Integrating Medical Sensor Systems into Electronic Medical Records:
The ITALH Project and Testbed

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- **According to the National Coalition on Health Care, total health care expenditures in 2003:**
  - **Increased by 7.7 %**
    - **four times the rate of inflation**
  - **To $1.7 trillion**
    - **Projected at $2.1 trillion in 2006 and $3.8 trillion in 2015**
  - **Which was 15.3 % of (GDP)**
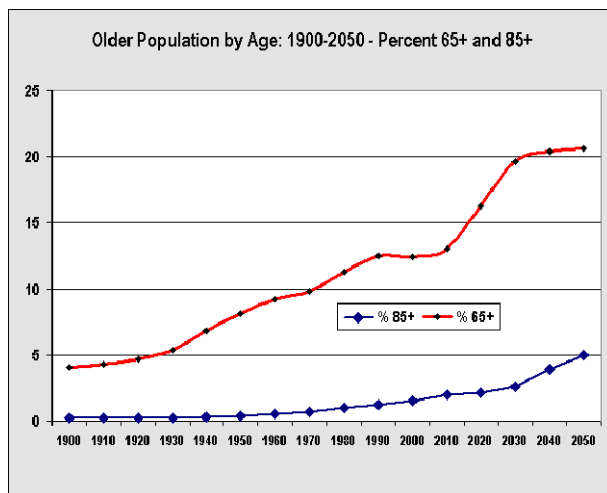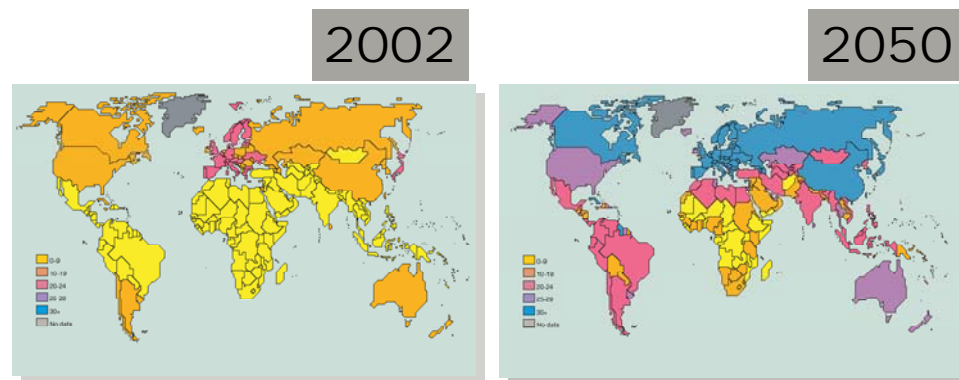   - **It is projected that the percentage will reach 19.0 % by 2015.**

Older Population by Age: 1900-2050 - Percent 65+ and 85+

Table compiled by the U.S. Administration on Aging based on data from the U.S. Census Bureau.

2002

Percentage of Population over 60 years old Global Average = 10%

2050


Percentage of Population over 60 years old Global Average = 21%

SOURCE: United Nations ▪ "Population Aging ▪ 2002"

