What is Telemedicine?
What is eHealth?

Pedro Brandão

References

- Part of these “slides” are based on:
  - “Introduction to telemedicine” edited by Richard Wootton, John Craig and Victor Patterson, Royal Society of Medicine, 2006
- Other sources are noted by [Source], and the last slide holds the complete citation
- Inline citations are indicate as Source: CitationSource
TELEMEDICINE

Telemedicine – Basic definition

- Tele = at a distance, far (from Greek)

- “telemedicine refers to the delivery of medical health services at a distance” [104-defs]

- “there is no single or uniform telemedicine application” [104-defs]
Looking at it from different views

- Medical
- Technological
- Geographical/Spatial
- Benefits

104 Definitions

- Journal and conference peer-reviewed papers from 1970 – 2006;
- International organizations: WHO, ITU, European Commission;
- Health organizations: NHS (UK);
- Professional organizations: American Telemedicine Association (ATA).
Telemedicine is the practice of medicine without the usual physician–patient confrontation via an interactive audio–video communications system.
- Bird Tulu, et al, 1970

Telemedicine is a tool that can be used by health providers to extend the traditional practice of medicine outside the walls of the typical medical practice.
- Dena P, Barbara J, Stuart S, 2006

Telemedicine: move the information rather than the people by transmitting digitized bits of information such as video and audio, the need for physical proximity can, in many instances, be eliminated.
- Villaire M, 1996
What is...?

**[104-defs]: Geographical**

- In 72 das 104
- “Telemedicine reduced to its simplest form is connecting geographically separate healthcare facilities via telecommunications, video, and information systems.”
  - Klein S, Manning W, 1995

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**[104-defs]: Beneficial**

- In 36 out of 104
- Benefits:
  - Improved access
  - Enhanced efficacy/quality/delivery/efficiency of healthcare services
  - Equality of distribution of healthcare services
  - Lowering of costs of treatment
- “Telemedicine holds many promises to improve access to specialty care while decreasing costs and increasing the quality of patient care.”
  - Taylor GW 1998
Telemedicine being a subset of telehealth, uses communications networks for delivery of healthcare services and medical education from one geographical location to another, primarily to address challenges like uneven distribution and shortage of infrastructural and human resources.

Rapid access to shared and remote medical expertise by means of telecommunications and information technologies, no matter where the patient or the relevant information is located.
Telemedicina e E-Saúde 2011/2012

Tele...

- care
- health
- consult
- surgery
- dermatology
- neuro-physiology
- oncology

Telemed eSaúde 11/12 - What is...? - pbrandao

[pubAnalysis], from 1995 to vol 1 2004

Telemedicine Publications
A BIT OF HISTORY

A bit of history

- **14th century**: bubonic plague alerts transmitted using fires
- **Telegraph**
  - X-Rays sent after technology develop in the 19th century
- **Telephone**
  - 1910 Brown sends heart sounds (stethoscope) over the phone
- **Radio communications**
  - 1920 Seaman’s Church Inst of New York supports ships in high sea.
History (recent)

- **Television**
  - 1964 bidirectional closed TV connection between Psychiatry Institute of Nebraska and Norfolk Hospital (180 Km)

- **Satellite communications**
  - 1971-1975 Alaska ATS-6 Satellite Biomedical Demonstration, improving healthcare in remote villages using video-consults

- **Mobile phones**

To Be Continued...
Types/categories

- Synchronous vs. Asynchronous
  - Real-time (live) vs. “store-and-forward”
  - Remote monitoring;
- Observation equipment needed;
  - Camera, stethoscope, ECG, etc.;

Types/categories II

- Communication systems;
  - Ethernet, Cellular, satellite, etc.
  - Internet is a transport system transparent for the user;
- Automatic decision vs. professional control;
  - Artificial intelligence, automatic catalogue, medication suggestion; robot control, professional diagnostic, etc.
**eHealth – Basic definition**

- e → electronic, digital

- “a means of applying new low cost electronic technologies, such as 'web enabled' transactions, advanced networks and new design approaches, to healthcare delivery” [WIeH4]

