IHE 2012-2013 Call for Proposals

IHE Brief Work Item Proposal

1. Proposed Work Item: Pre-hospital Resting ECG Workflow

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Domain: Cardiology, coordinating with Patient Care Coordination and IT Infrastructure

2. The Problem

Cardiovascular disease causes approximately 17 million deaths throughout the world each year.[i] In acute STEMI (ST-Elevation Myocardial Infarction), patient survival is directly correlated with the rapidity of intervention to restore blood flow to the heart. The American Heart Association and the American College of Cardiology recommend that specific intervention, including emergency fibrinolysis or (where available) cardiac catheterization with primary percutaneous coronary intervention (PCI), should occur as quickly as possible from the point of initial medical contact. The recommended "door-to-needle" (first medical contact to administration of fibrinolysis) time is less than 30 minutes, while the recommended "door-to-balloon" (first medical contact to first interventional catheterization device) time is less than 90 minutes. "Both primary percutaneous coronary intervention and fibrinolysis are well-recognized treatments for STEMI, and benefits are maximized when treatment occurs early."[ii] When acute STEMI is the diagnosis, minutes translate into survival.

The ideal scenario includes diagnosis of myocardial infarction at the scene of first medical contact, availability for additional consultation by non-EMS personnel, transfer of the patient to the most appropriate hospital (which may not be the closest hospital), activation of the appropriate care teams prior to patient arrival, and end-to-end documentation. Early transmission of a pre-hospital 12-lead electrocardiogram is critical to the process; receipt of 12-lead ECG data by the admitting hospital prior to the patient's arrival can be used to trigger the mobilization of resources such as an emergency cardiac catheterization team. In some cases, it may enable patients to bypass the Emergency Department altogether, reducing further the time to reperfusion.

The current state-of-the-art is to have disparate solutions in these environments, including the ECG devices in the ambulance, the systems used to receive and display the ECGs in the

ED, and the ECG and EHR systems where long-term storage of the ECGs could be expected to occur as part of a patient's health record. To date, only limited multi-vendor interoperability has been achieved through business partnerships and proprietary data exchange methods.

Many emergency medical services are operated by organizations separate from the hospitals they serve. An IHE profile can specify how to achieve multi-vendor interoperability and enable EMS to source ECG equipment independently of the IT systems used by the hospitals.

3. Key Use Case

John Jones feels unusual chest pain while at home, and he calls 9-1-1. Ambulance 5 from the county Emergency Medical Services (EMS) is dispatched to John's home. When the ambulance arrives, they assess John's symptoms and take John's vital signs. They determine a 12-lead ECG should be obtained to evaluate for a possible acute myocardial infarction. The name "Jones" is entered into the ECG device and an ECG is acquired. It is interpreted by the on-board computer as "suggests ischemia" but is not diagnostic of an acute STEMI. The Emergency Medical Technician (EMT) decides to send the ECG to a local emergency department for consultation and further instructions. The EMT asks John if he'd prefer to be taken to St. Joseph's Hospital or Memorial Hospital for further care, and John chooses Memorial. The EMT transmits the ECG to Memorial and then calls their Emergency Department (ED) for further instructions.

The physician on call finds the ECG from Ambulance 5 with "Jones" as the patient name. He looks at the ECG and is uncertain about the diagnosis. He calls the cardiologist on call who requests that the ECG be sent to her smartphone. The ECG is transmitted and the cardiologist reviews the ECG while in the check-out line at the grocery store. She determines John is likely having an acute posterior STEMI. The ED physician gives instructions to the EMT regarding immediate care measures and to transport the patient straightaway to Memorial Hospital. The ED physician also activates the on-call cardiac catheterization team to come in for an emergency STEMI case. Before John arrives, additional demographics are forwarded from EMS to Memorial to properly register John in the hospital's information system. When EMS arrives with John, they take him directly to the cath lab for further diagnosis and treatment. The cath team looks at John's pre-hospital ECG(s) and John's current vitals as they care for him.

John's pre-hospital ECG(s) are updated electronically with the rest of his demographic information and stored in the ECG management system of Memorial Hospital. Access to the ECG is made available through the Memorial Hospital EHR system. Finally, EMS reports information about the case, including the ECG device's automatic interpretation and image of the waveforms, to the state's EMS database via the NEMSIS reporting standard.

Key interoperability issues highlighted by this use case include:

- Entering limited demographics on the ECG device.
- Transmission of the ECG to a hospital of the patient's choice.
- Emergency department receiving the ECG and viewing the correct ECG.
- Forwarding the ECG to a mobile device and making a STEMI call.
- Viewing the ECG in the cath lab.

- Reconciling the ECG with the patient's full demographics, and storing the ECG in an ECG management system.
- Viewing of the ECG image and report in an EHR system.
- Reporting data to the state via NEMSIS.

4. Standards & Systems

Systems possibly involved include:

- ECG acquisition devices, including electrocardiographs, monitors, and defibrillators.
- EMS charting systems.
- RF data transmission systems.
- Hospital IT systems, including those used by the emergency department, cardiology, and the hospital.
- Mobile (e.g., smartphone) devices.
- Government-sponsored EMS databases.

Existing standards and IHE profiles that may be relevant:

- HL7 – ADT, OBX, NEMSIS
- DICOM – General ECG Waveform, PDF
- IEEE
- IHE – Cardiology Resting ECG Workflow (REWF), Cardiology Retrieve ECG for Display (ECG), PCC Emergency Department Referral (EDR), ITI Consistent Time (CT), ITI Cross-enterprise and Cross-community profiles
- Secure data transmission standards.

5. Discussion

Device and IT purchasing decisions often occur at different times and by different organizations. A new IHE profile, or extensions to existing profiles, would facilitate multi-vendor interoperability for the acquisition, communication, viewing, interpretation, storage, and retrieval of pre-hospital ECGs.

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[i] World Health Organization

[ii] JAMA, June 2, 2010 – Vol. 303, No. 21