- **Group care facilities are very expensive**
  - **Monetary cost to**
    - **The individual and their family**
    - **And/or the social welfare system**
  - **Health/happiness cost**
    - **Leaving ones home is often difficult or even traumatic.**
- **The goal of ITALH is:**
  - **to keep people healthy and happy at home if possible,**
  - **and thus avoid having moving them to more intensive care facilities**
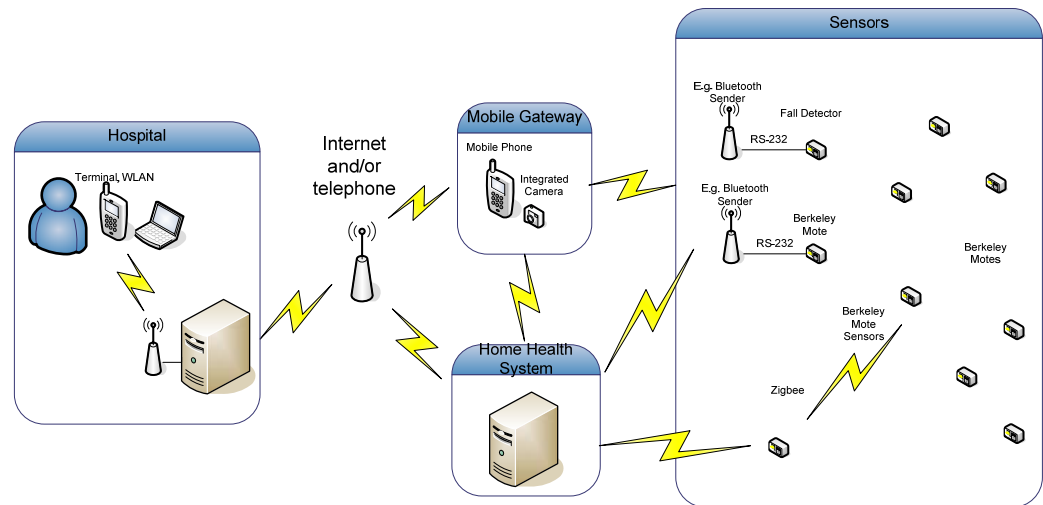
The ITALH System
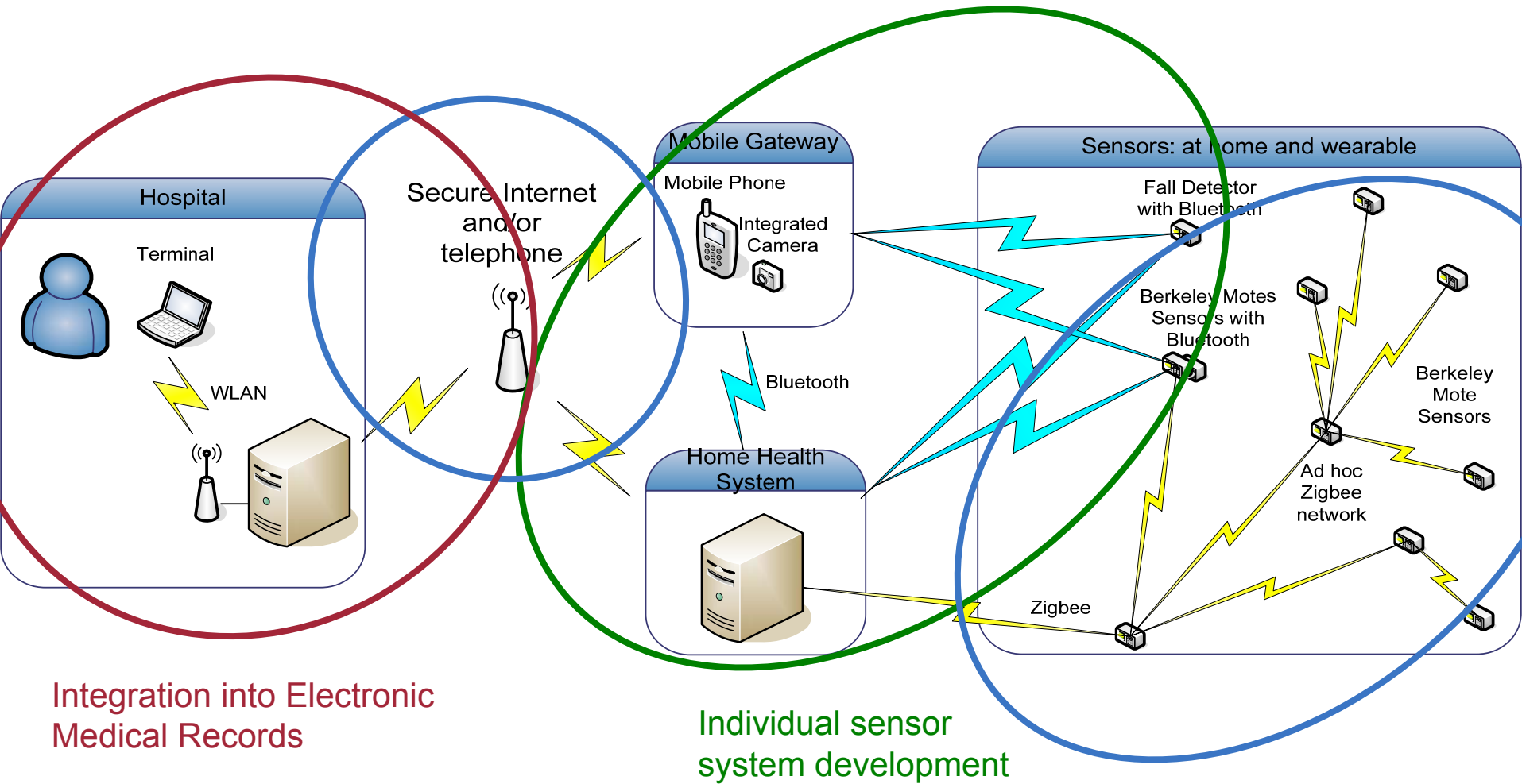
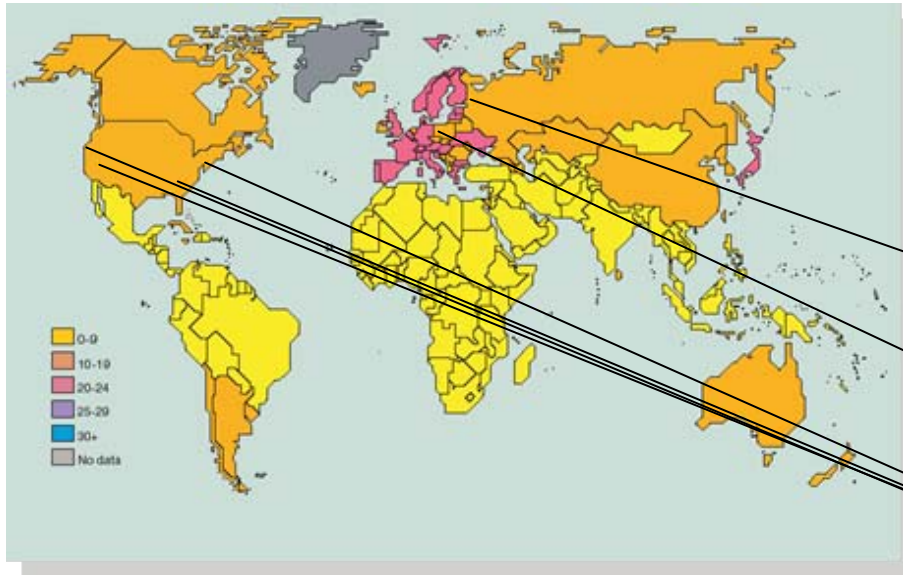Integration into Electronic Medical Records
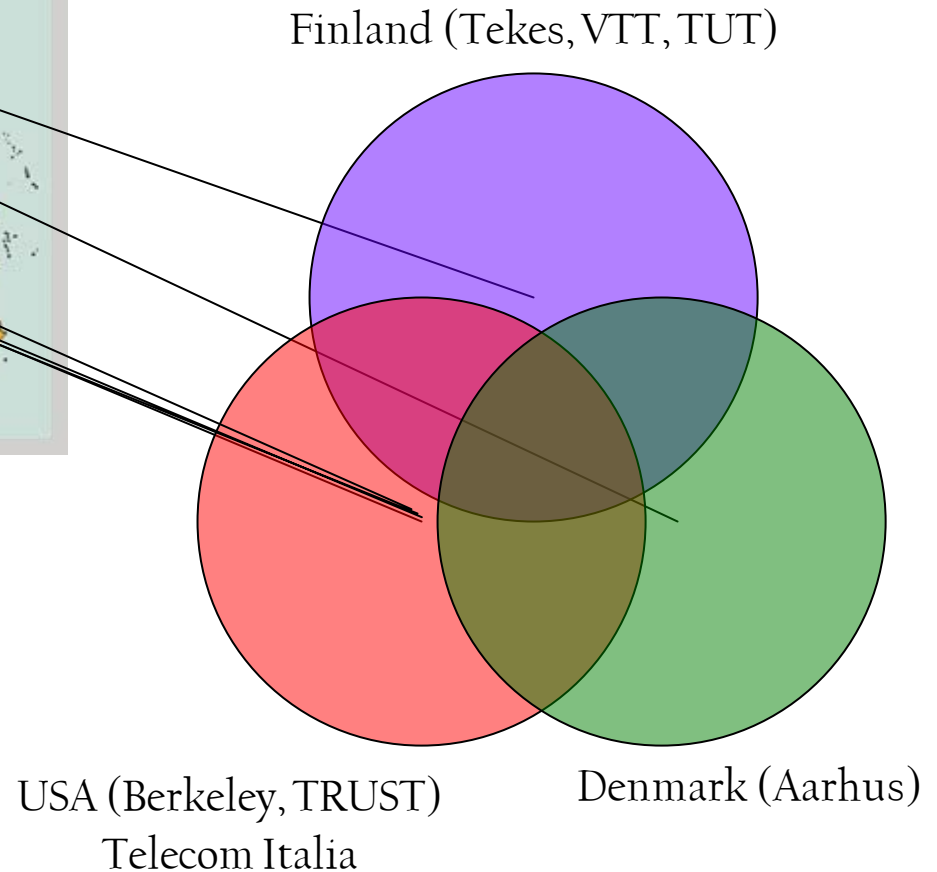
Individual sensor system development

