eHealth: A New Economic Growth Point, A New Gold Mine

Xiujun GONG
(gongxj@tju.edu.cn)

School of Computer Science and Technology
Tianjin University
Outline

Definitions and contents

Current status in oversea

Opportunities in China

Our solutions

Conclusion

- What is the eHealth
- Some acronyms
- Related disciplines
- Application areas
What is the e-Health: definitions

Wikipedia: 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. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology.

Source: Gunther Eysenbach, J Med Internet Res 2001;3(2):e20
What is the e-Health: definitions

- **WHO**: eHealth is the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research.

  source: WHA58.28, May 2005

- **EC**: eHealth is the use of modern information and communication technologies to meet needs of citizens, patients, healthcare professionals, healthcare providers, as well as policy makers.

  source: http://ec.europa.eu/, May 2003

- "eHealth = Medicine + Communication + Information + Society"

  source: http://yi.com/home/EysenbachGunther/
A different vision emerging

eHealth is the purposeful application of technology integrated with professional knowledge and individual talents designed to achieve health outcomes and accomplish personal goals.

It is Not just the ... device
... web page
... infrastructure
... ... ...
What is the e-Health: some acronyms

**ENGLISH words**

- e-Health
- Medical Informatics
- Public Health Informatics
- Biomedical Informatics
- Health Informatics
- Clinical Informatics
- Biomedical Computing
- Dental Informatics
- Nursing Informatics
- Clinical Bioinformatics
- Bioinformatics
- Neuroinformatics
- Genomeinformatics
- Molecular Informatics
- Chemoinformatics
- Pharmainformatics
- Computational Biology
- MI, BI, BMI, HI, CI, PHI, NI, GI, DI, NI, MI, CI, PI, CB, BMC...

**Chinese words**

- 数字健康
- 电子健康
- 公共健康
- 医疗信息学等
eHealth: a inter across discipline

1. Medical Informatics (MI)
   - citizen, patient and population informatics
   - Electronic Health Records
   - Decision Support Systems
   - Terminologies, ontologies
   - Telemedicine and telecare services
   - Health information networks
   - Interoperability of systems

2. Bioinformatics/Genomics (BI)
   - molecular and cell informatics
   - Structural Genomics
   - Functional Genomics
   - Proteomics
   - Biochip Technologies
   - Computational Biology

3. Neuroinformatics (NI)
   - cell to organ informatics
   - Biosignal Analysis and Pattern Recognition
   - Neuro Algorithms
   - Neurocell Technology
   - Human Computer Interfaces
   - Machine Learning

Example: Advancing into the molecular causes of diseases: Genomic Medicine
Example: Informatics in support of the next generation of brain research: Molecular Neuroscience
Example: integration of genomic and neuroscience databases: Neurogenomics

Medical Sciences
Biological Sciences
Behavioral Sciences
Social Sciences
What is the e-Health: its scope

- Bioinformatics
- Medical Imaging
- Medical Informatics
- Public Health Informatics

Public Health Informatics

Medical Informatics

Genome Epidemiology

Medical Imaging

Health information levels

Bioinformatics

INFORMATICS

Molecular

Tissue, organ

Patient

Disease

Public Health
What is the e-Health: its aims & objectives

- Improve quality of life
  - save lives
  - reduce patient discomfort
  - reduce medical errors

- Control of cost
  - demographics -- aging population
  - increasing fraction of GDP
  - healthcare growth in developing countries

Proportion of population aged 60 and over

Healthcare spending USA (% of GDP)

- More developed regions
- Less developed regions

--- | --- | --- | --- | --- | ---
5.2% | 7.3% | 10.9% | 13.0% | ~17%
Key application areas of e-Health

- Electronic Medical Records (including patient records, clinical administration systems, digital imaging & archiving systems, e-prescribing, e-booking)
- Telemedicine and telecare services
- Evidence Based Medicine
- Decision support tools
- Health information networks
- Internet-based technologies and services
Major ICT advances still to come enabling:
- From Genomics to Proteomics (Physiome)
- Virtual Organs (simulation)
- Non Invasive imaging (Beyond C.scan, MRI, PET)

