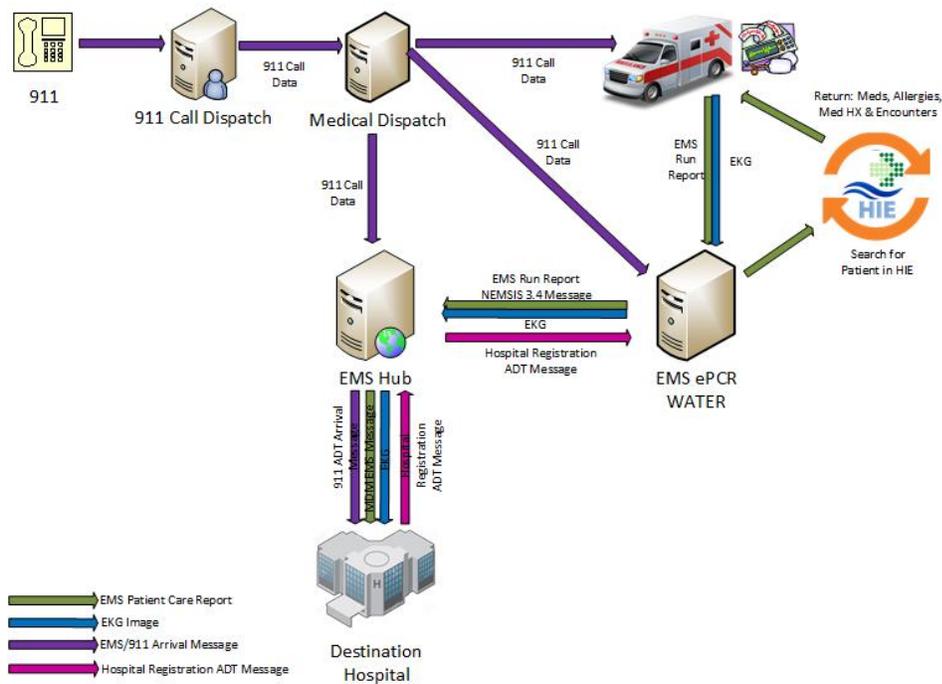
One area that remains unconnected from this growing exchange of patient data is the pre-hospital Emergency Medical Services (EMS) setting. EMS is an integral part of the health care system - actions taken by EMS providers at the scene and en-route to the hospital affect outcomes, quality of care and patient satisfaction. Paramedics and ambulances often do not have access to electronic patient data creating gaps of care. Just as importantly given the potential acuity of presentation, information from paramedics in the field may not be available in a timely manner for providers in the Emergency Department (ED) and trauma center receiving these patients. Pre-hospital care agencies are now just beginning to create electronic records from the field, but these records cannot exchange information with hospital systems and vice-versa. A robust EMS- hospital health information exchange relies on a bi-directional flow of data covering all aspects of the patient care continuum including dispatch, field care, transport, emergency department, hospital admission, hospital discharge, and practitioner care. Such an exchange would allow providers in the field to appropriately access and securely share a patient's vital medical information electronically to improve medical care and quality, and reduce errors with the following features:²

- Search a patient's health record for problems, medications, allergies, and end of life decisions to enhance clinical decision making in the field
- Alert the receiving hospital about the patient's status directly onto a dashboard in the emergency department to provide decision support
- File the emergency medical services patient care report data directly into the patient's electronic health record for a better longitudinal patient record
- Reconcile the electronic health record information including diagnoses and disposition back into the EMS patient care report for use in improving the EMS system

Based on this premise, we proposed and developed the SAFR EMS Integration system that was funded by a grant from the State EMS agency (Cal EMSA) in partnership with the federal ONC creating an innovative, first-of-its-kind real-time patient data exchange based on existing data standards between EMS providers and hospitals EDs and trauma centers to improve care for patients in the field and the acute care setting. The project was a collaboration between UC San Diego Health (hospital partner), City of San Diego EMS agency (prehospital partner), County of San Diego Public Health Agency (local governing body), and San Diego Health Connect (non-profit healthcare organization).