- “ehealth includes use of the internet or other electronic media to disseminate health related information or services.” [WIeH4]
Themes

- Health
- Technology
  - Internet, PDA, interactive TV
- Stake Holders
- Activities

Attitudes

Place
  - “to provide and support health care wherever the participants are located”

Outcomes

Commerce
  - Appears in 11 defs (from 51)

Some definitions

- “consumer-centred model of health where stakeholders collaborate”
- “do the previously impossible”
- “Ehealth is connectivity”
- “The practice of leveraging the Internet to connect caregivers, healthcare systems and hospitals with consumers”
- “Many of the major forces of change impacting health care today have technological underpinnings, and many of the less desirable impacts may have technological solutions. Two related technological forces are transacting business, online (e-business) and delivering health care online (e-health).”
Hierarchy of MeSH descriptors found below Medical Informatics

From: [WleH4]

Topics in published articles using the term eHealth

From: [WleH4]
Definitions that encompass

- Eng’s 5 C’s for eHealth:
  - content, connectivity, community, commerce, care [eHLand]

- Eysenbach 10 essential E’s in eHealth:
  - efficiency, enhancing quality of care, evidence-based, empowerment of consumers, encouragement, education, enabling, extending, ethics, equity [WIeHEy]

- Richardson 4 pillar-model:
  - clinical applications, healthcare professional continuing education, public health information, and education and lifetime health plan

Definitions: trying to get one...

- “e-health is the use of emerging information and communications technology, especially the Internet, to improve or enable health and healthcare” [eHLand]

- “e-health is an emerging field of medical informatics, referring to the organization and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology” (adapted in [WIeH4] from Eysenbach [WIeHEy])
What both terms are not

- Something for *techies, nerds, geeks*

- For people *not* at ease with technology

- A mature discipline

**WHY?**
Healthcare pyramid

- University Hospital
- General Hospital
- Primary care
- Community care
- Personal care

Population Aging

- Percentage of population by age

[UN-data]

- World
- Portugal

What is...?
Population Aging

Growth and life expectancy

Population growth

Life expectancy

World

Portugal

[UN-data]

Population Aging

Percentage of population aged 60 or over

World and development regions, 1950-2050

[UN-News]
Data

- 158 in 1000 Angolan children dies before 5
  - Finland 3 in 1000

- 1800 in 100,000 women die during pregnancy or from delivery complication in Afghanistan
  - Ireland 1 in 100,000

- Only 12% of deliveries in Chad are assisted by physicians
  - 99% in Sri Lanka, 94% in Botswana

Fonte: Jornal i 5 Maio 2010, dados [WHO-GHO]
Medical Errors

Deaths per 1,000 discharges with complications potentially resulting from care (failure to rescue), adults ages 18-74, 1994, 1997, and 2000-2005, in the USA

[NHQR-Report2009]

Medical Errors

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received 1 of 33 inappropriate drugs</td>
<td>Received 1 of 11 drugs that should be avoided</td>
<td>Received 1 of 33 inappropriate drugs</td>
</tr>
<tr>
<td>Percent</td>
<td>18.4</td>
<td>17.7</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.7</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Adults over 65 that potentially received inappropriate medication from 2002 to 2005 in the USA

