

Impact of Information and Communication Technologies (ICT) on Health Care

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Outline



1. ICT and health.

WHO Report for the World Summit on the Information Society – Tunis, 16-18 Nov. 2005 WHO Global Observatory of eHealth - 2006

- 2. History. Major achievements in ICT for health care
- 3. Aspects:
- Accessibility
- Economy
- Quality
- Education
- 4. Conclusions



eHealth - the use of Information and Communication Technologies (ICT) for health



Connecting for Health Global Vision, Local Insight WHO Report for the World Summit on the Information Society – Tunis, 2005

dvancing ICT in health

Core components	Requirements
Infrastructure	Affordable, reliable, durable and high-speed connections Intersectoral investment in 'last-mile' solutions
Technology and tools	Designed, developed and deployed for health Affordable, durable, user-friendly access devices and people who can install and support them
Education and training	Skills to access, manage and use information Build capacity in eHealth policy and planning
Policies and standards	Coordinate systems and services Affordable rates, tariffs and services Development of global ethical and scientific norms, standards and commitments for transfer of information and protection of citizens
Evaluation	Evidence and experience to guide development and investment Evidence and information for policy and advocacy
Leadership and commitment	Long-term cross-sectoral outlook for public health policy, linked to ICT policy, with participation of civil society Working together across disciplines to improve opportunities for mutual gain Design of macro-level policies to support micro-level initiatives

Source: Connecting for Health Global Vision, Local Insight. WHO Report, 2005

Life expectancy at birth, 2003



Examples of ICT in health

ICT in public health practice	ICT in clinical care and laboratory practice
Identify disease and risk factor trends	Track and provide patient information
Model diseases in populations	Enable communication between patients and professionals
Analyse demographic and social data	Deliver services despite distance and time barriers via 'telemedicine'
Access research, publications and databases	Standardize ordering and delivery of drugs and supplies
Monitor and communicate potential threats to health	Monitor quality and safety in patient care settings

Source: Connecting for Health Global Vision, Local Insight. WHO Report, 2005

Towards new eHealth paradigms

Stakeholders	Impact of ICT
Citizens	Allows personalized, citizen-centred care
	Health at home, in the workplace, or school – not just the hospital
	Focus on prevention, education and self-management
	Reaching out to peers for advice and support
Professionals	Readily available high-quality distance-based learning for continuing professional education
	Remote consultations with patients, second opinions and professional networks
	Access to current, specialized, accredited knowledge for clinical care, research and public health
Hospitals and	Hospitals as a virtual network of providers, connecting all levels of the system
academia	Quality and safety: improving care processes and reducing the possibility of medical errors.
	Facilitating mobility of citizens and their medical records
	New opportunities in basic and applied research: from health knowledge to action
	Collaboration and shared computing power (e.g., grid computing)
Health-related	Providing health content as a commodity to the public and health professionals
businesses	Research and development of new products and services: electronic health records, information systems, clinical registries
	Broad and cost-effective marketing for health products and services
Governments	Health increasingly central to economy, security, foreign affairs and international relationships
	Limiting factor is no longer technology, but enabling environments
	New roles for stakeholders: health professionals and authorities, citizens
International agencies	Need for rapid, coordinated response to global threats: natural disasters, infectious diseases and bioterrorism
	Growing awareness of importance of ICT in sustainable health systems

Source: Connecting for Health Global Vision, Local Insight. WHO Report, 2005

Inequity between burden of disease and spending



WHO's mortality strata

Stratum	Child mortality	Adult mortality
А	Very low	Very low
В	Low	Low
С	Low	High
D	High	High
E	High	Very high

Source: Connecting for Health Global Vision, Local Insight. WHO Report, 2005

WHO Member States, by region and mortality stratum

Region and mortality stratum	Description	Broad grouping	Member States
Europe			
Eur-A	Europe with very low child and very low adult mortality	Developed	Andorra, Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom
Eur-B	Europe with low child and low adult mortality	Developed	Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Poland, Romania, Serbia and Montenegro, Slovakia, Tajikistan, The former Yugoslav Republic of Macedonia, Turkey, Turkmenistan, Uzbekistan
Eur-C	Europe with low child and high adult mortality	Developed	Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine

Source: Connecting for Health Global Vision, Local Insight. WHO Report, 2005

Adult literacy by WHO Region, projections for 2005



Source: United Nations Educational, Scientific and Cultural Organization database, 2004.

