International Collaborative Research in eHealth

A/Prof Pradeep Ray
Director, Asia Pacific u-Health Research Centre (APuHC)
University of New South Wales, Australia
Email: p.ray@unsw.edu.au
http://www.apuhc.unsw.edu.au
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  – Overcoming Infrastructure Problems
• eHealth from the Perspective of Developed Economies
  – Privacy Issues from the Perspectives of Consumer, and eHealth Service Providers
  – Chronic Illness Management
• eHealth from a Global Cooperation Perspective
  – Pandemics and International regulatory environment
  – Knowledge Management (semantic interoperability)
The International Perspective

• Developing Countries
  – No healthcare in remote communities
  – Poor infrastructure
  – Role of Wireless Mobile Technologies
  – ITU-D Mobile Health for Developing Countries
  – WHO Research on Assessment of e-Health

• Developed Countries
  – Home-based Tele-Healthcare
  – Broadband Wireless Infrastructure
  – Healthy Life Initiatives
  – IEEE Healthcom
  – International u-Health Initiative
Developing Country Perspective

- eHealth Initiative of the ITU-D
- Ongoing work in Remote Asian Regions (e.g., Bhutan)
- ITU-D/IEEE Mobile eHealth Initiative for Developing Countries
- eHealth kiosks based on various communication technologies (satellites/mobile phones/PDAs)
Difficult Terrains in Bhutan - Difficulty to Transport Patients to Referral Hospitals
Tele-Medicine Session in India
ITU-D/IEEE Mobile eHealth Initiative for Developing Countries

- Joint Effort of ITU-D Q14 and IEEE started in 2004 (consortium of twenty countries)
- Use of Mobile Wireless Technologies for supporting eHealth for applications, such as
  - Emergency Telemedicine
  - Epidemic Control
  - Combating Bioterrorism
Internet-based eHealth System
Tsunami Affected Areas in Aceh, Indonesia

The Internet

- Internet through JCSat satellite
- Wireless/Microwave LAN

AI3 Unsyiah

Medical Faculty Unsyiah

DKK Banda Aceh

Zainal Abidin Hospital

e-Health Kiosks (mobile units)

- Kiosk #1
- Kiosk #2
- Kiosk #3
- Kiosk #n
Lessons Learned

• The eHealth system in Banda Aceh worked only between 2-5AM due to the heavy congestion in the GSM Network
• The eHealth kiosks were used by Doctors and nurses for e-Learning, NOT for tele-consultation or patient diagnosis
• The Laptop based eHealth kiosks not suitable for m-Health; Mobile phone based systems needed
Developed Country Perspective

• Privacy and Compliance Issues
  – eHealth Privacy from Consumer Health Perspective
  – eHealth from Healthcare Service Provider Perspective

• Ageing Population
  – Chronic Illness Management
Consumer Health covers

- Health Condition or disease - Elderly Care, Diabetic Management, Cardiac Rehabilitation
- Health Plans: Insurance, Medicare
- Prescriptions
- Quality of Care – Information on disease prevention, education
- Smoking and alcohol related facts
- Obesity Control
- Surgery – Information while planning for surgery
Legal Requirements

Fair Information Practice Principles

- Notice/Awareness
- Choice/Consent
- Access/Participation
- Security/Integrity
- Enforcement

HIPAA 1996

Health Insurance Portability and Accountability Act

COPPA 1998

Children’s Online Privacy Protection Act

AS/NZS 7799.2

National Privacy Principle

NPP

12
Privacy and Technology

P3P

Notice

Collect Consent

Enforce Privacy Policy

Audit Compliance
Privacy from Healthcare Provider Perspective

• Collaboration between healthcare professionals.

