

e-health and Its R&D Activities in Taiwan

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Outline

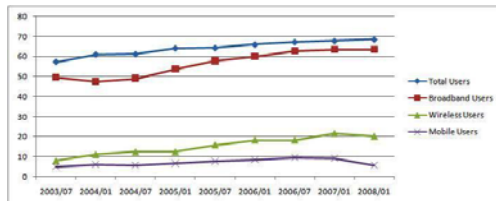
1. Introduction
2. History of e-health in Taiwan
3. e-health R&D in Taiwan
4. e-health R&D in NCKU
5. Future Perspectives



Internet Users Population in Taiwan

— January 2008

- Total Users: 68.51% (about 15.5 million) of Taiwan population
- Broadband Users: 63.37% of Taiwan population
- Wireless Users: 20.27% of Taiwan population
- Mobile Users: 5.81% of Taiwan population
- The percentage of broadband, wireless, & mobile users in recent years:



Source: Taiwan Network Information Center

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Area & Population in Taiwan

- Area: 35,980 km² (ranked as the 140th in the world)
- Population: 23,027,672; (2008/11/11) the second highest population density in the world after Bangladesh



Source: Dept. of Household Registration Affairs, MOI.

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Broadband Wireless & Mobile Networks in Taiwan

- Broadband Network:
 - ADSL: 82.94% of the families with broadband access to the Internet in Taiwan.
 - Cable modem: 7.32% of the families (93% world OEM market)
 - FTTH/FTTB: 800 thousand families (the rate of fiber-laying premises: 9%, the 4th in the world)
- Wireless Network:
 - Wi-Fi: widely available at home. Taipei City has built WIFLY, the Wi-Fi based city network system. (93% world OEM market)
 - WiMAX: base-station infrastructure still in development (the total investment ranks the 2nd of the world)
- Mobile Network:
 - Mobile phone, PDA: about 1150 thousand people

Source: Taiwan Network Information Center



A Brief History of e-health in Taiwan

- 1990 — TANet (Taiwan Academic Network)
- 1994 — NII (National Information Infrastructure) Planning
- 1995 — NII Kickoff, NHI (National Health Insurance) started
- 1996 — NII Pilot Telemedicine projects: Medical Distance Education, Teleconsultation
- 1997 — TANet2
- 1999 — 921 Earth Quake
- 2000 — NTU-PCH (Puli Christian Hospital, Nantou) Telemedicine Project, Joint Network-Clinic Service Center System (NTUH-NCKUH-TSGH)
- 2003 — SARS
- 2004 — TWAREN*, NHI IC Card

* Taiwan Advanced Research & Education Network

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Telemedicine (1/11)

— The Pilot Projects

- Why Telemedicine?
 - Geographic: 75% mountainous area, several groups of isolated islets
 - Limited medical resources in rural areas
 - Physicians are reluctant to practice in rural areas
- Planning started in 1995
- Pilot Project:
 - Medical Distance Education for physicians in rural areas
 - Teleconsultation for patients in rural areas

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Telemedicine (3/11)

— Distance Education, Teleconsultation & Videoconference



Distance Education



Videoconference



Teleconsultation

Source: Dept. of Medical Informatics & Family Medicine, College of Medicine & Hospital, National Taiwan University, Heng-Shuen Chen

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Telemedicine (2/11)

— First Distance Medical Lecture in Taiwan 1995

- via ATM/DS-3
- NTU (College of Medicine), NTHU, NCTU

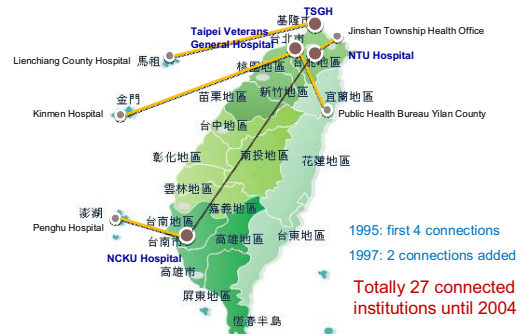


Source: Dept. of Medical Informatics & Family Medicine, College of Medicine & Hospital, National Taiwan University, Heng-Shuen Chen