Sensor and data fusion, communication issues

An international collaboration unified through institutional agreements, and tied together by societal interests.

Finland (Tekes, VTT, TUT)

USA (Berkeley, TRUST)
Telecom Italia

Denmark (Aarhus)

- **Biomedical sensor systems**
  - **Can monitor for acute and chronic conditions and emergency events**
  - **Is it necessary to store the data in an EMR?**
  - **Is it useful to do so? Would it provide medical benefit?**
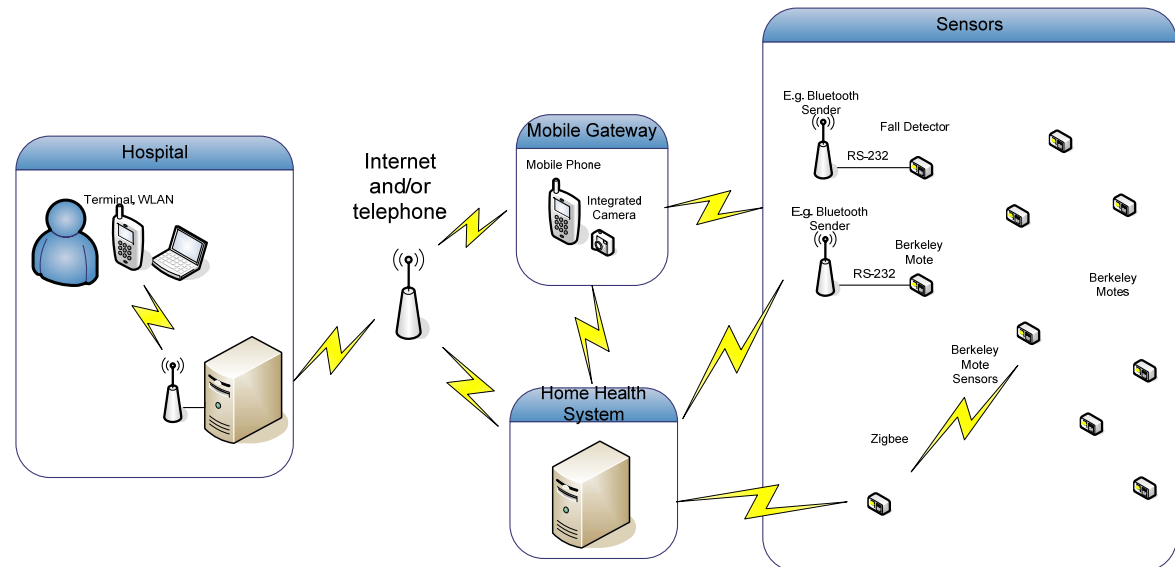
What are the possible benefits of including this data in an EMR?

- **Currently entry requires manual intervention by health care provider**
- **Most data is not used nor stored for analysis**
- **Could provide significant diagnostic ability, and improved care**
  - **E.g. for osteoporosis, where a clear negative correlation has been shown between activity level and bone density loss**
  - **E.g., currently, pre- and post-operative evaluations are *at best* snap-shots of the patients conditions**

Traditional Telemedicine

- **Telemedicine is a technology-rich alternative to a traditional face-to-face physician consultation.**
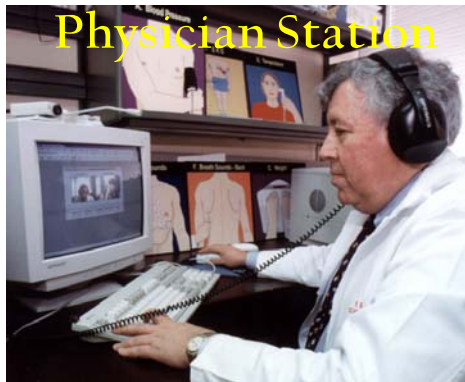
Courtesy Dr. Richard Re,
Ochsner Clinic

- **Telemedicine remains a one-to-one activity, more convenient of course**

- **E.g., Honeywell HomMed Products**
  - **http://www.hommed.com**
  - **Telemedicine applications**