The Solution and Innovation

Our solution required the collaboration of all parties to provide an environment of change management for the paramedics as well as receiving hospitals. Under the proposed system, upon arriving at a scene, the paramedics would search the HIE for information on the patient. Receiving this information would provide the paramedics with the patient's known and documented medical history including important information such as up-to-date medications and allergies. This information along with their assessment would then be transmitted in real-time to the destination hospital prior to the patient's arrival. With this knowledge, hospital providers would have greater knowledge of a patient potentially arriving to the ED or trauma center in acute extremis and would allow better preparation particularly in regards to the needed resources for the arriving patient. Once the patient arrived, the prehospital record and ED encounter are merged such that the 911 field medical records would be a part of the patients electronic medical record at the hospital. This entire information flow and exchange would be initiated at the time of the initial 911 call to formal handoff of care at the hospital.



To create this flow with information, numerous integration teams worked together to create and validate the flow of information. These integration teams included on the prehospital side with San Diego City EMS and their electronic record vendor, WATER; the County of San Diego EMS agency who track all dispatch and responses; the regional health care HIE, San Diego Health

Connect (SDHC) for message translation and exchange (for example, from the federal EMS standardized NEMSIS 3.4 format to the hospital standard HL-7 MDM messages). SDHC also had to create a unique HL-7 arrival message to export to the arriving hospital. This unique message had to contain elements of the 911 call, generated running number and a temporary ID number to be consumed by the EMR. The receiving hospital had able to consume this message and return an updated registration message to the EMS agency.

The Impact

This innovation has allowed a new workflow in EMS and hospitals that has improved the quality of patient care by allowing all providers (pre-hospital and hospital) access to up-to-date medical information not previously available. Example of this or trauma patient's that frequently arrive from motor vehicle accidents or other major traumas that may not be able to speak or give a history to the provider. Key information such as anticoagulants medications (like warfarin), are critical when managing a patient with an acute head injury who cannot provide this information themselves. Other examples include, with chest pain who has evidence of a heart attack on pre-hospital ECG. Previously, this image would not be available for hospital cardiologist to make a decision regarding whether to activate the emergency catheterization unit. Time is critical in this circumstance in terms of opening the clogged coronary artery under 60 minutes. However, activating for patients who do not meet criteria on ECG (false positives) can lead to unnecessary expense. Under the data exchange with pre-hospital providers, we have been able to transmit the ECG from the field to the hospital emergency physicians and cardiologists prior to the patient arrival significant reducing false positives from 33% to 0% with improved timeliness of definitive care for those patients who are suffering a heart attack in the field.³

In simple terms, our hospital staff now know when a patient is arriving from the field, their basic medical information, somewhat akin to the saying “the data is here, where’s the patient?” Providers now receive real-time vital signs updates, field medical information, and EKG images.

Measures of Success

Project success was measured by the quantity and quality of information transitioned from EMS to UCSD EMR. To send data successfully (UCSD) both the incident number (EMS unique identifier) and the destination hospital had to be entered to trigger the send message. The send message was a simple customized ADT message that included the EMS ambulance demographics, patient name, complaint, vitals and quick narrative. Once the message was received additional data was sent in near real-time as the paramedic completed a field or page on their application. A final full report is sent with a hand-off time stamp in the EMS system.

To date, we have received 220 transaction messages from SD City EMS to UCSD's two emergency departments, Hillcrest and La Jolla. Since we are only 4 weeks into deployment we are still evaluating length of stay measures, morbidity and mortality outcomes for both Trauma and Emergency Department patients, ancillary test ordering patterns and patterns of frequent utilizers of the 911. Messages included for each transaction were an arriving ADT message, and MDM EMS narrative message, attached EKG image and Full EMS report(pdf).

The hospital information management team estimated a cost-saving of not having to prep & scan prehospital EMS reports and revenue reversals due to late/missing EMS documentation of nearly \$230,000 annually.