[NHQR-Tool]
### Human resources

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of physicians</th>
<th>Number of nursing and midwifery personnel</th>
<th>Number of dentistry personnel</th>
<th>Number of community health workers</th>
<th>Number of other health service providers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abs /10,000</td>
<td>Abs /10,000</td>
<td>Abs /10,000</td>
<td>Abs /10,000</td>
<td>Abs /10,000</td>
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<tr>
<td>Africa</td>
<td>150,708</td>
<td>2</td>
<td>23,964</td>
<td>1</td>
<td>257,520</td>
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<tr>
<td>Americas</td>
<td>1,620,329</td>
<td>19</td>
<td>4,095,757</td>
<td>49</td>
<td>5,904,376</td>
</tr>
<tr>
<td>Eastern</td>
<td>532,486</td>
<td>10</td>
<td>734,949</td>
<td>15</td>
<td>499,977</td>
</tr>
<tr>
<td>Mediterranean</td>
<td></td>
<td></td>
<td>84,033</td>
<td>2</td>
<td>98,648</td>
</tr>
<tr>
<td>Europe</td>
<td>2,816,481</td>
<td>32</td>
<td>6,659,394</td>
<td>79</td>
<td>3,338,011</td>
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<tr>
<td>South-East Asia</td>
<td>849,324</td>
<td>5</td>
<td>1,955,203</td>
<td>12</td>
<td>2,002,575</td>
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<tr>
<td>Western</td>
<td>2,435,023</td>
<td>14</td>
<td>3,413,921</td>
<td>20</td>
<td>2,629,404</td>
</tr>
<tr>
<td>Pacific</td>
<td></td>
<td></td>
<td>318,082</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Global</td>
<td>8,404,351</td>
<td>13</td>
<td>17,651,585</td>
<td>28</td>
<td>14,631,863</td>
</tr>
</tbody>
</table>

[WHO-GHO]

### Hospital resources

<table>
<thead>
<tr>
<th>Region</th>
<th>Beds per hospital (per 10,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>10</td>
</tr>
<tr>
<td>Americas</td>
<td>20</td>
</tr>
<tr>
<td>Eastern</td>
<td>30</td>
</tr>
<tr>
<td>Mediterranean</td>
<td>50</td>
</tr>
<tr>
<td>Europe</td>
<td>60</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>70</td>
</tr>
<tr>
<td>Western</td>
<td>20</td>
</tr>
<tr>
<td>Pacific</td>
<td>10</td>
</tr>
<tr>
<td>Global</td>
<td>12</td>
</tr>
</tbody>
</table>

[WHO-GHO]
Difficult access

Education

- Educate more specialists
- Educate patients
  - Do not believe everything you read online
- Educate physician/technician that does the consult/observation
Motivation I

- Improving equity
  - Access to information (education);
  - Access to specialists;

- Medical errors
  - Automate processes;
  - Access to specialists for diagnostics;

Motivation II

- Distance monitoring;

- Improve access to specialists
  - Remote locations;
  - Lack of specialists;
  - Disaster/war scenarios/locations;

- Education

- Reduce costs
Problems: Social

- "sacrosanct" relationship between doctor and patient;
  - De-personalisation;
  - Different procedure for consult;
- Doctor/technician at consult and remote specialist
  - "not doing a good observation" stress;
  - "Being watched";
  - De-motivation.
Problems: Physical

- Inability to accomplish all procedures
  - Ex.: palpation;
- Patient unable to do teleconsult:
  - Bad vision;
  - Bad hearing;

Problems: Bureaucratic and Legal

- Reimbursement of telemedicine consults:
  - Not recognized by some insurance companies (USA);
  - National health services not up to date;
- Licence to practice may not apply everywhere (country, state);
- Compensation of medical errors (previous bullet);
- Confidentiality;
Problems: Other

- System distrust by patients and doctors;
- Ergonomic, handling difficulties;
- How to appraise improvements brought by Telemedicine;
  - more can mean better;

Problems: Fears

- Lack of evidence base results;
- Role and status of healthcare professionals;
- More work;
- Telemedicine being conditioned by industry and not the end user;
- Technologic obsolescence;
- Users knowledge are not used;
- Cultural and linguistic differences;
- Lack of standards.
APPLICATIONS

Examples

Basic

- SMS:
  - “GP Surgeries use SMS to Advise Patients on Swine Flu” [eHealthNews-SMS]
  - Medication reminders;
  - MAMA – Mobile Alliance for Maternity Action
- Phone follow ups
- Phone triage/medical advise;
  - Saúde 24, NHS Direct
Example: Telemental health

Fonte: Telemental Health Guide Brochure
http://www.tmhguide.org/

Example: Tele radiology

Fonte: wikipedia
Example: Teleconsult

- Tele Consult at Univ. Kansas medical centre de Kansas [KU-MedicalCenter]
- Using:
  - Digital Stethoscopes
  - Otoscope Camera
  - Dermascope
  - Intra-oral Scope

