Open Ended Mobility in Healthcare

Ronald Merrell, MD
Professor of Surgery
Director, Medical Informatics and Technology Applications Consortium
Virginia Commonwealth University
Jamestown May 1607
400th Anniversary of English Settlement in America
Richmond, Virginia
Health Care as a Place

- The hospital as locus for heavy technology
- The Record Room for medical documents
- The File Room for radiology studies
- The clinic and emergency department for incident care
Mobility is the tradition; Not a revolution. Mobility represents a return to traditions.
We expect first and urgent response to be mobile and fast. The response can also be in multimedia communications continuity with the remainder of health a system.
Health Care in an Electronic Continuum

• Digital data, digital records, digital decision support
• Lightweight mobile intermittent technology for diagnostics and intervention
• Continuous disease management
• Longitudinal care
• Home Health Care
• Telemedicine
Bones and the Tricorder!!!
This is what we really want. Wireless diagnostics on site with interventions possible.
Well we do not have this!!
What Technology do we have? Is it really useful?
Mobility in Healthcare

- Mobile patient
- Mobile disease manager
- Mobile technology
- Mobile First Responder
- Mobile learner and consultant
Through all ages and activities medicine can be an electronic presence and advocate.
Everest

A catastrophic season and a telemedicine challenge
Real-Time Physiologic Cipher

Mount Everest 1999
Vital Signs Monitor
FitSense Technology

05/13/1999 06:29:49

Climber 1
27.98815 N 86.86985 E
144
36.8

Climber 2
28.01329 N 86.88607 E
146
36.8

Climber 3
27.98815 N 86.86985 E
164
37.8

Mount Everest
1999
Very remote and hostile medical settings. Space, etc.
Program Description

- Sensor network
- Data sampling and conditioning
- Data pre-processing
- Data archive and analysis
- Data communication

VPack
Download, upload, keep moving until battery charge needed
Bio Sensor Network: Sensors in a sock

- Integrate sensor physiological sensor network in direct contact with skin
- Signals into a single feed to computer with VPack
- All wires from sensors embedded inside sock to prevent tear in suit bladder

Skin Temperature sensor

Pulse oximetry sensor

Galvanic Skin Resistance

Liquid cooling garment (overlay)
Diabetes monitoring applications

Chronic care - Diabetes monitoring

Alarm - text message

Software interface

Sensors in a sweat band, System in wireless and interactive continuity
Hypomon Glycemia Monitor

Respirations
Temperature
Pulse

Hypomon Glycemia Monitor
Mobile Disease Management

Pulse Oximetry, PDA Data Collection, Infrared download and upload
Need for Mobile Diagnostics, Analysis, Alerts and Response

• Medical situations or probabilities that require prompt response and might otherwise confine the individual to a strictly monitored environment

• Desire for maximal independence of mobility and location

• Need for local prompt alert and response while maintaining strong connection to a distant management site

• Great technical solutions for sensing, data management and telecommunications awaiting application
Mobile Home Care Applications

- Activity
- Location
- Vital signs
- Acute change alarms
- Trending alerts
- Messaging to reconfirm regimen and refine response to changes
Medical Applications

• Alzheimer Syndrome
• Physical impairment due to neurological injury
• Congestive heart failure monitoring
• Diabetes mellitus monitoring
• Arrhythmia monitoring
• Sleep pathology
• Fall alerts
• Alerts for loss of consciousness
• Seizure alerts
• Monitoring for peripheral vascular disease
• Home or out of home
Mobile Disease Management

• Health worker in the hospital (PDA, RFID, EMR)
• Home Health Worker with electronic continuum
• Health Worker in the Field
• Health Manager at home or out of unit
Kenya
Mobile Disease Management

- Power
- Sensors
- Telecommunications
- Information Management
- Assisted Autonomy

Kenya
When telecommunications fail. Mass disaster and the need for automatic telecommunication redundancy
Field testing software and system for automatic recognition of telecom failure and transition to another modality. Superbowl. San Diego
Simulated Medical Event above

Arctic Circle: Mars Society

Mobile consultant and distant emergency
Wireless Interface
Consultant in Richmond
Mobile Technology
Mobile Technology

- Technology is lighter and more robust
- Radiology first application against tuberculosis
- Endoscopy
- Primary Care
- Children’s care
- Prenatal care
- Surgery (ophthalmology, general surgery)
Distant learning and just in time training
Mobilizing access to fixed technology by telemedicine

- The surgical suite is not ready for full mobility!
- Access to new technology, new knowledge, surgical consultation and mentoring strictly limited by place of surgery and therefore knowledge as well as medical treatment is confined to privileged sites
- Event capture, software and telecommunications could overcome this isolation and highly limited access.
Surgical data Collection. Integration, Storage and Retrieval System
SdCISRS
the middle thyroid vein was secured between 3-0 silk ties over the carotid artery and
Integration of Fixed and Mobile Telemedicine

- Remote Environments
- Mobile capabilities
- Pre-op / post-op screening
- Low Bandwidth
- EMR
- Validation
Fixed Telemedicine
Distant Diagnosis and consultation by telemedicine in a digital record.
Remote data collection and diagnostics
Mobile Surgery Unit in Ecuador
Image capture for teleconsultation from Ecuador to Richmond
Early Multimedia Interface Ecuador to Yale University
Very low bandwidth!!!
Does technology fail when the road ends?
Certainly not!!!
Tsunky Nua in Puerto Morona, Ecuador
Mobile Telemedicine

*Delta Project – a case study*

Telemedicine Efforts for Danube Delta

[Bucharest]

[Tulcea]

[Constanța]

[Danube Delta]

[Black Sea]
Information Portal and Manager
Open Ended Mobility

- Satellite
- Cell Phone
- Wireless
- ISP
- Telephony
- Radio
Telemedicine
Wherever
Whenever
Whatever
Thank you for your kind attention!!

Ronald Merrell
rmerrell@mcvh-vcu.edu