Telemedicine (4/11)

— NII Teleconsultation Connection

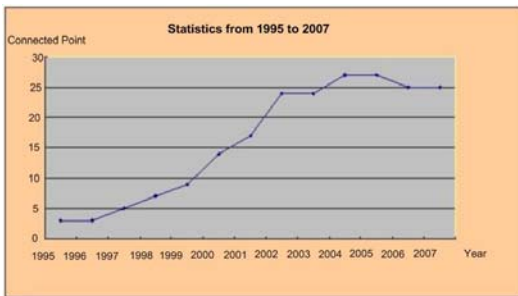


Source: NII (National Information Infrastructure)



Telemedicine (5/11)

— Number of Connected sites



Source: NII (National Information Infrastructure), 林淑美

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Telemedicine (7/11)

— 921 Earthquake Motivated Telemedicine in Taiwan

- Sep 21th 1999, 1:47 AM
- Measured 7.3 on the Richter scale
- 2,415 people died, 29 disappeared, and over 11,000 injury.
- About 110 thousand buildings collapsed, transportation was almost completely destroyed in the area.



Source: Wikipedia, 《大難見真情——921七周年有感》 Link: <http://tinyurl.com/79yu9g>

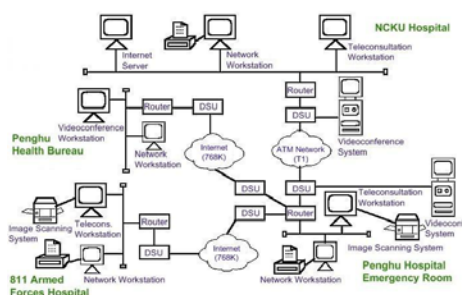
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Telemedicine (6/11)

— NCKUH to Penghu Hospital Connection



Source: Department of Health, Executive Yuan, R.O.C. (Taiwan)



Telemedicine (8/11)

— NTU Telemedicine after 921 Earthquake

- NTU was responsible to reconstruct the health care system of Nantou County, which was the epicenter of the earthquake.
- NTU-PCH (Puli Christian Hospital, Nantou) Telemedicine Project played an important role in relief operations.
- Network Clinics Center (doctor's end, as shown in the slide followed):
 - The Department of Family Medicine, NTUH
 - Puli Christian Hospital
- Network Clinics Remote Sites (patient's end):
 - Puli Health Care Center
 - Aboriginal people tribes in Puli area



Telemedicine (9/11)

— Clinic Devices in Network Clinic Center & Remote Site

Doctor's end

Patient's end



Source: Dept. of Medical Informatics & Family Medicine, College of Medicine & Hospital, National Taiwan University, Heng-Shuen Chen

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Telemedicine (10/11)

— NTUH & NCKUH Joint Network-Clinic Service

- Connected institutions:
 - Puli Christian Hospital
 - Cardinal Tien Hospital
 - Health Center of Alishan Township in Chiayi County
 - Wulai Township Health Office, TCG
 - St. Martin De Porres Hospital
- Via Intranet, Internet, & ISDN
- Joint Network-Clinic Center Online Registration



SARS Grid (2/5)

— SARS in Taiwan

- First SARS patient in Taiwan: March 14th, 2003
- About 307 people were infected, 47 people died.
- July 5th 2003, Taiwan was removed from the Infected Area Listed by WHO.
- Taiwan was/is NOT a member of WHO and has very limited help from the other countries.

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SARS Grid (3/5)

— Objectives

- It provides official, transparent, timely, and accurate information and reports on SARS.
- It provides efficient monitoring for home-bound suspected SARS patients.
- It provides a video teleconference service for medical experts to discuss SARS cases and share diagnosis and treatment experiences.
- It serves as medial data transfer system between hospitals/clinics.
- It provides timely and accurate statistical references to the Government.



Telemedicine (11/11)

— Online Registration of Joint Network-Clinic Service

1. Doctor Selection



2. Registration



3. Data Input



4. Cancellation



Source: Dept. of Medical Informatics & Family Medicine, College of Medicine & Hospital, National Taiwan University, Heng-Shuen Chen

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SARS Grid (1/5)

— About SARS

- SARS: Severe Acute Respiratory Syndrome
- First patient in the world: Nov 16th, 2002 in China
- About 8069 people was infected, 775 people died, around the world.