Example: Tele Emergency

Mississippi University
http://telemergency.umc.edu/
Example: LSTAT

- Life Support for Trauma and Transport

[CMU-SNAKE]

Mobile health

From MIT Tech Review

Source: MobileHealthNews, Mobile MIM for iPhone, iPad

Source: Alive ECG for iPhone, Android
Other examples

- Airplane, ship Assistance (specialist)
- Rehabilitation
  - physical
  - Communication
- Wounds specialists
- Even Intra-hospital

Other senses (not just vision)

- Smell
  - Remote microbiology
- Tact
  - Haptic devices
- Taste
  - Usually not necessary, use of biochemical analysis
## In summary

<table>
<thead>
<tr>
<th>Topic</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why</td>
<td>• Added value</td>
</tr>
<tr>
<td></td>
<td>• allow efficiency, quality, cost reduction and accessibility.</td>
</tr>
<tr>
<td>Who</td>
<td>• Patients/Consumers</td>
</tr>
<tr>
<td></td>
<td>• Healthy, concerned, at risk and sick</td>
</tr>
<tr>
<td></td>
<td>• Providers</td>
</tr>
<tr>
<td></td>
<td>• Medical doctors, nurses, healthcare assistant, others</td>
</tr>
<tr>
<td></td>
<td>• Funding entities</td>
</tr>
<tr>
<td></td>
<td>• Public and private</td>
</tr>
<tr>
<td>Where</td>
<td>• Industrialized world</td>
</tr>
<tr>
<td></td>
<td>• Patient/consumer house and body</td>
</tr>
<tr>
<td></td>
<td>• Developing world</td>
</tr>
<tr>
<td></td>
<td>• Healthcare centres and triage hospitals</td>
</tr>
<tr>
<td>How</td>
<td>• Human factors</td>
</tr>
<tr>
<td></td>
<td>• Increased adoption between providers and patients/consumers.</td>
</tr>
<tr>
<td></td>
<td>• Policies, laws and social stimuli.</td>
</tr>
<tr>
<td></td>
<td>• Economical factors</td>
</tr>
<tr>
<td></td>
<td>• Third-party reimbursement</td>
</tr>
<tr>
<td></td>
<td>• Consumer healthcare market</td>
</tr>
<tr>
<td></td>
<td>• Technology</td>
</tr>
<tr>
<td></td>
<td>• Small device, passive, cheap, wearable</td>
</tr>
<tr>
<td></td>
<td>• Internet access, ubiquitous, wireless</td>
</tr>
<tr>
<td>What</td>
<td>• Clinical</td>
</tr>
<tr>
<td></td>
<td>• Triage, diagnostics, monitoring, consulting applications</td>
</tr>
<tr>
<td></td>
<td>• Non-clinical</td>
</tr>
<tr>
<td></td>
<td>• Education and administration applications</td>
</tr>
</tbody>
</table>

### Questions?

http://www.dcc.fc.up.pt/~pbrandao/aulas/1112/TeleSaude/
pbrandao_AT_dcc.fc.up.pt
References

- [UN-News] Population Ageing and Development, 2009, United nations,
- [Intro-Tel] “Introduction to telemedicine” edited by Richard Wootton, John Craig and Victor Patterson, Royal Society of Medicine, 2006

References

- [CMU-SNAKE] Snake Robot Design, BioRobotics CMU,
- [KU-MedicalCenter] Kansas University Medical Center, Telemedicine
References

- [WHO-GHO], Apps WHO
- [NHQR-Tool] National Healthcare Quality & Disparities Reports Interactive Tool
- [eHealthNews-SMS] GP Surgeries use SMS to Advise Patients on Swine Flu, 06 August 2009

Acronyms

- ATA – American Telemedicine Association
- ICU – Intensive Care Unit
- ITU – International Telecommunication Union
- NHS – National Health Service
- OMS – Organização Mundial de Saúde (see WHO)
- ONU – Organização Nações Unidas (UN)
- PC – Primary Care
- SMS – Short Message Service
- TBC – To Be Continued
- UN – United Nations
- WHO – World Health Organization (see OMS)