Blood Glucose

Peak Flow/FEV1
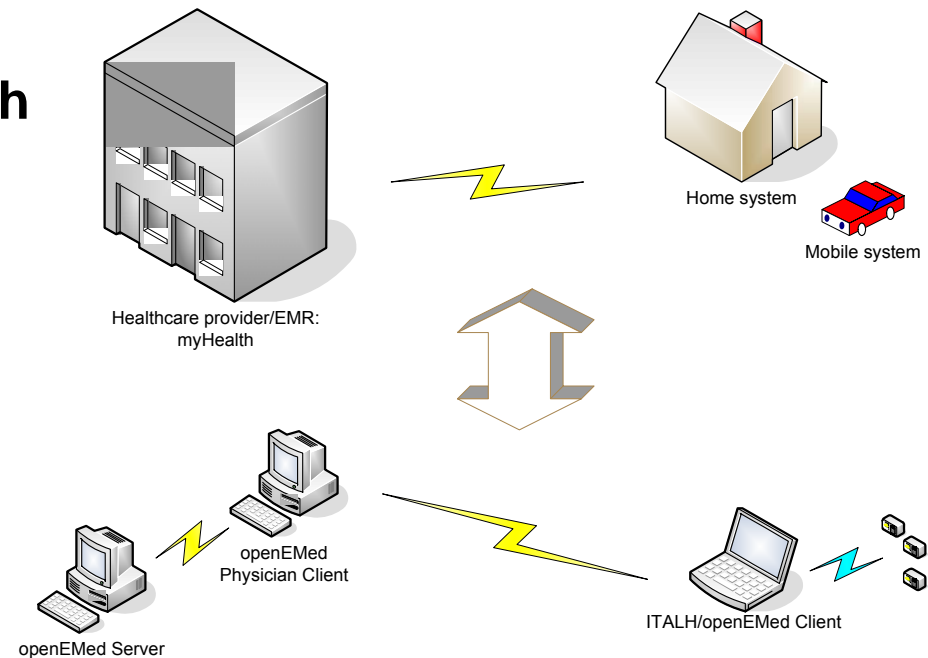
Spirometer

PT/INR

ECG

Oximeter

- **ITALH's primary purpose is to enable improved self-care by**
  - **Providing preventive tools**
  - **Improving safety, security, monitoring, at home**
  - **Enabling technology cooperation, delivery of services**
- **ITALH differs from related efforts in that it aims to** *automate* **much of the monitoring and alerting**
  - **Drastically reduce the amount of care required to provide the same level of care**
- **And to make it ubiquitous through wireless and embedded technology**
- *Automation must also be thought of in term of EMRs and healthcare providers*
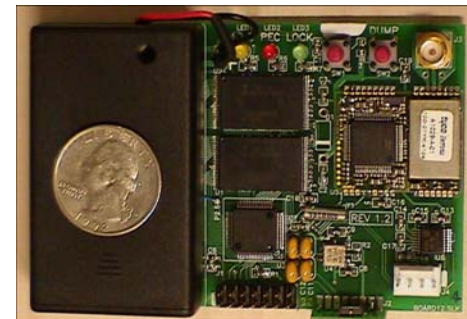
- **Protocols and policies must be established for the inclusion of automated data collection**

  - **This will be integrated with the Vanderbilt myHealth system following initial development**
  - **And Telecom Italia test bed**

  - **A test system is being developed to integrate the ITALH testbed with an open source EMR system**
  - **Using volunteers in Sonoma**

Home system

Mobile system

Healthcare provider/EMR:
myHealth

openEMed
Physician Client

openEMed Server

ITALH/openEMed Client

- **Initial focus of sensor development: Fall Detection**
    - **Falls are the leading cause of fatal and nonfatal injuries to older people in the U.S.**
    - **Each year, more than 11 million people over 65 fall – one of every three senior citizens**
    - **Treatment of the injuries and complications associated with these falls costs the U.S. over 20 billion annually**
- **Secondary information that has resulted:**
    - **The devices reveal additional information about the user**
    - **This provides significant opportunities for health monitoring**
    - **It also creates a potential threat to the users privacy**