Source: Wikipedia, TIME Magazine



SARS Grid (4/5)

— Platform



Fig. 1 Historical X rate record



Fig. 2 Case discussion whiteboard

1. New disease Identification;
2. Quick clinical learning/experience sharing.



Fig. 3 Expertise users training during SARS outbreak

Source: National Center for High-Performance Computing, Shu-Hui Hung

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SARS Grid (5/5)

— Results

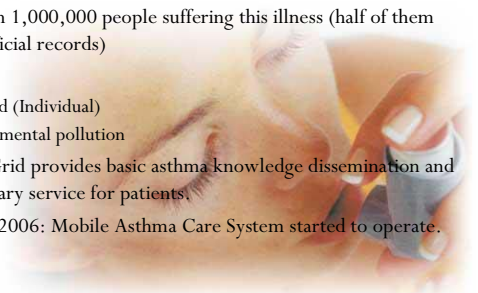
- More than 10,000 registries for SARS monitoring cases within 10 days since its launch;
- 3 Medical Centers/2 SARS dedicated hospitals/4 off-shore local health centers joined the SARS grid;
- 26 SARS patients were benefited, to save 25 lives.



Asthma Grid (1/4)

— About Asthma Grid in Taiwan

- More than 1,200 people died in Asthma in Taiwan every year.
- More than 1,000,000 people suffering this illness (half of them are on official records)
- Causes:
 - Inherited (Individual)
 - Environmental pollution
- Asthma Grid provides basic asthma knowledge dissemination and asthma diary service for patients.
- May 18th 2006: Mobile Asthma Care System started to operate.



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Asthma Grid (2/4)

— Mobile Asthma Care System

- Asthma care via mobile devices
- It provides an easy way for doctors to monitor patient's condition in a real time manner.
- Patients receive timely response on asthma assessment.
- Integrated with a real time weather forecast service to send alerts to patients in order to prevent asthma attack.
- It works in cooperation with Chunghwa Telecom.



Asthma Grid (3/4)

— Network of Asthma Care via Mobile Phone



Source: National Center for High-Performance Computing, Shu-Hui Hung

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Asthma Grid (4/4)

— Asthma Care Mobile Device



Source: National Center for High-Performance Computing, Shu-Hui Hung



NHI IC Card (1/3)

— From Paper Cards to Smart IC Cards

- Mar 1st, 1995: National Health Insurance started in Taiwan.
 - 100% population insured, 18,818 authorized medical institution
 - Old Paper Cards were not secured, and needed to change new cards frequently.
- 1995: NHI Smart IC Card first try in Penghu
- Jan 1st, 2004: NHI IC Cards issued in the whole Taiwan, first in the world.



Source: Bureau of National Health Insurance

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NHI IC Card (2/3)

— More Information

- Includes Name, ID, Photo and other information on it (no need to carry other ID cards).
- Embeds 32K memory, including private medical- records. Protected and can only be read/write by NHI IC card readers.
- Uses High-tech anti-counterfeiting
- Simplifies registration process in medical institutions and enhanced the accuracy of medical data.
- Stays good at least for 5~7 years.



Source: China Times, 范揚光



NHI IC Card (3/3)

— The Influence

- In 2003 (SARS outbreak in Taiwan), NHI IC card was still in its trying in Penghu. The poll showed that 71.8% people agreed that IC card is useful against SARS, and 75% people hoped that NHI IC card could be released as soon as possible.
- Expenses needed for medical institutions to install card readers & related systems, but saving about 42,090 million NTD for replacing paper cards from 2001 to 2009.

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NCKU Healthcare Information System

- Objectives:
 - Provide healthcare services with electronic and mobile technologies.
 - Make the medical services more user-friendly to patients
 - Promote tele-medicine and tele-consultation services.
 - Develop multi-media medical records to replace hard-copy records.
 - Facilitate the networking connection and integration with other medical institutions.