Integration of emerging ICTs into Health Care
- Empowering the individual
- Preventive
- “Next” generation monitoring (independence)

New e-Health markets emerging (e.g. elderly)

Plenty of privacy / security / cost / liability issues!
Outline

- Definitions and contents
- Current status in oversea
- Opportunities in China
- Our solutions
- Conclusion

- Government-level efforts
- Enterprise-level efforts
National efforts:
- National architecture: National Health Information Network (NHIN)
- Standards development: HIT Standards Panel
- Technology certification: Certification Commission on Health Information Technology (CCHIT)
- Federal board: American Health Information Community (AHIC)

State-level efforts:
- Regional and state information sharing projects
- Shared infrastructure
- HIE organization and governance
- Encouragement of increased EMR and HIT adoption

Federal-state partnership efforts:
- Security & Privacy collaboration (HISPC)
- 4 AHIC workgroups, 5 breakthrough projects:
  1) Biosurveillance: ER data for public health
  2) Chronic Care: Secure messaging
  3a) Consumer Empowerment: Electronic registration summary
  3b) Consumer Empowerment: Electronic medication history
  4) Electronic Health Records: Lab data
Categories of Common e-Health Projects

- Record Locator & Master Patient Index
- Clinical Messaging
- Medical and/or Drug History
- Disease Reporting or Registries
- Regional/State Health Data Exchange
- Electronic Prescribing
- HIT Grant Programs
- Hub for Administrative & Financial Transactions
- Creation of Statewide e-Health Network

Regional/State Health Data Exchange

Electronic Prescribing

HIT Grant Programs

Hub for Administrative & Financial Transactions

Creation of Statewide e-Health Network

Clinical Messaging

Medical and/or Drug History

Disease Reporting or Registries
Coordinating organization facilitates rules of engagement:

- Data-sharing Agreement
- Legal Framework
- Standards
- Interoperability
- Transparency
- Value
- Quality/Cost

Broadband % of Access, Stakeholders, Automation

Framework for Trust and Collaboration

EMR / EHR/PHR Implementation

Structured notes & Paper Records

Administrative Transactions (claims…)

Secure Clinical Messaging (labs, imaging, email….)

E-prescribing Roll Out

H.I.E.
eHealth in EU - Overall Strategy

- From ‘late disease’ to ‘early health’
- From ‘hospital-based’ to ‘patient-centred’
- Two main areas:
  - Preventive medicine
    - Chronic disease management
    - Empowering the patient (training, monitoring ..)
  - Predictive medicine
    - Molecular medicine
- Increasing multidisciplinarity
  - Strong cooperation with DG RTD and DG SANCO
- Sustainability of healthcare systems
eHealth Vision

Through all the stages

Across all the points of care

Prevention
Diagnosis
Care
Rehabilitation

How: Sharing information

Tools: Electronic health records,
Regional health information networks
ICT for Health Activities

- ICT for health programme established in 1989, supported to date over 500 projects, worth more than 1 Billion Euro
- Major focus in 90’s: Regional Health Information Networks, electronic Health Records, Homecare/telemedicine
- Today’s activities: The 4 Ps:
  - Deployment – Improving Access, Quality and Productivity
  - Mid term research – Preventive & Personalised medicine
  - Long term research – Predictive medicine
STEP #1: Link the healthcare institutions and provide applications to/for health professionals (R&D Focus 1991-1998)
STEP #2: Link the homes of people and social care centers (R&D Focus 1999-2002)
STEP #3: Link the people with the health Infrastructure/services (R&D focus since 01)
STEP #4: Understanding the endogenous determinants
And integrating them with other health related information
HealthGrid

An environment, created through the sharing of resources, in which heterogeneous and dispersed health data:

- molecular data (ex. genomics, proteomics)
- cellular data (ex. pathways)
- tissue data (ex. cancer types, wound healing)
- personal data (ex. EHR)
- population (ex. epidemiology)

as well as applications, can be accessed by all users as a tailored information providing system according to their authorisation.

