General development of e-Health

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Course Objectives:

- Concept and Technologies
  - Concept
  - Standardization
  - Technologies
- e-Health experiences in China
What’s e-Health?

**Defined by WHO**

eHealth is the **cost-effective and secure use of information and communications technologies** (ICTs) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research. (Resolution 58/28 of the World Health Assembly, Geneva, 2005)

**Defined by JMIIR**

E-Health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies.

**Defined by Intel**

Intel, referred to e-health as "a concerted effort undertaken by leaders in health care and hi-tech industries to fully harness the benefits available through convergence of the Internet and health care."
What’s e-Health?

Seeing a doctor
What’s e-Health?

Healthcare management
What’s e-Health?

Medical record
What’s e-Health?

Reading medical image
E-Health Standardization in ITU

» E-health standardization has been on ITU-T’s agenda since 2003.
» This work was given further impetus by the WTSA, 2012, which adopted Resolution 78 - Information and communication technology applications and standards for improved access to e-health.

» **Study Group 16** (Multimedia), **Question 28/16**: Multimedia framework for e-health applications

» **Study Group 17** (Security), **Question 9/17**: Telebiometrics

» **Study Group 20** (IoT, smart cities & communities), **Question 7/20**: Performance evaluation frameworks of e-health systems in the IoT.
Other Organizations

IEEE has launched the project: interoperable communications for professional healthcare devices and 3D medical systems since 2014.
- IEEE 11073™ IEEE 11073 Personal Health Device Working Group
- IEEE 3333-2 3D Based Medical Application Working Group


Personal health equipment standards with IEEE.

Remote and medical information system standards.

Built by some related e-Health organizations in April, 2015.
- Formed to enable common, timely health informatics standards by addressing and resolving issues of gaps, overlaps, and counterproductive standardization efforts through.
- Hosted by Health Level Seven International.
Scope

2005

- health-care services
- health surveillance
- health literature
- health education
- knowledge and research

2015

- Medical artificial intelligence
- Internet Hospitals
- Medical sensing equipment

The eG2015 survey was divided into eight thematic subjects, each offering its own perspective on the contribution of eHealth to UHC:

- eHealth foundations
- mHealth
- Telehealth
- eLearning in health sciences
- Electronic health records
- Legal frameworks for eHealth
- Social media
- Big data
# Technologies 1: Cloud Computing

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Medical record data, image data, drug data, equipment data, block chain data.</th>
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<td>Service Layer</td>
<td>HIS Cloud</td>
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<td>Product Layer</td>
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<td>Object storage</td>
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**DaaS (Data as Service)**
- Data mining
- Data Collect
- Data Service
- Data Opening

**SaaS**
- Collaboration
- CRM/ERP/HR
- Finacials
- Industry Application

**PaaS**
- Middleware
- Database
- Java Runtime
- WEB2.0 Application Runtime
- Development Tooling

**IaaS**
- Servers
- Networking
- Data Center Fabric
- Storage
- Shared Virtual, dynamic provisioning
Technologies 2 : Big Data

Medical Big-data: covers the whole life cycle, including personal health data and relates to the medical services, through large data mining modeling, data analysis and processing technology of value.
Technologies 3: AI-Medical image recognition

**Medical image recognition**: Computer vision & Deep learning

**Technologies**

- **Phase A**
  - Multidimensional image fusion

- **Image Recognition**
  - Image preprocessing
  - Image separation
  - Matching & judging
  - Feature extraction

- **Deep learning**
  - Case Database
  - Other medical database

- **Phase B**
  - Convolutional neural network

**Diagnosis effect**

- **CT film**
  - According to lung nodules or lung cancer, the accuracy rate of AI is 50% higher.

- **X ray film**
  - AI can detect a slight fracture of 0.01% of the entire X area.
Technologies 3 : AI-Pathological diagnosis

Pathological diagnosis for cancer

» Demand: Cancer has a certain rate of misdiagnosis;
» Computer Vision: Discovering the details of the human eye that are difficult to detect, and personalize the diagnosis and treatment

Phase A: Processing of large size pathological slices on cell surface

Phase B: pathological changes recognition

Cell differentiation ability
+ Gland condition
+ Mitotic level
Judgement
Technologies 3: AI-Clinical decision support

Current status of electronic medical records (EMR)

» A lot of detailed patient information is stored in free text, which often has ambiguity and many nonstandard descriptions, making it difficult to analyze the data.
Technologies 4: wearable devices

**Wearable devices**: Help people to health management, get real-time dynamic data anytime, laying the foundation for the analysis of large medical data.

- **Dynamic monitoring**
  - Wireless communication module and data analysis system
  - Timeliness of data analysis and persistence of test results
  - Danger warning function.