Index of ICT diffusion

Connectivity	Physical infrastructure available to a country: per capita Internet hosts, PCs, telephone mainlines and mobile phones Excludes electricity, broadband, and affordability measures
Access	Number of Internet users, adult literacy rate, cost of a local call, and GDP per capita
Policy	Comprises presence of Internet exchanges, competition in the local loop/ domestic long distance and competition in the Internet service provider market

Source: Connecting for Health Global Vision, Local Insight. WHO Report, 2005

ICT diffusion = (Connectivity + Access + Policy) / 3

0 <= ICT diffusion <= 1



ICT diffusion, Africa

1.00

ICT diffusion, South-East Asia



Source: The digital divide: ICT development indices 2004. Geneva, UNCTAD, 2004.



ICT diffusion, Americas

ICT diffusion, Europe



ICT diffusion, Eastern Mediterranean



Source: The digital divide: ICT development indices 2004. Geneva, UNCTAD, 2004.

ICT diffusion, Western Pacific



Source: The digital divide: ICT development indices 2004. Geneva, UNCTAD, 2004.

ICT diffusion - summary

Region	Max ICT diffusion
Africa	0,36 Mauritius
South East Asia	0,33 Maldives
Americas	0,80 USA
Europe	0,76 Iceland
Eastern Mediterranean	0,58 United Arab Emirates
Western Pacific	0,68 Singapore

Sample country fact sheet on health and ICT diffusion



Country statistics

WHO region: Africa Total population: 6,736,000 GDP per capita (Intl \$, 2002): 930 Life expectancy at birth m/f (years): 52.0/54.0 Healthy life expectancy at birth m/f (years, 2002): 43.4/44.5 Child mortality m/f (per 1000): 158/150 Adult mortality m/f (per 1000): 393/332 Total health expenditure per capita (Intl \$, 2002): 44 Total health expenditure as % of GDP (2002): 4.7 Figures are for 2003 unless indicated.

Source: The world health report 2005. Geneva, WHO, 2005.

Mortality stratum D: high child, high adult

Countries in regional mortality stratum

Algeria, Angola, Burkina Faso, Cameroon, Cape Verde, Chad, Comoros, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Madagascar, Mali, Mauritania, Mauritius, Niger, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Togo

Source: The world health report 2004. Geneva, WHO, 2004.

Selected demographic indicators Selected countr / expenditure (% GDP)



Source: World health statistics 2005. Geneva, WHO, 2005.

Country ICT trends





Source: World development indicators 2005. Washington, DC, World Bank, 2005. UNCTAD handbook of statistics 2004. Geneva, UNCTAD, 2004.

Country ICT access indicators



Source:

- 1) UNCTAD handbook of statistics 2004. Geneva, UNCTAD, 2004.
- 2) World health statistics 2005. Geneva, WHO, 2005.
- UNCTAD handbook of statistics 2004. Geneva, UNCTAD, 2004.
- 4) World development indicators 2005. Washington, DC, World Bank, 2005.

See explanatory notes for sources and methods (...) data not available.



Source: World development indicators 2005. Washington, DC, World Bank, 2005.

ICT diffusion index

Calculated as average of scores for connectivity, access and policy



Source: The digital divide: ICT development indices 2004. Geneva, UNCTAD, 2004.

WHO Global Observatory of eHealth - 2006

- At 58th Session in May 2005, the World Health Assembly (WHA) adopted a resolution WHA58.25 establishing an eHealth Strategy for the World Health Organization (WHO). The Global Observatory of eHealth (GOe) was created which undertook a world-wide survey on eHealth.
- The Observatory's mission is to improve health by providing Member States with strategic information and guidance on effective practices, policies and standards in eHealth.