Computing Grid
For data crunching applications

Data Grid
Distributed and optimized storage of large amounts of accessible data

Knowledge Grid
Intelligent use of Data Grid for knowledge creation and tools provisions to all users
FP6 projects

  Wearable systems (intelligent textiles) for prevention, early diagnosis and management of cardiovascular diseases

- OFSETH ([www.ofseth.org](www.ofseth.org))
  Textiles with optical sensors for physiological monitoring

- HEARTFAID ([www.heartfaid.org](www.heartfaid.org))
  Knowledge-based platform for heart failure management

- SMARTHEALTH ([www.smarthealthhip.com](www.smarthealthhip.com)) and MICROACTIVE ([www.sintef.no/microactive](www.sintef.no/microactive))
  Point of care devices for cancer screening (breast, cervical and colorectal cancer)
WP 2007-2008: eHealth financial support ~ 180 M€

One challenge: **Towards sustainable and personalised healthcare**

Defined as a set of three objectives

- **Personal Health Systems for Monitoring and Point of Care diagnostics** (72M€)
- **Advanced Risk assessment and Patient safety** (30M€)
- **Virtual Physiological Human** (72M€)
Microsoft Common Health Framework: CHF
Healthcare Transformation through Technology

Improved Outcomes for Patients, Clinicians and Governments

- **Lifetime Clinical Record**
- **Long Term Condition Management**
- **Outcome Based Funding**
- **Service Delivery Reform**
- **Disease Surveillance**

- **EMR/E Prescribing**
- **Community EMR**
- **Data Aggregator**
- **Tele Medicine**
- **Real Time Data Consolidation**

- **MPI**
- **LCR**
- **BI Engine**
- **Health ID Cards**
- **Deployment System**

- **Information Hub**
- **Electronic Referrals**
- **Visualization and Analysis**
- **Genomic Medicine**
- **Mapping**

- **Clinical Messaging**
- **Clinical Decision Support**
- **Clinical Coding**
- **Call centre & online Triage**
- **Community Data Collection**

- **PACS**

---

**National - State - Local - Patient**

- **Developed - Emerging - DRE Healthcare**

**Microsoft Value**

- **Connected**
- **Productive**
- **Best Economics**
- **Dependable**

**Independence**

- **Mobility, Remote Access, inclusion**

**Information**

- **Messaging, Portals, Real-Time collaboration, Business Intelligence, ERP**

**Integration**

- **Interoperability and Orchestration**

**Identity**

- **Single Sign On, Role Based Access, Privacy, Federated Identity**

**Infrastructure**

- **Systems Management, Directory, Security, Disaster Recovery, Business Continuity**

**Industry Standards**

- **Respect for Privacy**
- **Improve adoption**
- **Leverage legacy apps**
- **Scalable and robust**

---

**Disease Surveillance**

- **Real Time Data Consolidation**
- **Deployment System**
- **Mapping**
- **Community Data Collection**

**Disease Management**

- **Community EMR**
- **Data Aggregator**
- **Tele Medicine**
- **Real Time Data Consolidation**
- **Deployment System**

**Clinical Decision Support**

- **Clinical Coding**
- **Call centre & online Triage**
- **Community Data Collection**

**Clinical Coding**

- **Call centre & online Triage**
- **Community Data Collection**

---

**Developed - Emerging - DRE Healthcare**

- **Microsoft Value**
- **Connected**
- **Productive**
- **Best Economics**
- **Dependable**

**Independence**

- **Mobility, Remote Access, inclusion**

**Information**

- **Messaging, Portals, Real-Time collaboration, Business Intelligence, ERP**

**Integration**

- **Interoperability and Orchestration**

**Identity**

- **Single Sign On, Role Based Access, Privacy, Federated Identity**

**Infrastructure**

- **Systems Management, Directory, Security, Disaster Recovery, Business Continuity**

