



Integrating the Healthcare Enterprise White Paper

Integration Profiles for Stress Testing

This white paper provides information regarding several IHE Cardiology Profiles for cardiac stress testing. The technical specification of some of these Profiles is complete, while others are currently being developed by the IHE Cardiology Committees; therefore, some of the capabilities described in this paper are beyond the scope of Year 2 (2006) IHE demonstrations.

Problem Statement:

Cardiac stress tests exhibit a variety of forms, with stress induced by treadmill, ergometer, or pharmacologically, and assessment of cardiac function made from ECGs and/or echo or nuclear imaging. If there are both ECG and imaging components to the study, they may be interpreted separately by different cardiologists.

Managing the ordering and performance of these varieties of stress tests is currently a process with many manual steps and duplication of effort. Electronic handling of orders, when it exists at all, rarely handles both the stress ECG equipment and the stress imaging equipment, requiring double entry of patient demographic data. There are currently few workstations that can integrate both ECG data and imaging data for a consolidated view of the entire study for report preparation, requiring different side-by-side workstations, and duplicated navigation to the patient's data on each. If there are separate ECG and imaging

reports, they are often handled by two different systems with no link between them.

The seamless integration of the stress testing equipment into the departmental and hospital information workflow will result in elimination of useless duplication of work, reduction of errors (wrong patient data entered), and integration of all aspects of the results into the patient's electronic health care record, from where the complete data set can be reviewed. It will significantly improve the quality of care and the efficiency of the cardiologists and the stress testing laboratory.

Use Cases:

In medicine today, a cardiac stress test is ordered by a physician, either inside the performing institution, or by referral from outside the institution. The study is scheduled for the patient; the exam room, personnel and equipment are reserved, and radiopharmaceuticals are ordered if nuclear imaging is indicated.

The study is performed by a physician or trained professional (such as a nurse, physician's assistant, or trained exercise technician). If there is a nuclear imaging component to the study, administration of the radiopharmaceuticals must be documented, including technical parameters of the dose. The patient is subjected to increasing stages (levels) of exercise on the treadmill, and the equipment collects ECG waveforms, patient performance (symptoms, heart rate, blood pressure), and equipment settings (speed, elevation, duration). A typical exercise examination goes through progressive stages until a clinical end-point is reached, such as achieving a pre-determined heart rate, or emergence of symptoms preventing the patient from continuing (arrhythmia, hypotension, angina, fatigue, etc.). A procedure may be complete, even though fewer than the full number of planned stages have been acquired. The stress study is interpreted by a physician, and the results reported.

The exercise study is interpreted by a cardiologist, and the results reported. If there is an imaging component to the study, it may be interpreted separately by a different physician.

There are several common exceptions to the workflow. As an example, a patient is scheduled for a regular stress test (without imaging). He arrives at the laboratory and is identified as having an abnormal electrocardiogram precluding the use of the electrocardiogram for the interpretation of the test, and rendering a regular stress ECG test of no diagnostic value. The performing laboratory may instead perform an imaging stress test on the patient, requiring a new replacement order for the revised examination, and generally reconciling the change in ordered test type across the devices and systems.

IHE Profiles for the Stress Lab:

IHE has defined several Integration Profiles that can help manage the diverse requirements of the Stress lab.

- The ***Echocardiography Workflow Profile (ECHO)*** provides for end-to-end workflow, from patient registration and order entry, scheduling, and test performance with real-time in-progress status. Under this Profile, all systems automatically use the same patient and procedure identifiers without data re-entry, and store their data to a single archive in non-proprietary formats. The ***Stress Echo Option*** provides standard labeling of image view and protocol stage (baseline, pre-, mid-, post-stress, and recovery) so that the images are consistently displayed on any IHE compatible workstation, relieving the sonographer or cardiologist of spending time rearranging image sets.
- The ***Evidence Documents Profile (ED)*** defines standard templates of image-based measurement data to facilitate cross-vendor exchange, longitudinal patient care, and extraction of critical parameters for outcomes research. In particular, the ***Echo Option*** specifies a standard template for stress echo measurements.
- The ***Scheduled Workflow Profile (SWF)*** provides the same end-to-end workflow for nuclear cardiology modalities as the Echo Profile. The associated ***Nuclear Medicine Profile (NM) Cardiology Option*** (in development) provides standard formats and displays of nuclear stress studies in accordance with ACC guidelines.
- Now under development are the ***Orders and Observations Profile (OOW)*** and its associated ***Stress Content Profile***. These profiles bring the coordinated workflow to the stress ECG systems, allowing a single order and schedule to be applied to both ECG and imaging, and maintaining a link between them, even though the ECG equipment uses the HL7 standard messaging protocol and the imaging equipment uses the DICOM protocol. The Stress Content Profile defines a standard nomenclature to be used for stress ECG measurements, allowing follow-on data re-use for longitudinal or outcomes studies.
- The ***Retrieve ECG for Display Profile (ECG)*** defines a web-based interface for any clinical workstation to retrieve and display ECG tracings, including stress ECGs, from an ECG Management system.
- The ***Displayable Reports Profile (DRPT)*** defines a standards-based mechanism for submitting PDF-formatted reports to an Electronic Health Record system, including report signature, distribution, archive, and retrieval.