It is recommended that WHO in collaboration with appropriate partners should:

- 1. Facilitate the development of those generic eHealth tools most sought after by its Member States.
- 2. Raise awareness of existing eHealth tools and services through the creation of electronic directories and that there should be a special focus on open source eHealth solutions.
- 3. Develop an international knowledge exchange network to share practical experiences on the application and impact of eHealth initiatives.
- 4. Create an eHealth information resource to support the needs of Member States in key areas such as eHealth policy, strategy, security and legal issues.
- 5. Promote the use of eLearning programmes for professional and ongoing education in the health sciences.....Further, WHO should advocate for the inclusion of eHealth courses within university curricula.

History. Major achievements in ICT for health care

Nobel prizes in Medical Imaging:

- 1979 Cormack, Hounsfield Computer Tomography (CT),
- 2003 Lauterbur, Mansfield Magnetic Resonance Imaging (MRI)

Beginning of Medical Imaging

• Roentgen – 1905







Computer Tomography - CT

• Hounsfield – 1975





Results





Results cont.







Frequently used definitions



<u>Telemedicine</u> - use of medical information exchanged from one site to another via electronic communications to improve patients' health status. (ATA)

<u>Telehealth</u> – use of information and communication and technologies to deliver health services and transmit health information over both long and short distances. It's about transmitting voice, data, images, and information rather than moving patients or healthcare practitioners and educators. (CST)

<u>Telenursing</u> - is the practice of nursing over distance using telecommunication technology (NCSBN)

Accessibility



 Access to medical services becomes possible from rural areas and small towns

Alaska largest US Telemedicine Program Hubs & Spokes are the heart and hand of each program









Ontario, Canada physicians schedule Telemedicine Encounters with patients





Source: D.Castelli. AMD Global Telemedicine. Presentation for the Medical University of Warsaw, 8.01. 2007

South Africa – Polkowane -Northeast Region





Medical Residents learning Telemedicine Software & Video Applications for Spirometry Obstacles: Remote South African village with limited technology

Developing Countries request help from a distance for pediatric illnesses or injuries









A R M E N

A

Economy - cost containment

European health expenditures per country



- Currently some costs are paid by
 - National Health Organizations
 - Private Insurance
 - Individual payment

Source: F.Lievens, M.Jordanova. eHealth International Initiatives, Structures and Trends. 11th ISfTeH Int. Conf., 27-29 November 2006, Capetown, South Africa

Economy



In developed countries 60% of health care costs are generated by ageing population.

- How eHealth can cope with that problem?
- By home monitoring and telecare.

It can be applied in diseases such as cardiac failure, hypertention, diabetes, chronic obstructive pulmonary disease (COPD).

Telehealth Monitoring Applications



Telemedicine/Telehealth Clinical Applications

Patient Suite Integration Model



Video Colposcope



Telemedicine/Telehealth Clinical Applications

Camera and Illumination Source









Telemedicine/Telehealth Clinical Applications

Electronic Stethoscopes

SmartSteth





Ausculette II

Simulscope



Telemedicine/Telehealth Clinical Applications

Medical Devices

Vital Sign Monitor





Digital Spirometry



Digital 12-Lead ECG for PC or Palm Pilot

Telemedicine/Telehealth Clinical Applications



General Exam Camera







Quality



- In many cases ICT can improve the quality of medical care.
- Telecardiology applied in Acute Coronary Syndromes (ACT) is a good example. The use of eHealth can diminish the time from the onset of symptoms (pain in the chest) to intervention (angioplasty and stent implantation). The rule of "Golden Hour" can be fulfiled.



Acute Coronary Syndromes (ACS)



Urbands Partner, Wrochw 2002, Opokhi G., Filipiah K. J., Pokus hi L. im, (md.), 1-4.