**Industry Standards**

- **Respect for Privacy**
- **Improve adoption**
- **Leverage legacy apps**
- **Scalable and robust**
IBM: “Better information for better health”

- Improve the effectiveness, safety and cost of medical care through better diagnosis, treatment and operational efficiency
- Translate molecular biology research into medical care
- Develop new, more effective, drugs faster and cheaper
- Understand biological systems with predictive models
Other enterprise efforts in EU

- **Philip:**
  - Hardware etc
  - HeartCare Telemedicine Services

- **Intel:**
  - **Intel's** digital health group

- **Oracle**
  - Healthcare Transaction Base

- **GE, Simons, INFINITTT (from Korea) .etc**
The Continua Health Alliance

A non-profit, open industry alliance of the finest healthcare and technology companies

Its mission is to establish an ecosystem of interoperable personal health systems

Launched on June 6th 2006. 22 companies, Rapid growth, 60+ companies, 350 members

http://www.continuaalliance.org/
Outline

- Definitions and contents
- Current status in oversea
- Opportunities in China
- Our solutions
- Conclusion

Current status
- Related activities
- Keynotes speaker
- Case studies
我国医疗信息化建设处于第一阶段与第二阶段之间

• 建设了医院信息系统(HIS)的医院，仅占被调查医院的31%；
• 省级医院建设HIS的比例达到84%，地市级医院建设HIS的比例为37%，县级医院为34%；
• 85%的医院信息系统是以财务核算为中心的管理信息系统(MIS)，10%的医院开始探索建立以医生工作站为核心的临床信息系统(CIS)，5%的医院正在探索建立PACS系统。

来源：人民邮电报 2006年6月22日
China investment in medical IT fields

2007 年医卫行业 IT 产品投资结构预测

2005年  2006年  2007年

数据来源：CCW Research, 2007/1
组织委员会：由信息产业部、卫生部、科技部和国家人口与计划生育委员会有关主管部门的司（局）级机构负责人，中国电子学会负责人组成。

主办方：中国电子学会

研讨会主席：吴祈耀，国家863项目现代数字医疗核心装备和关键技术研究课题组组长，中国电子学会医学工程专家委员会主任委员，中国仪器仪表学会医疗仪器分会理事长，北京理工大学教授

主任委员：萧绍博，国家863项目现代数字医疗核心装备和关键技术研究课题组副组长兼电子健康专题组组长，中国电子学会医学工程专家委员会副主任委员，中国仪器仪表学会医疗仪器分会副理事长，北京理工大学教授

专题报告：
- 电子健康的国际历史、现状与未来发展趋势
- 中国电子健康发展与数字化医疗
- 医院、社区卫生、计划生育信息化与电子健康
- 电子健康的技术支撑：电子病历、电子健康档案、数字医疗装备
中国制造业信息化数字医疗装备高新企业CEO论坛

♦ 国家科技部高技术研究发展中心与863计划机器人技术主题专家组共同召开

♦ 特邀报告
  - 对加速我国医疗器械产业发展思考，北京理工大学 吴祈耀
  - 电子健康（eHealth）：我国产业发展的战略机遇，国家人口与计划委员会 萧绍博
  - 国内外医疗机器人与MEMS的发展及应用，北京航空航天大学 王田苗
  - 对我国三级医院核心技术装备的现状分析及未来发展的建议与思考，首都医科大学附属北京朝阳医院 李宁
  - 国家863课题—数字化医疗核心装备和关键技术研究友通公司 趋鲁民
充分发挥信息网络的优势，优化配置和共享优质医疗资源，在全国实现各城市居民和个人健康档案与临床信息融为一体的医疗信息系统；