Profile Benefits:

The IHE Cardiology Profiles for stress testing synchronize and harmonize patient, order, and schedule identifying information across all aspects of the test, and fully integrate stress testing equipment into the workflow of the hospital or office. This enables the technician to obtain the necessary demographic information from a schedule and order system prior to starting the test, to increase efficiency and reduce data entry errors. At the completion of the test, the profiles facilitate the storage of the data for review/interpretation by a physician or other caregivers at any clinical workstation in the facility. This allows other clinicians to access and review the data set as a consistent whole at the next point of care.

These Profiles also increase standardization of data formats, regardless of equipment manufacturer or design platform. This will allow clinicians and facility management to focus on features and cost-benefit with the understanding that they need not trade-off clinical utility and benefit for the sake of connectivity.

The Profiles provides the following specific benefits to cardiologists, administrators, and IT staff:

- Allow cardiologists to review stress testing data and results at all points of care.
- Allow the management of stress results, both ECG and imaging, as a single coordinated data set.
- Allow the simple display of stress test results and tracings on a variety of systems, including "generic" computers allowing the cardiologist to review tracings acquired and interpreted elsewhere.
- Reduce the need for task- or modality-specific workstations in the patient care areas to review, collate and correlate clinical information.
- Eliminate duplicate patient demographic data re-entry into multiple systems.
- Simplify the purchasing process for cardiology administrators by referencing IHE Profiles for connectivity technical requirements.
- Avoid the implementation and maintenance costs for "one-off" integration interfaces to each type of device, and make integration of stress systems to facility networks, and to reporting and review stations, routine.
- Ensure proper functioning of a multi-vendor environment, allowing equipment decisions to be based on the best available technology, rather than being limited to the current equipment supplier.
- Reducing "switching costs" when new equipment is purchased

How the Profiles actually work:

IHE defines “actors” which are responsible for performing certain roles. Vendor products in the marketplace often implement more than one IHE actor.

Some key Actors in the stress-related Integration Profiles, and examples of products which might implement them, are:

- Order Placer, for example a Hospital Information System, or Computerized Physician Order Entry (CPOE) System
- Departmental System Scheduler/Order Filler, such as a Cardiology Departmental Information System
- Acquisition Modality, such as Echo or NM
- Observation Creator, for example a Stress ECG system
- Evidence Creator, such as an application that performs measurements on a modality or workstation
- Image Manager/Archive, such as a PACS system
- Observation Repository, for example, an Electronic Health Record system

See the white papers describing the Echocardiography Workflow Profile and the Nuclear Medicine Profile for further details.

Summary:

In summary, the IHE Cardiology Profiles allow integration of the stress testing data and interpretation into the cardiology workflow. The data will be acquired more accurately due to interfaces that provide consistent demographic information. Procedure results, including tracings, will use standard nomenclatures and will be available widely. This availability will allow the clinician access to the data at the point of care or interpretation of other relevant data, such as imaging results, laboratory results and other essential clinical information.

IHE Integration Profiles standardize the exchange of healthcare information, increase clinician efficiency, accelerate the adoption of the EHR, and enhance patient care, safety, savings and satisfaction.

Consider joining the “IHE Cardiology Users’ Group” which holds web seminars, teleconferences, and other educational opportunities on an informal basis. For more information, send an email to ihe@acc.org.

It is worth your time to learn more about IHE and it is time to demand IHE Profiles from your vendors. See www.ihe.net or www.acc.org/ihe.htm.