Current developments in telecardiology(1)



- Home-monitoring of patients with arrhythmias and after myocardial infarction
- Event-monitoring in patients with implanted cardioverterdefibrillator





Current developments in telecardiology(2) HOME MONITORING - Report



Current developments in telecardiology(3)



 Medical images, movies and sounds transmission (coronarographies, ECHO, stethoscope, etc.) for consultation







Current developments in telecardiology(4)



- Home-monitoring of patients with end-stage heart failure – approved by Polcard National Program
- System for cardiological rehabilitation in patients after CABG – approved by Polcard National Program







Education



1. Blended model of learning seems to be most appropriate in medical sciences.

2. The most challenging factor in e-learning is lack or limitation of interpersonal contact, which is crucial in training future physicians.

3. Multimedia, virtual reality and simulations of different types are opportunities given by e-learning.



Blended Model of learning



The Virtual Patient

http://www.medics.man.ac.uk/work/virtpat/



dialogue with the simulated patient is carried out using natural language

Interactive Simulation of Patients the ISP-project http://isp.his.ki.se/



User types the question using free text and the system responds by playing a corresponding video sequence, in which the simulated patient (actor) gives the answer.

Virtual Hospital: Patient Simulations

http://www.vh.org/Providers/Simulations/PatientSimulations.html







Virtual Reality

Simulation of endoscopic techniques



Microsurgery simulation



Microsurgery simulation





International Virtual Medical School

IVIMEDS – established in 2002 as a not for profit organization. There are 26 participating universities from all over the world - Europe, North and Central America, Asia and Australia. Embraces the continuum of medical education including undergraduate, postgraduate and continuing medical education (CME).

www.ivimeds.org



ivimed The International Vietual Medical Sc	S • Overview	 Services 	 Collaboration 	Partners	6
Overvie	?W		F	tembers login Username: Password: orgot your login or your	password?
» Vision » Progress	IVIMEDS is an internation schools and institutions	nal not-for-profit partne working to develop the	ership of medical e tull potential of		

» Educational philosophy

schools and institutions working to develop the full potential of e-learning in medical education. In partnership with its members IVIMEDS aims to provide an effective means of developing and sharing a range of quality digital learning resources and value-added educational services across the continuum of education. Primary cevelopment efforts are focussed on the undergraduate medical curriculum, though strategic opportunities for developments at postgraduate and continuing professional development level are being explored.



Opportunities of e-learning



E-learning is being described as **revolutionary approach** in presenting and transfering knowledge, which will be quickly developed in the upcoming future. There are several opportunities, which stand for this point of view:

- 1. Creation of interactive model of learning, which stimulates knowledge acquisition,
- 2. Flexibility in both time and location , while accessing content presented on-line,
- 3. Appropriate use of innovative IT technologies in learning process,
- 4. Possibility of cooperation between teachers and students from different schools.

Future developments of ICT in health care



- **Telenavigation** during operations: PTCA, ablation
- Robots (e.g. da Vinci)





Benefits of eHealth, an example

- U.S. Government Accounting Office studied benefits of e-Health in 11 public and private Health Care Delivery organizations of varying sizes and settings (rural/urban) that had invested significantly in e-Health (Oct., 2003).
 - 50%-80% reduction in medication error rates
 - >15% reduction in laboratory and diagnostic imaging tests due to online access to results
 - 30% increase in use of formulary and generic drugs
 - Significant reduction in time to refer patients using online scheduling and communication tools
 - 40% increase patient screening and preventative health care procedures
 - 40% increase in use of standard protocols by physicians

Source: Jalayer B. eHealth, Electronic Health Record and Technology Infrastructure. Presentation to WHO-EMRO, Sept. 2004, Teheran, Iran

Conclusions



- Impact: The advantages of eHealth implementation are numerous: better access to health care services, cost containment, better quality and safer care, possibility of e-learning for undergraduate and postgraduate medical education
- Health is increasingly seen as a driver for as well as beneficiary of – ICT development
- Universities and health institutions can implement eHealth in research, education and clinical practice
- Combination of demographics, health statistics and ICT indices is vital for developing eHealth strategy for each country