Telehealth and the promise of advanced networks

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Telehealth

- Delivery of some aspect of health care when one or more of the participants are separated by distance
- Includes some educational and administrative uses of ICT in the healthcare system
- A subset of “eHealth” – the use of ICT in healthcare
- Usually regarded as synonymous with “telemedicine”

Early examples of telehealth – Royal Flying doctor service
The need for telehealth

Life expectancy (years)

- City: Males 80, Females 90
- Rural: Males 70, Females 80
- Remote: Males 60, Females 70
- Indigenous: Males 50, Females 60
Some classifications

Store and forward (e.g. Reporting on medical images)

Real time (e.g. Monitoring an ultrasound examination)
More classifications

Hub and spoke

Distributed

Makes central expertise available over a wide area

Mutual support among a group of clinicians or patients
What can telehealth do?

• Ensure that each patient is managed with optimum medical expertise wherever that patient or the source of expertise are available.

• Makes that expertise available at the cheaper, less complex periphery of the health system
  • GP’s office or local clinic
  • Small hospital with minimal specialist cover
  • Patient’s home
  • Accident or disaster scene
  • Wherever....
Some barriers to telehealth expansion

- Lack of access to affordable broadband connectivity
- Technology is often hard to use
- Entrenched work practices make healthcare industry resistant to change
- Lack of Medicare rebate
- There are only so many specialists anyway
- Technology is based on videoconferencing, not delivering medical services
What if the barriers were to be removed?

- The Centre for Networking Technologies for the Information Economy
- Funded by Australian Department of Broadband, Communications & the Digital Economy and CSIRO.
- 2001-2007

What would life be like if bandwidth were free and infinite?
Four telehealth applications
1. Virtual Critical Care Unit (ViCCU)

• Emergency support for hospitals in Katoomba, Lithgow
• Specialist at Nepean Hospital
• Multiple cameras and video channels for real-time team guidance
• Evaluated of 18 months for
  • Clinical Effectiveness
  • Technical Design
• Now integrated into hospital use
1. Virtual Critical Care Unit (ViCCU)

- Nepean Hospital (specialist)
- Katoomba Hospital
- 100 Mbit/s fibre
2. ECHONET

- Provided mobile bedside-to-bedside connections among
  - Burnie Hospital ICU (Tasmania)
  - Royal Hobart Hospital ICU
  - Royal Hobart Hospital Cardiology

- 3-way connections possible
- Two video channels
  - Camera View
  - Echocardiography (or other electronic source)
- Used for patient management and teaching
- Nine month clinical trial
- Evaluated for social/organisational, technical and clinical benefits
2. ECHONET

- Burnie Hospital ICU
- Royal Hobart Hospital Cardiology
- 100 Mbit/s network

Royal Hobart Hospital ICU
3. Virtual surgical training

- Two surgeons working in a shared virtual environment
- Separation could be a few metres or intercontinental
- 3D vision + sound + haptic (force feedback)
- Other teaching information available on demand
- Evaluated during actual training of ENT surgeons
- Commercial version now available
3. Virtual surgical training
4. Remote outpatient consultations

- Replaces a paediatric surgical followup consultation with a virtual consultation
- Specialist and remote rooms designed to mimic actual specialist's office
- Several advanced visualisation systems to create rich but natural data environment
  - Pointers and drawing tools
- Evaluated by
  - Specialists
  - Remote assistant
  - Patients & families

in a trial within Royal Children's Hospital, Melbourne
4. Remote outpatient consultations
Findings from CeNTIE projects

- Users could deliver services, not just talk about them
- Users able to achieve a high level of patient focus
  - Usability
  - User-centric - designed around current work practices
- Advanced visualisation technology and high bandwidth created a sense of “physical presence”.
  - Low latency – natural conversations
  - Sense of “trust” between health professionals
  - Bandwidth for trust higher than bandwidth for diagnosis
- Clinicians were able to work in a complex information space
  - Multimedia, generated in real time, potential for errors
- Social and organisational outcomes
  - The systems created new working relationships among geographically separated teams
  - Reduced professional isolation
  - Supported teams not just individuals
Telehealth to the individual

- Ageing population
- Rise in chronic disease
- Independent living vs residential care
- Shift to prevention rather than trying to cure the incurable
- Three approaches
  - Smart home
  - Assisted home-based self-management
  - Wearable devices
Home telehealth – “smart homes”

- Multiple sensors
- Connected by LAN
- “Smarts” assess well-being and raise alarms
  - Alarms based on departures from learned patterns
Home telehealth – self-management

- Self-administered tests (e.g. Blood pressure)
- Guided (where necessary) by videoconference
Home telehealth – wearable systems

- Wearable, unobtrusive device
- Body area network
- Automatically raise alarms for
  - Unusual vital signs trends
  - Adverse events such as falls

Image: Holst Centre

Technology for Easy Life

Image: Aerotel
Telehealth can overcome boundaries

CSIRO Telehealth and the promise of advanced networks

TEIN2
Network 2006

National Hospital of Paediatrics, Hanoi, Vietnam

Royal Children's Hospital Melbourne
Future telehealth

Doctor’s office
Doctor’s home
Doctor on ward rounds
Doctor anywhere

Emergency bed
Accident scene
Patient’s home
Patient anywhere

Patient’s personal health record

Instantaneous, multichannel secure connections
Challenges for networks

- Provision of secure *ad hoc* networks
- Guaranteed QoS
- Inhomogeneous technology
  - Fibre
  - Wireless
  - Mobile
  - WAN→LAN→BAN
- Transparency for the users
  - Patient focus
  - Users might be the patients
- Adaptable to user interfaces
  - Immersive
  - Carried in the pocket