• Issues
  – Accuracy of patient information
  – Interoperability
  – Security
Multi-Agent Architecture

**Agents** – autonomous software entities

**Multi-Agent System** – multiple agents cooperate within an environment to reach a desired goal

**XML** – Used to encode queries and translated EHRs
Intelligent Knowledge Management
Chronic Illness Management

- Knowledge Management
  - Software Agents driven by Ontologies
    - Ontology Mapping
    - Ontology Structuring
    - Ontology Development
  - Ontologies for different chronic illnesses, such as cardiac, renal and other chronic conditions
International Cooperation Perspective

• More and more international cooperation needed across countries and regions for:
  – Disaster Management
  – Pandemic response
  – Climate Control

• Barriers include different regulatory, cultural, linguistic and regulatory environments in different countries
International Perspective
Major Elements

Stakeholders / Communities:
1 – Intelligence Agencies, Law Enforcements, ...
2 – Researchers, Scientists, ...
3 – Public, Farmers, ...

Events:
A – Traditional Terrorist Attacks
B – Bioterrorism
C – Natural Outbreaks
Solution Strategies

- International Cooperation and Interoperability strategies, such as CDC Public Health Information Network
- Regional ubiquitous Network Centre (u-NC) for eHealth Management
- Regional Geographical Information Systems for the management of public health
- Ontology driven Intelligent Situation Management techniques for Interorganisation business processes
U-Health NetCentre (uNC)

The uNC combines skilled personnel with a powerful set of networking tools and applications to provide users with valuable resources for network management, pandemics, research and planning.
Visualisation – Hot Zone
APuHC Research Directions

- Asia Pacific ubiquitous Healthcare Research Centre (APuHC) with nodes in Australia, Taiwan, India, USA and South Korea
- Development and Evaluation of m-Health Kiosks based on Wireless Mobile Technologies
- Development of Ontology-Based Multi-Agent Systems
- E-Health for intelligent Care (iCare)
- Assessment of e-Health for Health care Delivery (WHO eHCD)
- Networked BioSecurity Framework
APuHC-UNSW Research Programs

1. Cooperative Management and Semantic Interoperability- attracted 6 (including four ARC) Research grants since 2000 with UNSW (CSE), WCH (Aust), CGU, SNHU, SJSU (USA)

2. Service Level Management and icare- attracted 5 (including one ARC, one international and 1 industry) research grants since 2004 with NCCU (Taiwan), IBM-Global, Netstar (Aust), UC-Irvine, RPI (USA), I2R Singapore

3. E-Health Systems Surveillance, Security and Evaluation- attracted 2 (including WHO and ITU-D initiatives) since 2005 with NTU (Taiwan), Netstar (Sg) and six developing countries (India, China, Vietnam, Sri Lanka and Philippines)
Strong need for Formal Assessment

- Need evidence of software effectiveness in terms of factors, such as:
  - Cost
  - Quality and safety
  - Access
  - Acceptance by Physicians, and healthcare workers
  - Acceptance by Patients
Objective of WHO eHCD Study

- Development of research methodology to uplift the concept of “evidence-based research practices” acceptable to the scientific community
- Development of research instruments for the assessment of “e-Health preparedness” for e-health implementation and practice
- Reducing “digital divide” (Parent et al, 2001) between developed and developing world in primary healthcare sectors
- Participant countries: India, China, Vietnam and Philippines
EVALUATION OF E-HEALTH SYSTEMS IN PRIMARY HEALTHCARE

DATA COLLECTION & ANALYSIS

- **Data collection by researchers at Health Centers**
  - Pre- & Post-test periods
  - Standardized template for data recording
  - Data recorded for each event into a database (e.g., patient or specimen presentation/referral/physician log in etc.)

