Current Status of e-Health Applications in Emerging Home Network Technology and Need of its Standardizations

Yun Sik Kwak
Kyungpook Nat’l Univ Sch Med, Daegu, Korea
ISO/TC 215, Health Informatics

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U-Health Systems
Rationale

Life Saver :
Right Information at Anytime and Anyplace and Any Device and Any Line

(Ubiquitous : u-Health)
Benefits of Health Informatics

Level of Benefits

- Citizen
- Society
- Physician
- Clinic
- Hospital

Society/Public (Empower !)
Health Care Models

[Diagram showing health care models across the life span with labels for Diabetes Case, Wellness Management, CHF, and Illness Management. Cited from SK Mun]
U-Health : Home Health Monitoring

- Chronic disease management
  - High Blood Pressure
  - Diabetes Mellitus
  - Chronic Heart Disease
  - Pre-natal Care
  - Hypercholesterolemia
  - Drug Dispensing Management System
  - Emergency Alert
U-Health : Home Health Monitoring (2)

- Hospital Based Home Care
- Physical Fitness
  - Body Strength Management
  - Body Weight Control
  - Health Monitoring Screenings
  - Child Development Monitoring
  - Prognosis Monitoring
  - Emergency Alert
Customer Management Program (Customer Focused)

- Birthday Card with Health Reminder
- Test Results with its Interpretations
- Vaccination Reminder
- Medication Directives and Drug Information
- Appointment Reminder
- Seasonal Disease Information and Epidemic Alerts
Devices for u-Health

- Portable Bio-sensor Analyzers
- ECG
- Blood Pressure Measuring Devices
- Vital Sign check
- Fetal Heart Sound Monitor
- Exercise Monitoring Device
- Body Weight & Height Measuring Dev.
- Wearables
- Diet Analyzing Device
- PDA, Mobile phone, etc
Role of Technology

- Set of tools to be used
- Who should use it?
- What is the cost of it’s use?
- Whose cost is it?
- How can a stand alone technology be integrated into routine healthcare system?
- There are many disconnects.

[Cited from SK Mun]
Role of Technology

- Quality
- Access
- Cost

[Cited from SK Mun]
Balancing and Competing
Where does your technology fit?

Charge
More
Spend
Less

Providers
Physicians
Hospitals
Suppliers

Payers
Insurance
Government
Patients

Patients
More
Benefits

[Cited from SK Mun]
In Closing

- Healthcare is a highly complex business of multiple competing processes
- Stand alone technology will not be useful
- Technology insertion requires proper business model
- Who will pay for the use of technology?

[Cited from SK Mun]
Business Model for Home Health Monitoring
Scenario

- Communicate patients directly to care provider - do not work well
- Citizens (Patients) initiate service via business service center; service center screens results of health monitoring; in case clinical care is needed, service center will then connect patients to care providers.
International Telecommunication Union

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Home Health Monitoring

Bio Measurement
Health G/W
Zigbee
Home G/W

Service Feedback
Home G/W
Zigbee Health indicator
Emergency Message

Home Server
Alarm
Dig Frame
Danger Alarm

Bio Data Trans.
Alarm & Home Appliance Con.
CDMA/PSTN

Zigbee Mgt
HC Device Authentication
Health Data Communication
HC Feedback Module
Healthcare Device Mgt

HC Service Center
Content DB
Body Comp
Interview
Exercise
Diet

CDSS (Sleep mon.)
(EKG, Vital Sign, etc)
Healthcare User DB
Healthcare User DB

Emergency System
Danger Alarm
Healthcare User DB

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In Closing

- e-Health (u-Health) is an important component of emerging Home Network Technology.
Glucose measurement result message & transmission protocol
Current Methods of Glucometer Data Management

TYPE 1: RS232-C or Ir transmission - upload blood glucose results from glucometer to PC.

TYPE 2: UWB (Bluetooth) or phone line - transmit glucose results from glucometer to remote server and manage cumulative data.
Issues

- Different data content depending on device
  - A: (glucose result)
  - B: (glu. result, meal time of analysis)
  - C: (glucose result, name, time of analysis)

- Different transmission protocol depending on manufacturer

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Standard Mode

- Standardized upload
  - Standard message
  - Standard message
  - Standard message

- Transmission method
  - Standardized transmission protocol
  - Internet
  - Application system (ex: HIS)
Effects of Standardization

- **User**
  - Platform free and device free: seamless interoperable

- **Manufacturer**
  - Reusability of S/W and platform

![Diagram](image-url)
### Message Format for Glucose

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Fields</th>
<th>Length (bits)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory field</td>
<td>result</td>
<td>10</td>
<td>- Glucose value [mg/dL]</td>
</tr>
<tr>
<td></td>
<td>year</td>
<td>7</td>
<td>- Analysis year, - Device value plus 2000</td>
</tr>
<tr>
<td></td>
<td>month</td>
<td>4</td>
<td>- Analysis month, - mm</td>
</tr>
<tr>
<td></td>
<td>day</td>
<td>5</td>
<td>- Analysis day, - dd</td>
</tr>
<tr>
<td></td>
<td>hour</td>
<td>5</td>
<td>- Analysis time, - hh</td>
</tr>
<tr>
<td></td>
<td>minutes</td>
<td>6</td>
<td>- Analysis minute</td>
</tr>
<tr>
<td>Optional field</td>
<td>temperature</td>
<td>6</td>
<td>- Body temperature</td>
</tr>
<tr>
<td></td>
<td>stress</td>
<td>1</td>
<td>- With stress 1, without stress 0</td>
</tr>
<tr>
<td></td>
<td>exercise</td>
<td>1</td>
<td>- After exercise 1, before exercise 0</td>
</tr>
<tr>
<td></td>
<td>meal</td>
<td>1</td>
<td>- After meal 1, before meal 0</td>
</tr>
<tr>
<td></td>
<td>Plasma (serum)</td>
<td>1</td>
<td>- Basis for sample reference value</td>
</tr>
<tr>
<td></td>
<td>Extension field</td>
<td>Variable length</td>
<td>- Blank for future use</td>
</tr>
</tbody>
</table>
Need of Standards for e-Health Application of Home Network
What Standards?

- Interoperability
  - Device Interface (IEEE, ISO/TC 215, CEN/TC251 jointly developing)
  - Data Transmission Protocol
  - Document (HL7 Clinical Document Architecture: CDA, XML based)
- Security
- Terminology Codes
- Integrate documents to Electronic Health Records