More importantly, the project has improved emergency care and saved lives. On May 17, 2017, 911 was called for a middle-aged man with left shoulder pain. Paramedics found the patient pale, cool, diaphoretic and hypotensive with a blood pressure of 60/40 mmHg. An ECG in the field demonstrated a potential heart attack (ST elevation myocardial infarction or STEMI). Through SAFR, this information including the ECG was sent to UCSD-Hillcrest medical center and was in the hands of the Emergency physician and cardiologist *BEFORE* the patient arrived. Staff were prepared and pre-activated personnel such that the patient was in the cardiac catheterization unit *within 16 minutes* of arrival! The patient was found to have a severe coronary artery thrombosis, underwent angioplasty and stenting at that time, and is now recovering and doing well as of this writing.

The Collaborative Teams

This project collaboration would not have been successful without every member of the team participating. Each team is broken up below with their accomplishments:

UC San Diego Health Department of Emergency Medicine

The entire department participated in this project by providing both leadership roles and success in implementation. Dr. Theodore Chan, Department Chair provided project oversight & strategy steering. Dr. Gary Vilke, Service Line Chief provided leadership and training expertise as well as QA. Dr. James Killeen, MD Informaticist and Project Lead coordinated project goals and timelines between UC San Diego Health IS Department, SDHC, and SD City EMS Agency. Christopher Kahn, MD Base Station Director provided MICN QA regarding data transfer. Dr. Edward Castillo provided data analysis and evaluation verification.

UC San Diego Health Information Services

Project and Physician leads included James Killeen, MD, Brian Clay, MD CMIO and Christopher Longhurst, MD CIO. Alexander Winter, Project Manager kept tasks and projects on time. Jeanne Sparks Director of Integration Services along with her team members (Srinivas Mani, Eric Scott and Jeffery Bennett) provided all of the integration design for the custom inbound EMS ADT Message as well as the MDM (EMS Report) message. Robert Powell, lead ASAP Analyst provided the data display outline for providers to read to read the EMS Report.

San Diego Health Connect

The San Diego Health Connect (SDHC) team was led by their executive director, Daniel Chavez, VP of operations Deborah Kennedy, CMO James Killeen MD and Mark Branning Project Manager designed SAFR and interfaced with UCSD, SD City EMS and UC San Diego Health. SDHC's lead analyst Derrick Callanan designed along with UCSD the inbound ADT message as well as MDM EMS Report. He also worked along SD City EMS and their application vendor WATER to receive real-time ePCR data in a standard NEMESIS 3.4 standard message which was then translated into HL-7 for inbound hospital messaging.

SD City EMS Agency

SD City EMS and AMR paramedic training was provided by Dr. James Dunford and Ruth Ann McGuire. Application evaluation and QA was provided by Ruth Ann McGuire and Christopher Kahn, MD. Application upgrades and NEMESIS 3.4 certification was provided by WATER's CEO John Pringle and James Stewart.

SD County EMS Agency

Drs. Nick Yphantides and Sayone Thihalolipavan provided quality oversight of the project and communication with the State EMS Agency Director Daniel Smiley. Robert Wester EMS IS Analyst provided data oversight and QA. Ellie Regan-Smith, Barbara Stepanski and Nicolas Yanischeff provided QA and policy support.

Project Timeline

Our project was initiated in May of 2016 after receiving the award from the Ca State EMS Agency. The goal of the project was to create, establish and educate both prehospital community and emergency department teams on the value of the new workflow and information being provided. Project team members initially met in June and the *Discovery Phase* was started over the next 3 months. The *Build and Test Phase* occurred over the next 5 months. During the last 2 months of the test phase training started with 740 paramedics from the City of San Diego EMS agency. Emergency department teams at both UC San Diego Health hospitals located at Hillcrest and La Jolla. *Go live* occurred on March 20. Revisions to the prehospital software were made in mid-April. Current software has been in production since.

The Technology

The technology used for this project included off-the-shelf currently in use electronic patient care record for prehospital care. The standardized NEMESIS 3.4 message along with an EKG image was sent to SDHC. This standard message was converted into an HL-7 message and sent to the receiving hospital for consumption into the Epic EMR. SDHC leveraged the 911 data to create a custom HL-7 ADT message for arriving patient's. Full hospital registration ADT message from epic was returned to the EMS agency via SDHC.