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Three Development Stages

- The earlier stage:
 - Build e-learning platform
 - Build medical service information system for patients
 - Strengthen executive information system
- The middle stage:
 - Develop electronic medical record database
 - Enhance medical information & administration management information system



Three Development Stages

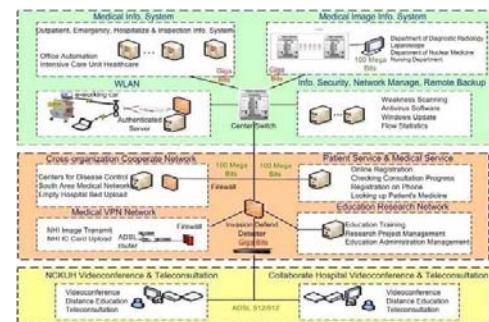
- The later stage:
 - Build expert medical diagnosis system
 - Cross-organizations/institutions networking and database integration
- The final Objectives:
 - Build an ideal healthcare center for patients
 - Build a comprehensive e-health education, research, & service environment

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The Whole Network Structure



Source: Ting-Wei Hou, National Cheng Kung University Hospital



South Taiwan Medical Resource Integration System

- Connect to the regional medical service platform developed by Department of Health (DOH).
- Share e-health resources between medical institutions.
- Referee system for medical services
- Disease reporting chain
- Serious accident reporting system
- National disaster-relief ambulance headquarter

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Electronic Medical Images & Record Databases

- Electronic images: X-ray image, electrocardiogram, chromosome, laparoscope, etc.
- Serve for 24-thousand people, with about 404-thousand images per year.
- Paper free: save the time for developing/printing photos, money and human-resource (about 900 thousand NTD per month).



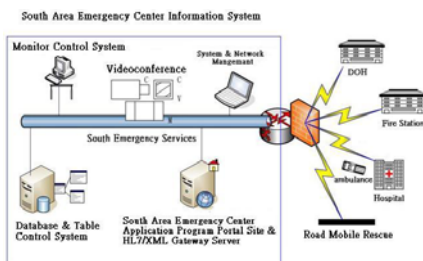
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South Taiwan Emergency Center Information System

- It helps enhance efficiency of rescue and disaster-relief operations
- It handled 277 emergency cases in 2006.



Source: Ting-Wei Hou, National Cheng Kung University Hospital



Research & Education

- The case history image conference
- In-operation video education & research system
- Library education system
 - Class video recording
 - 113 handouts
 - Education training slides
 - 43 education videos
 - Electronic periodical & e-book
 - About 100-thousand people accessing e-data per year.





RFID

- Use a watchstrap-like RFID tag to track psychosis patients.
- Started in 1993, but limited by the battery life and signal loss problem.
- Now plan to introduce new generation Wi-Fi tag system.



Source: Ting-Wei Hou, National Cheng Kung University Hospital

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u-health

- Ubiquitous healthcare (**u-health**)
- Provide healthcare to people **anywhere at anytime** using broadband and mobile technologies.
- Extend the e-healthcare services from medical institutions to home or anywhere **on real-time basis**.
- Provide critical services especially for **elder people who live alone and people in emergency**.

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Assist to the Aged People (1/2)

— Objectives

- With the benefit of u-health care services at home, the elders could be cared just like having a doctor at home.
- u-health forms an important part of Smart Living Technology.
- It provides the services through:
 - Teleconsultation
 - Physiology measurement
 - Video visits/conferences with relatives
 - Distance medical education
 - Medicine safety services
 - Emergency alarming/alerting



Assist to the Aged People (2/2)

— Aged People Emergence Alarming System



Source: Dept. of Medical Informatics & Family Medicine, College of Medicine & Hospital, National Taiwan University, Heng-Shuen Chen

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Unified Electronic Medical Record

- Goals:
 - Offer more informative multi-media content.
 - Put them into NHI IC card with security. Let patients carry them and data can only be read by doctors.
 - Unify the currently widely used two record formats:
 - HL7 (Health Level 7) for medical information exchange.
 - DICOM 3.0 (Digital Imaging and Communication in Medicine) for digital image representation & communication.

Source: Department of Health, Executive Yuan, R.O.C. (Taiwan)

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Unified Regional Teleconsultation & Emergency Networks



Source: NII (National Information Infrastructure)

Thanks for listening!