- **Data Analysis by Principal Research Investigator**
  - Change in value for specific health outcome indicators (Pre- vs Post- test)
  - Statistical analysis using standard software (e.g., SPSS)
MULTI-METHOD EVALUATION

(A). QUANTITATIVE METHOD

- Controlled Evaluation
  (for specified quantifiable outcome indicators)

  Pre- & Post-test study design

(B). QUALITATIVE METHOD

- Developmental Evaluation
  (for impact of local contextual factors)
### E-HEALTH PILOT PROJECTS TO DEMONSTRATE BENEFITS

<table>
<thead>
<tr>
<th>E-HEALTH TOOL/SYSTEM</th>
<th>Electronic Health Records (EHR)</th>
<th>Electronic referrals</th>
<th>Teleconsultation (Internet based)</th>
<th>E-learning Modalities - Dermatology, ECG, Radiology, Histopathology, Teleconsultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT #</td>
<td>1</td>
<td>2</td>
<td>3 to 6</td>
<td>7</td>
</tr>
<tr>
<td>RESEARCH FOCUS</td>
<td>Cost-effectiveness</td>
<td>Pt Referral patterns</td>
<td>Training effects</td>
<td>Pt Referral patterns</td>
</tr>
<tr>
<td></td>
<td>Clinical communication</td>
<td>Clinical</td>
<td>Clinical skills &amp; capacity</td>
<td>Utilization by healthcare professionals</td>
</tr>
<tr>
<td></td>
<td>Pt Access</td>
<td>Travel costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIFIC OUTCOME</td>
<td># Identifiable &amp; Complete records</td>
<td># &amp; Type of Referrals (specialization?)</td>
<td># &amp; Type of Diagnostic errors (specialization?)</td>
<td># Log Ins (Total)</td>
</tr>
<tr>
<td>INDICATORS</td>
<td># Pt/day/physician</td>
<td># &amp; Type exchange</td>
<td># Errors avoided</td>
<td># &amp; Type exchange</td>
</tr>
<tr>
<td></td>
<td>Time/Physician</td>
<td>Pt travel costs</td>
<td></td>
<td>Time/Log In</td>
</tr>
<tr>
<td></td>
<td>Time spent for medical info.</td>
<td>Pt access to specialists</td>
<td>Pt access to specialists</td>
<td># Response to prompts</td>
</tr>
<tr>
<td></td>
<td>Recording Retrieval Identification</td>
<td></td>
<td></td>
<td># No response to prompts</td>
</tr>
<tr>
<td>EXPECTED OUTCOMES</td>
<td>↑ # complete &amp; identifiable records</td>
<td>↑ Communication</td>
<td>↓ Diagnostic errors</td>
<td>↑ Communication</td>
</tr>
<tr>
<td></td>
<td>↓ Time for acquiring medical information</td>
<td>↑ Access to specialist services</td>
<td>↑ Diagnostic skills &amp; capacity</td>
<td>↑ Access to specialist services</td>
</tr>
<tr>
<td></td>
<td>↓ Pt travel costs</td>
<td></td>
<td></td>
<td>↑ Use of online learning materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>↑ Evidence based practice</td>
</tr>
</tbody>
</table>

- E-HEALTH
- EHR
- E-learning Modalities
- Internet based
Research outcome 1: Modeling e-health scenario
Research outcome 2: Qs. Generation & Data collection framework

Background info
- EPR, e-Ref
- Tele-conf
- E-learning
- ICT infrastructure

**Category-1**
Admin. #1-8

**Category-2**
doctors #1,2,7

**Category-3**
doctors #3-6,7

**Category-4**
doctors #8

**Category-5**
ICT staff. #1-8

Qualitative data

Quantitative data (admin, physicians, ICT staff)

WHO

Node (PI) (Analysis)

Sub node (CI) (Country-specific)

Local interviewer

PHC
Longitudinal Global Study on Assessment of m-Health

- Study Period: 3 years from 2009
- Scope: Global, 10-12 countries representing all continents
- Methodology: Pre and Post Study as in eHCD Project
- Mobile Platform: PHR/EHR based on wireless mobile devices (PDAs /cellphones)
- Partners: 10 academic institutions, 3 industry partners and global organisations (ITU, WHO)