- **Being able to measure and analyze a patients activity, enables:**
  - **Rapid and automated response to critical and emergency situations**
- **Activity of Daily Living Identification:**
  - **Sitting,**
  - **standing,**
  - **Walking**
- **Implications?**
- **Benefits?**
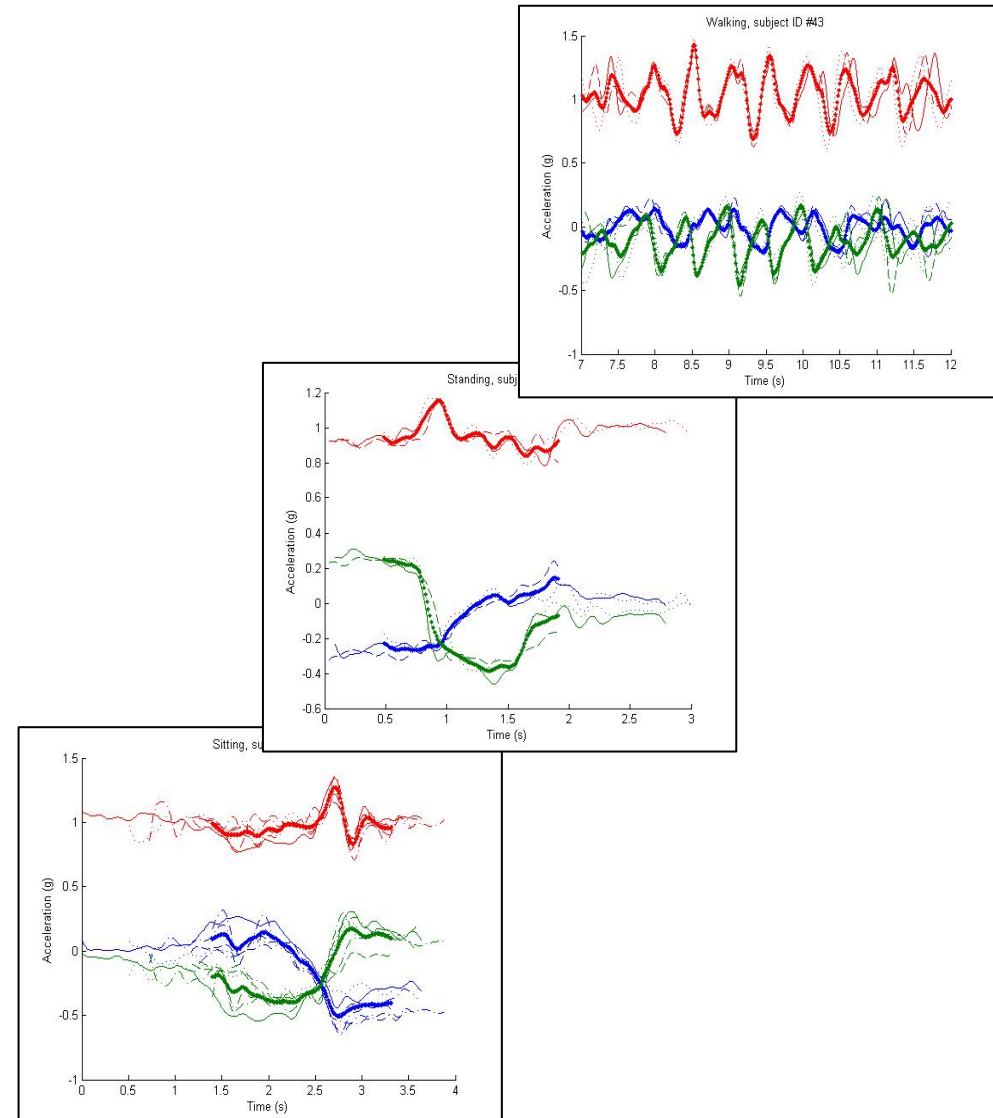
- **The potential of such systems can only be realized on a societal scale if such devices can be integrated in the EMR systems, so that:**
  - **Data acquisition is at least semi-autonomous**
  - **The data can be guaranteed to be accurate**
  - **The system is secure**
- **What does Security mean?**
  - **We must be able to assure the user of their privacy**
    - **Not limited to medical information**
  - **We must be able to assure data integrity**
  - **Other considerations: what if they withhold or provide false information?**

Conclusions

- **Through the TRUST EMR Project**
  - **Developing a testbed and protocols for directly including sensor data in EMRs**
  - **Integrating into open source EMR system locally**
  - **Will implement policy and access control, and model-based approaches**
  - **Communications issues with telecom providers**
  - **Plan to integrate into VUMC myHealth system**
- **The goal is to enable live, automated medical record entry from sensor systems**
  - **Home based at first**
  - **Clinical applications later**