- **Keeping tracking & analysis**
  - Continual detection of high blood sugar, high blood lipids, high blood pressure, and change bad habits (such as weight loss, smoking cessation), so can help users find the cause, find potential risks, and achieve the purpose of prevention of chronic diseases.
Technologies 5: Block chain constructs a credible medical network environment

» Block chain is a database, a distributed system, a consensus agreement depends on different technical points.

Distributed
- Each node has a backup. A single point of failure does not compromise the integrity of the data.

Smart Contracts
- Everyone related can do something to the data, including the patient.

Consensus
- Data access rules.
- Implements single medical record distribution with multiple private keys;

Immutability
- Changing is ok, hiding the original data is impossible.
- Once the medical data is tampered with, it may cause serious harm.

GEM : Building towards a blockchain network for the global community of companies that take part in the continuum of healthcare.
Course Objectives:

- Concept and Technologies
- e-Health experiences in China
  - Background
  - Applications
  - ICT enterprises’ practice
### Why e-health?

- **Population aging goes fast**: According to statistics, the population aged 60 and above accounted over 16% in 2015, China has entered the ranks of old-type state.

- **Average number of persons per household is dropping**: The average size of family households in China has been shrinking since 1980s. The average size of households was 3.02 in 2012. It brings about the increasing pressure on the aged and the increasing demand for social pension.

- **Health condition changes**: According to government’s data, the prevalence of chronic diseases in our country has increased year by year. There is 260 million confirmed chronic diseases, accounting for about 19% of the total population in China in 2015.
Why e-health?

- **Medical resources are sparse**: According to WHO’s data, the density of physicians and nurses per capita was low compared to developed countries.

- **Unbalanced distribution**: The medical resources in China are concentrated in large hospitals and the health resources for local service are seriously inadequate.

- **Medical insurance payment system has not been equalized**: Medical expenditure is mainly based on the national basic medical insurance, and there are differences between urban and rural areas.
Why e-health?

“Healthy China” has become a national strategy.

“Without national health, there would be no overall well-off society. Health should be integrated into all policies”。

——《 Xi Jinping’s speech at the National Conference on health 》( 19/8/2016 )

General Office of the State Council released the guidance on promoting and standardizing the development of big data for health care on 21/6/2016:

» The national and provincial population health information platform and the national drug recruitment platform will be connected in 2017.

» National medical and health information classification open application platform will be constructed in 2020.
By using technologies to promote telemedicine, pathological diagnosis, remote surgery guidance, telemedicine education, traditional hospitals make their business extend beyond the hospital.
Six e-Health applications in China

- Hospital Information system
- Telemedicine
- mHealth
- Internet hospital
- Artificial intelligence
- Health management
Large scale complex hospital focus on connecting and medical data electronization

- To achieve interconnection and interworking within the hospital information systems and eliminate data islands.
- To achieve unified management through a unified platform integrated all the information systems within the hospital.

Case: CDR integrated platform of Peking University People’s Hospital

**Public service**

- RIS
- LIS
- PIS
- Blood bank
- HIS
- EMR

**EMPI within the hospital**

**EMPI outside the hospital**

- IDS
- Mobile nurse station
- medically examined
- research management
- Image center
- ERP

CDR integrated platform
Primary medical institutions focus on regional interconnection

» Medical community cloud connects to the township hospitals and community health service centers, so as to realize the establishment and coverage of the basic medical service information system, and provide technical support for telemedicine and tiered medical service.

» Application scene: primary hospitals with lower information level which have the demand of regional cooperation.

Case: Medical imaging cloud solution offered by China Telecom

» Launches a full range of medical products By cooperating with Wondersgroup.

» Focus on medical precision providing image cloud services
  • Image storage capability Computing power
  • Access capability
  • Application capability
  • Business Coordination ability
Six e-Health applications in China

- Hospital Information system
- mHealth
- Artificial intelligence
- Health management
- Telemedicine
- Internet hospital
What’s Internet Hospital?

» Internet Hospital has been mentioned in China since 2015.
» It is a new intelligent health care platform, which doctor resources are shared, and is generally patient-oriented service (2C) model.

» The first internet hospital is Guangdong Network Hospital.

1. Have the certificate of a medical institution
   • Engage in diagnostic and therapeutic activities

2. Online diagnosis and treatment behavior should work in coordination with office hospitals.

3. Professional medical staff
   • Medical standards
Overall progress in China

Internet hospital numbers
By 2017.2

» Local government and hospital usually take the lead, enterprises participate in the construction.

Not fully engaged in the medical industry, the profit model is still under exploration

<table>
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<tr>
<th>Pre treatment</th>
<th>During Treatment</th>
<th>After Treatment</th>
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<tr>
<td>• Medical inquiry</td>
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<tr>
<td>• Appointment</td>
<td>Treatment is still rely on traditional medical institutions.</td>
<td>• Chronic disease management</td>
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<td>• Medical electricity supplier</td>
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- Health management
What’s m-Health?

