Developments in Health Technology and Health Information: Challenges, Opportunities and Directions for Health Informatics

Anthony J. Maeder PhD FIEAust SMACS

Professor in Health Informatics
School of Computing, Engineering and Mathematics
University of Western Sydney
Health Informatics: Perspective
Health Informatics: Knowledge Domain

Health System Organisation & Policies

Health Informatics “Body of Knowledge”

Clinical Knowledge & Methods

ICT Knowledge & Methods
Health Informatics: Levels of Complexity

- **Information**
  e.g. electronic health records, population health, smart home

- **Decisions**
  e.g. assessments, medications, health status

- **Systems**
  e.g. chronic disease management, team/community based care
### Health Information: Daily Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting on Chair</td>
<td>Chair</td>
</tr>
<tr>
<td>Sit-to-Stand</td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td></td>
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<tr>
<td>Walk-to-Sit</td>
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<tr>
<td>Sitting on Bed</td>
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<tr>
<td>Sit-to-Lie</td>
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</tr>
<tr>
<td>Lying</td>
<td></td>
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<tr>
<td>Walking to X</td>
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<tr>
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<td></td>
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</tr>
</tbody>
</table>

[Diagram showing a marked point, bed, chair, and video camera setup]
Health Decisions: Interpret Vital Signs

[Graph showing vital signs over time with annotations for different periods and values for heart rate, respiratory rate, temperature, and blood pressure]
Health Systems: Walk 2.0 Project

• Can an active online collaborative environment improve healthy living?

• Three arm RCT (n = ~900)
  – Active social networking Internet intervention
  – Passive individual record Internet intervention
  – Control (written diary and printed materials)

• Outcome measures (0, 3, 6, 12 months)
  – Physical activity levels (pedometer data)
  – Nutritional intake profile (questionnaire)
  – Body mass index and girth (measured)
  – Health literacy (physical activity & nutrition)
Health Informatics: Challenges
A STRATEGY FOR AMERICAN INNOVATION:
DRIVING TOWARDS SUSTAINABLE GROWTH AND QUALITY JOBS

History should be our guide. The United States led the world’s economies in the 20th century because we led the world in innovation. Today, the competition is keener; the challenge is tougher; and that is why innovation is more important than ever. It is the key to good, new jobs for the 21st century. That’s how we will ensure a high quality of life for this generation and future generations. With these investments, we’re planting the seeds of progress for our country, and good-paying, private-sector jobs for the American people.”

-President Barack Obama, August 5, 2009

SEPTEMBER 2009
Catalyze Breakthroughs for National Priorities

- Unleash a clean energy revolution
- Support advanced vehicle technology
- Drive breakthroughs in health IT
- Address the “grand challenges” of the 21st century

Promote Competitive Markets that Spur Productive Entrepreneurship

- Promote American exports
- Support open capital markets that allocate resources to the most promising ideas
- Encourage high-growth and innovation-based entrepreneurship
- Improve public sector innovation and support community innovation

Invest in the Building Blocks of American Innovation

- Restore American leadership in fundamental research
- Educate the next generation with 21st century knowledge and skills while creating a world-class workforce
- Build a leading physical infrastructure
- Develop an advanced information technology ecosystem
The NAE Congratulates the 2012 Grand Challenges Scholars!

See the full list of graduates

Watch the video (6:27)
Download high-quality version (100MB)

With input from people around the world -- much of it on this website -- an international group of leading technological thinkers were asked to identify the Grand Challenges for Engineering in the 21st Century. Their conclusions created this website.

From urban centers to remote corners of Earth, the depths of the oceans to outer space, and the mysteries of the universe, there are grand challenges for engineering. The National Academy of Engineering was founded to respond to these challenges. This website is the first in a series of initiatives to address these grand challenges.

SHARE YOUR COMMENTS ON
One of these grand challenges:
- Prevent nuclear terror
- Engineer better medicines

COMMITTEE MEMBER SPOTLIGHT

ROBERT SOCOLOW
PROFESSOR OF MECHANICAL AND AEROSPACE ENGINEERING

Robert H. Socolow, a member of the Princeton University faculty since 1971, is professor of mechanical and aerospace engineering. From 1979 to 1997, he was director of the Center for Energy and Environmental ...
Grand Challenges for Engineering

- Make solar energy affordable
- Provide energy from fusion
- Develop carbon sequestration methods
- Manage the nitrogen cycle
- Provide access to clean water
- Restore and improve urban infrastructure
- Advance health informatics
- Engineer better medicines
- Reverse-engineer the brain
- Prevent nuclear terror
- Secure cyberspace
- Enhance virtual reality
- Advance personalized learning
- Engineer the tools for scientific discovery
Grand Challenges – Fostering innovation in global health research