建设公共卫生和国民健康信息管理体系；

建立突发事件预警和应急处理系统；

要利用现代信息技术解决我国医疗卫生资源短缺且利用率不高、医疗服务不均、医疗成本高、医疗服务效率不能满足需求等问题。

-卫生部信息中心副主任高燕婕
推广电子病历，辅助诊断，为各医疗机构共享数据提供基础支持；
医疗机构的相互无间合作与数据共享，提高医疗效率，降低医疗事故率；
开展远程医疗，实现医疗资源的最优配置与利用；
电子保健，通过多元、立体、网络等手段提供给居民定制化的健康知识和健康指导，预防疾病，提高居民生活质量；
相关服务和公共健康状态的监控和评估

---国家发改委宏观经济研究院研究员曾红颖
EHR/EPR领域的五项热门技术

- 语音识别：笔者2004年曾在HIMSS会议上见到语音识别用于放射报告的尝试，效果并不是很好，而电子病历的语音识别要比放射报告困难得多。因为放射报告识别符合“有限应用领域，长术语词汇”的原则，而电子病历内容涉及范围极广，变成了通用语言识别问题。

- 临床决策支持：支持循证医学检索查询，提供多种疾病权威的临床诊疗指导（Guideline）。

- 知识库：支持临床报警功能和复杂模板应用，用户可以自己整理临床诊疗指导（practice guideline）和临床路径（clinical pathway）。国外非常重视这类问题的研究，每年都有很多文章发表，国内则更多的是“务虚”，未见实实在在的工作。

- 系统集成：一个独立的EHR/EPR系统必须有很强的集成能力，因为需要连接众多其他子系统以便数据共享。

- 远程及移动医疗：包括基于Internet网络的远程访问以及掌上电脑的应用，以便充分支持移动远程医疗。

北京大学人民医院信息中心主任 何雨生
引进电子健康是人口与健康事业发展的必然选择，是卫生和健康事业（大卫生）发展的必然趋势。但迄今为止，国际上尚未形成统一的标准，我国及时进入，可以及时取得国际标准的话语权，避免将来的被动。

关于推进电子健康及相关产业的策略考虑

- 将数字化医疗设备作为实现数字化、网络化、智能化的电子健康体系的核心技术进行部署
- 按国情制定国家技术标准，通过高质量的医学群体科研建立高技术医疗设备的国人应用标准
- 发挥政府与市场两个积极性

国家人口与计划育委员会 萧绍博
Outline

- Definitions and contents
  - Two analogues
  - Proposed solutions
  - Related achievements

- Current status in oversea
- Opportunities in China
- Our solutions & achievements
- Conclusion
Integration of Bioinformatics resources

Biological data & tools
- SwissProt
- PDB
- FASTA
- Blast

Resource storage

Analysis workflow

Resource sharing

Comm. infra.
- TME
- PluginTool
- TextBrowser
- ASR

Information service
- Metadata mgnt
- Wrapped Program Toolkits
- Active Service Provider
- Filter mgnt

Service assistant

Application resource
- Bio-data
- Workflows
- Bio-program

Internet/Intranet/Grid community

3D+ Framework for eHealth

Health Knowledge

Neroinformatics

Bioinformatics

Public health

healthcare

Disease

Device

Connectivity

Decision making

ICT

Cont. Unders.

Hospital

Patient

community

Serviced agent

Diagnosis

Treatment

RFID

Internet

Wireless

Sensor

Grid

Predictive medicine

Knowledge fusion

Supporting

Personal health

Social health

Prediction
Three steps to eHealth

- Network connectivity
- Knowledge sharing
- Decision making
- Public health

- Content understanding
- Decision supporting
Our achievements

- Information infrastructure: Grid-based infrastructure, wireless adhoc network
- Data/tool integration: Ontology, Bioinformatics data integration;
- Secure & Privacy-protected data analysis;
- Decision Support Systems
- Wireless & Sensor Network devices;
- Video conference
Outline

- Definitions and contents
- Current status in oversea
- Opportunities in China
- Our solutions
- Conclusion
Conclusion

Promote public health by ICT

- Technology
  - Instruments
  - Networks
  - Decision support
  - Content understanding

- Protocol/Policy
  - Coordination
  - Sharing protocols
  - Standardizations
  - Adoptions

Sharing

All win
Thank You!