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OpenECG: Promoting Interoperability Through the Consistent Implementation of the SCP-ECG Standard in Electrocardiography

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Abstract and objective

The OpenECG Network (www.openecg.net) has been created to promote interoperability in electrocardiography with tutorials, specifications, open source tools, data sets, converters, and interoperability testing. ECG vendors, members of professional organizations, researchers, and other stakeholders participate in the OpenECG network to exchange views and receive assistance in implementation. In 2006, members are more than 700 individuals from 58 countries. A specific focus area for OpenECG that concerns diagnostic quality resting electrocardiograms (ECGs) is SCP-ECG, the European standard (EN1064:2005). An online interoperability testing service assists members in consistently implementing SCP-ECG and effortlessly integrating electrocardiographs with eHealth systems. OpenECG is a case of best practice in interoperability that should be followed by medical devices and sensors for effective personalized health monitoring.

Keywords:

interoperability, standards, telemedicine, eHealth services, medical devices, electrocardiography

Methodology

Electrocardiography is the most frequently applied non-invasive examination for early detection of heart disease, a leading cause of morbidity and mortality in western countries. It is estimated that more than 100 million ECGs are recorded annually in Western Europe. The ECG allows early detection and follow-up of heart disease, but today the operation of most ECG devices is still based on proprietary protocols and file formats.

SCP-ECG is a standard communication protocol that specifies the interchange format and a messaging procedure for ECG equipment-to-computer communication and for retrieval of ECG records from the computer to the ECG equipment (if needed). Since March 2005, SCP-ECG (EN1064:2005) is the European standard for high quality diagnostic ECG exchange and if consistently implemented ensures interoperability. Nevertheless, it is rather difficult for integrators to implement SCP-ECG correctly and there are variations in implementations, which can be a barrier to interoperability. Although a number of ECG device manufacturers and integrators have implemented the SCP-ECG standard, most implementations are not fully accurate. This is due partly to misconceptions and partly to the lack of widely publicized conformance levels and IHE-like integration statements that exist for modalities in radiology.

In 2003, OpenECG established an online conformance testing service to support the OpenECG community at large in implementing interoperable eHealth systems with SCP-ECG support. A member may submit an ECG file in an alleged SCP-ECG format and receive a list of errors and warnings. If no errors are detected, the submitter may request a certificate that is granted after thorough manual review of the file.

Results

The SCP-ECG conformance testing service has been used extensively by members and in many occasions an interoperable solution was achieved with support from the help desk. In the period 2003-2006, more than 1700 ECGs were submitted for conformance testing by members in more than 20 counties worldwide. Leading is Italy with 11 members, who have submitted 37.3% of the tests. After Italy, most ECGs have been submitted by Greece (17.74%) and Hungary (11.89%). ECG devices and eHealth services have been tested, improved, and validated using online tools and support from the OpenECG helpdesk. In 2005, a web service variant of the conformance testing service was integrated to the ECG viewer that won the first prize in the OpenECG programming contest. After certain limitations of the software were identified and amended, a new version of the ECG viewer was released and is currently available at the OpenECG open source repository.

Conclusions

The OpenECG network promotes best practice in interoperability for ECGs. Innovative eHealth services capable of managing personal wellness profiles call for plug-interoperability of medical devices, which is an issue of patient safety, key to advancing quality and cultivating consumer trust in the next generation of ambient intelligent working and living environments.