The Grand Challenges in Global Health initiative fosters scientific and technological innovation to solve key health problems in the developing world. The initiative includes the Grand Challenges in Global Health grant program and the newer Grand Challenges Explorations grant program.
Grand Challenges in Global Health

#1 Create Effective Single Dose Vaccines that Can Be Used Soon After Birth
#2 Prepare Vaccines that Do Not Require Refrigeration
#3 Develop Needle-Free Delivery Systems
#4 Devise Reliable Tests in Model Systems to Evaluate Live Attenuated Vaccines
#5 Solve How to Design Antigens for Effective, Protective Immunity
#6 Learn Which Immunological Responses Provide Protective Immunity
#7 Develop a Biological Strategy to Deplete or Incapacitate a Disease-transmitting Insect Population
#8 Develop a Chemical Strategy to Deplete or Incapacitate a Disease-transmitting Insect Population
#9 Create a Full Range of Optimal, Bioavailable Nutrients in a Single Staple Plant Species
#10 Discover Drugs and Delivery Systems that Minimize the Likelihood of Drug Resistant Micro-organisms
#11 Create Therapies that Can Cure Latent Infection
#12 Create Immunological Methods that can Cure Chronic Infections
#13 Develop Technologies that Permit Quantitative Assessment of Population Health Status
#14 Develop Technologies that Allow Assessment of Multiple Conditions and Pathogens at Point-of-Care
#15 Discover Biomarkers of Health and Disease
#16 Discover New Ways to Achieve Healthy Birth, Growth, and Development
AUSTRALIA'S HEALTH 2012

The thirteenth biennial health report of the Australian Institute of Health and Welfare
### Health status

<table>
<thead>
<tr>
<th>Health conditions</th>
<th>Human function</th>
<th>Wellbeing</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence of disease, disorder, injury or trauma, or other health-related states</td>
<td>Alterations to body structure or function (impairment), activity limitations and restrictions in participation</td>
<td>Measures of physical, mental and social wellbeing of individuals</td>
<td>Mortality rates and measures of life expectancy</td>
</tr>
</tbody>
</table>

### Determinants of health

**Are the factors determining good health changing for the better? Where and for whom are these factors changing? Is it the same for everyone?**

<table>
<thead>
<tr>
<th>Environmental factors</th>
<th>Community and socioeconomic</th>
<th>Health behaviours</th>
<th>Biomedical factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical, chemical and biological factors such as air, water and soil quality.</td>
<td>Community factors, such as social capital, support services; and socioeconomic factors, such as housing, education, employment and income</td>
<td>Attitudes, beliefs, knowledge and behaviours, such as patterns of eating, physical activity, smoking and alcohol consumption</td>
<td>Genetic-related susceptibility to disease; and other factors such as blood pressure, cholesterol levels and body weight</td>
</tr>
</tbody>
</table>

### Health system performance

**How does the health system perform? What is the level of quality of care across the range of patient care needs? Is it the same for everyone? Does the system deliver value for money and is it sustainable?**

<table>
<thead>
<tr>
<th>Effectiveness</th>
<th>Continuity of care</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care, intervention or action provided is relevant to the client's needs and based on established standards. Care, intervention or action achieves desired outcome</td>
<td>Ability to provide uninterrupted, coordinated care or service across programs, practitioners, organisations and levels over time</td>
<td>The avoidance or reduction to acceptable limits of actual or potential harm from health-care management or the environment in which health care is delivered</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Responsiveness</td>
<td>Efficiency and sustainability</td>
</tr>
<tr>
<td>People can obtain health care at the right place and right time irrespective of income, physical location and cultural background</td>
<td>Service is client-oriented. Clients are treated with dignity and confidentiality, and encouraged to participate in choices related to their care</td>
<td>Achieving desired results with the most cost-effective use of resources. Capacity of the system to sustain workforce and infrastructure, to innovate and respond to emerging needs</td>
</tr>
</tbody>
</table>

*Source: Adapted from AIHW 2010a.*

**Figure 1.5: National Health Performance Framework (2nd edn)**
Figure 2.1: Age structure of the Australian population, 1956 and 2005

Note: The age group 85+ includes all ages 85 years or over, and is not directly comparable with other five-year age groups.

Health Spend with Ageing Population

The graph illustrates the increasing health spend with and without age ageing over the years from 2002-03 to 2044-45. The line labeled "With ageing" shows a steady increase in spend, while the line labeled "Without ageing" shows a much less steep increase, indicating the significant impact of ageing on health spending.
Health Informatics: Opportunities
Labor planning to put e-health back on the agenda

Karen Deane
E-medicine

E-HEALTH will be back on the political agenda following Labor's official campaign launch tomorrow.

Shadow health minister Nicola Roxon yesterday said e-health in Australia had failed to reach its potential.

"We recognise that a coordinated national approach, with national leadership, is needed to implement integrated e-health initiatives," she said.

"So far, national leadership has been lacking.