M-health is an abbreviation for mobile health, a term used for the practice of medicine and public health supported by mobile devices.
m-Health Scenarios in China

For doctors

» Medical information
Provide medical information, such as news, expert lectures, case discussion, etc..

» Doctor-patient communication
Help doctors manage patient information, communicate with patients, and provide follow-up and other services.

» Doctor service
More like a doctor communication community.

For patients

» Make an appointment
Using cellphone to make an appointment to a certain hospital.

» Inquiry consultation
Asking for treatment advice online.

» Disease management

Hospitalize through smartphone gradually become the trend of development

Hospitalize through smartphone: Using smartphone app to seek medical advice, including information guidance and mobile payment (with medical insurance).

WeChat & Alipay are both creatively promoting hospitalize with app

Sixty percent over more than 1200 hospitals have already support seeking medical service by WeChat.

Alipay has partnered with more than 400 hospitals nationwide, data show that the future hospital has been serving more than 50 million people.
Six e-Health applications in China

- Hospital Information system
- mHealth
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- Health management
- Telemedicine
**Online health management**

Through online consultation or wearable device continuous monitoring, access to the health of users, dynamic health monitoring of users, and guide their healthy life.

- Sphygmomanometer
- Blood glucose
- Pedometer
- Other wearables

**Diagram Description**

- **Interface 1**: Mobile intelligent terminal
- **Interface 2**: Personal health management platform
- **Interface 3**: Medical analytical equipment

Connections:
- 3G
- Wi-Fi
- 4G
- TCP/IP

**Hardware Devices**

- Xiaomi focuses on personal healthcare management using Xiaomi hardware as an entry.

**Devices**

- **Smart bracelet**
- **Smart blood pressure meter**
- **Cellphone**
Chronic disease management in China

A whole chronic disease management system has been built in community hospitals in China.

Chronic disease management solution offered by Tencent.

» Tencent Inc officially launched the "Teng Love Medicine" strategic plan in 2016.
» To build "Internet plus medical" open platform
» To build China connector medical industry and the internet.
Six e-Health applications in China

- Hospital Information system
- Telemedicine
- Internet hospital
- mHealth
- Health management
- Artificial intelligence
Medical artificial intelligence has many applications.
Medical artificial intelligence has many applications.

**Baidu launched Baidu medical brain in 2016.**

Application area: Provides intelligent assistance for online inquiry, makes user profiles for patients and help patients to manage their chronic disease.

**Translate voice into EMR directly**

An APP called “Yunzhisheng” has been used in a hospital in Anhui Province, which can record the doctor's instructions directly and make them into an electronic document.
Six e-Health applications in China
What's telemedicine

Telemedicine is the use of telecommunication and information technology to provide clinical health care from a distance.

- Medical management standards should be followed
- Higher technical standards are required
Telemedicine is an effective way to realize hierarchical medical in China

70% patients go out to seek medical advice in China

Guiding Opinions of the General Office of the State Council on Propelling the Building of a Hierarchical Diagnosis and Treatment System》〔2015〕No.70，2015-9-11

- Consultation rate within county: 90%
- Proportion of medical treatment in local hospitals: 65%
- Critical diseases treated with county: 2/3
Telemedicine application in China

Five tier telemedicine architecture has been built by First Affiliated Hospital of Zhengzhou University in Henan Province of China.

- **Huawei** offers the whole project resolutions and all the video devices.
  - TE30-C-720P
  - ViewPoint 9030 720P

- **Huawei** offers the big-data platform.
What do we do?

Internet Healthcare industry alliance (IHIA)

» To build a supply-demand contact platform and promote industrial development in many ways.

» Committed to the construction of medical cloud computing, large data and artificial intelligence standardization system, to carry out the relevant services credible type selection certification.

» IHIA has published a series standards of Trusted Medical Computing standards.

» IHIA has launched a project called “Medical intelligent auxiliary diagnosis large data platform”.

Ministry of Industry and information technology
Health and Family Planning Commission

CAICT
Medical Center

Enterprises: HITs, ICTs, etc.
Hospitals, other institutions.

Medical
Cloud

Infrastructure
layer

Service
layer

Part1 Medical image cloud
Part 2 Telemedicine cloud
Part3 ECG cloud
Part4 Pathology cloud
Part5 Health management cloud
Part6 HIS cloud
Part7 LIS cloud

Medical
Cloud
What do we do?

Internet medical system and application of national engineering laboratory

» Authorized by the national development and Reform Commission
» Built by CAICT, China Mobile, Huawei, hospitals, etc.
» CAICT is responsible for the construction of the internet medical testing and verification center, the internet medical policy and standards research center

e-Health test verification center
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Photo:
Thanks!

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