"A better connected health system will deliver benefits to patients and healthcare providers, ensuring scarce health dollars are allocated in the most cost-effective way?"

Labor is yet to indicate any commitment or funding for e-health measures, despite launching a cornerstone "new directions" policy, promising to end the "blame game" on hospital funding and to slash waiting lists.

All of these programs will require a sound IT and communications foundation, but the new directions manifesto contains only one passing reference to information technology.

Indeed, any e-health announcements tomorrow seem likely to be tied to Labor's wider broadband initiative.

"Ultimately, the full potential of e-health can only be achieved through very fast, reliable broadband services," Ms Roxon said.

"The application of broadband services to the healthcare sector exemplifies the enormous opportunities broadband offers for Australia's future productivity."

Ms Roxon, who took on the health portfolio early this year from Julia Gillard, is still to prove her IT credentials.

While she held the portfolio, Ms Gillard was a regular, and well-informed, speaker at e-health events.

However, campaign documents suggest that Labor will invest in improved health IT infrastructure in collaboration with the state governments. Labor also plans to introduce personal electronic health records.

"It is critical that health providers can communicate effectively with each other while maintaining patient confidentiality," its policy states.

"The delay in establishing secure health data standards and a common framework for patient records is inhibiting the delivery of quality services and contributing to unnecessary adverse medical events."

Personal e-health records will be "built around a unique patient identifier based on the Medicare card" and legislation will prohibit this number being used for any other purpose.

"Technological change needs to be carefully managed, with close attention to the social and ethical implications and the need for privacy for health records," it says.

Meanwhile, doctors and the health IT sector will be looking for detailed plans and funding commitments ahead of the election.

It will not take much for Labor to upstage the Coalition, as last week The Australian revealed that spending on e-health crashed during 2006-07, with $415.5 million allocated to national projects left unspent out of a budgeted $79 million.

In an E-health Report Card in August, Health Minister Tony Abbott admitted he had not met his own benchmark for introducing an e-health record.
NEHTA - National E-Health Transition Authority

Personally controlled electronic health records (PCEHR) for all Australians. From July 2012, all Australians can choose to register for an electronic health record.

The ‘Learning Centre’ will help you find out about the benefits of an eHealth record, how to get involved and how to use the eHealth record system. Register now for an eHealth record.
Concept of Operations:
Relating to the introduction of a
Personally Controlled Electronic
Health Record System
Figure 10: PCEHR System components
The NBN rollout has started in my area. What happens now?

Have you been notified that the NBN is being rolled out in your area? If so, you can use this guide to find more information about what to expect.

Show me more

Case studies

Your stories

NBN to reduce the tyranny of distance

Jennifer Wilcox – Community

How the NBN will benefit...

- HOUSEHOLDS
- BUSINESS AND NOT-FOR-PROFIT
- ENVIRONMENT
- HEALTH AND AGED CARE
- EDUCATION
- TELEWORK
- GOVERNMENT SERVICES
- REGIONAL AUSTRALIA
Health and aged care

Improved health and aged care

Digital Economy Goal: by 2020, as identified in the National E-Health Strategy endorsed by the federal, state and territory governments, 90 per cent of high priority consumers such as older Australians, mothers and babies and those with a chronic disease, or their carers, can access individual electronic health records.

Through the government’s investments in telehealth, by July 2015, 495,000 telehealth consultations will have been delivered providing remote access to specialists for patients in rural, remote and outer metropolitan areas, and by 2020, 25 per cent of all specialists will be participating in delivering telehealth consultations to remote patients.

Increasing pressures on Australia’s health system from an ageing population, increased rates of chronic disease, and health workforce challenges mean it is critical to consider opportunities to deliver high-quality services more effectively and efficiently.

The NBN will provide a platform that allows homes, doctors’ surgeries, pharmacies, clinics, aged-care facilities and allied health professionals to connect to affordable, high-speed Internet.
Device Convergence and Connectivity

University of Western Sydney
Bringing knowledge to life
Health Informatics: Directions
Health Information: Enriching Knowledge

- **Electronic Health Records**
  (smart aggregation, personal health records, population datasets)

- **Personal Monitoring**
  (activities of daily living, vital signs, mental health, medication)

- **Personalised Medicine**
  (genomic/phenotypic patterns, bioinformatics, screening/images)
Health Decisions: Safety and Quality

- Workflow mapping and optimisation
  (patient journey modelling, performance dashboards)

- Clinical Decision Support
  (guidelines adherence, second opinion CAD)

- Interoperability
  (Semantic and ontological approaches; plug-and-play / BYOD)
Health Systems: New Models of Care

- **Shared Care**  
  (aged/CDM care team coordination, hospital-in-the-home)

- **Telehealth and Virtual care**  
  (remote consultations/visits, tele-care, tele-assessments)

- **Aged isolation**  
  (ambient intelligent living environment, social networking)