AUS-135 WHO CC (eHealth)

Symposium and Launch
Acknowledgment of country

We acknowledge the Gadigal of the Eora Nation, the traditional custodians of this land and pay my respects to the members and Elders both past and present.
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.00 – 2.05 pm</td>
<td>Welcome: Dean, UNSW Medicine</td>
<td>Prof Rodney Phillips</td>
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<tr>
<td>2.05 – 2.10 pm</td>
<td>Welcome: Head, Pub Health &amp; Comm Medicine</td>
<td>Prof Rebecca Ivers</td>
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<tr>
<td>2.10 – 2.20 pm</td>
<td>WHOCC, AeHIN &amp; UNSW global eHealth</td>
<td>Prof Teng Liaw</td>
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<tr>
<td>2.30 – 2.40 pm</td>
<td>A common language and understanding</td>
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<tr>
<td>2.40 – 3.00 pm</td>
<td>eHealth care of individuals</td>
<td>Prof Branko Celler</td>
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<tr>
<td>3.00 – 3.10 pm</td>
<td>eHealth care of populations and environment</td>
<td>Dr Nick Osborne</td>
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<tr>
<td>3.10 – 3.20 pm</td>
<td>Social enterprise, citizen engagement &amp; addressing the digital divide</td>
<td>Prof Teng Liaw</td>
</tr>
<tr>
<td>3.20 – 3.40 pm</td>
<td><strong>Address &amp; launch of WHOCC-eHealth</strong></td>
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<tr>
<td></td>
<td><strong>Prof Vivian Lin</strong></td>
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<tr>
<td></td>
<td>Former Director of Health Systems</td>
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<tr>
<td></td>
<td>representing Dr Shin Young-soo,</td>
<td></td>
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<tr>
<td></td>
<td>Regional Director, WHO Western Pacific Region</td>
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</tbody>
</table>
Welcome by Dean of Medicine

Professor Rodney Phillips
Welcome by Head, School of Public Health & Community Medicine
Professor Rebecca Ivers
WHO CC (eHealth)

Professor Teng Liaw
UN Sustainable Development Goals & Universal Health Coverage

1. No Poverty
2. Zero Hunger
3. Good Health
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Protect the Planet
14. Life Below Water
15. Life on Land
16. Peace and Justice
17. Partnerships for the Goals
Integrated People-Centred Health Services

Integrated health services

- continuum of health promotion, disease prevention, diagnosis, treatment, management, rehabilitation & palliative care;
- different levels and sites of care;
- throughout the life course

People-centered care

- adopts individuals’, carers’, families’ and communities’ perspectives as participants in, and beneficiaries of, trusted health systems

Primary Health Care

Accessible & equitable care
Chronic Care Model for individuals & populations
The WPRO WHOCC family
### Mind The GAPS

<table>
<thead>
<tr>
<th>Governance</th>
<th>HIT applications governed by the highest accountable officials. Define expected benefits, the risks to watch out for, and allocate resources.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>HIT needs a clear blueprint so all stakeholders in a country will know how they can contribute to the national structure as a whole rather than silos.</td>
</tr>
<tr>
<td>People and program management</td>
<td>HIT requires capacity-building of key sectors (clinical, IT, and administration) working together to make it work seamlessly</td>
</tr>
<tr>
<td>Standards and interoperability</td>
<td>HIT works are best if standards are adopted and reused by all stakeholders.</td>
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Fill The GAPS
Objectives of WHOCC

1. Evidence-based implementation & evaluation of eHealth, and

2. Capacity-building:
   - Scale-up, maintenance and refinement

➤ co-creation with a sociotechnical approach
eHealth in the Western Pacific

• Considerable international variation
• The evidence base is limited but
  • perceptions of the utility of eHealth were generally positive, and
  • positive impacts were found.

➢Implementation indicators: RE-AIM
➢Outcomes: safety, quality and cost-effectiveness
  • for individual, family and community
  • in the facility, district, region and nation
Beyond Adoption: A New Framework for Theorizing & Evaluating Nonadoption, Abandonment, & Challenges to the Scale-Up, Spread, & Sustainability of Health & Care Technologies.

Greenhalgh et al (JMIR 2017)
... and health system inefficiencies

<table>
<thead>
<tr>
<th>Health Systems Domains</th>
<th>Inefficiencies</th>
<th>eHealth Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health workforce</td>
<td>Inequitable distribution</td>
<td>Human resources for health information system</td>
</tr>
<tr>
<td></td>
<td>Inappropriate or costly staff mix</td>
<td>Use of geographic information systems for targeting services</td>
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<tr>
<td>Essential medicines</td>
<td>Irrational use of drugs</td>
<td>Logistics management information system</td>
</tr>
<tr>
<td></td>
<td>Counterfeit drugs</td>
<td>Counterfeit drug detection systems</td>
</tr>
<tr>
<td>Healthcare service delivery</td>
<td>Inappropriate hospital admissions</td>
<td>Web-based access to shared electronic health records</td>
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<td></td>
<td>Over-use of procedures, investigations, and equipment</td>
<td>Clinical decision support tools</td>
</tr>
<tr>
<td>Health system leakages</td>
<td>Corruption</td>
<td>Hospital and insurance digital payments Financial management information systems</td>
</tr>
<tr>
<td></td>
<td>Fraud</td>
<td>Radio-frequency identification-based supply chain and logistics</td>
</tr>
<tr>
<td>Patient monitoring and community health</td>
<td>Drug nonadherence</td>
<td>Shared electronic health records</td>
</tr>
<tr>
<td></td>
<td>Underserved populations</td>
<td>Telemedicine</td>
</tr>
<tr>
<td></td>
<td>Missed appointments</td>
<td>Mobile health applications, including mobile phone-based reminder systems, integrated patient ID registries, rapid reporting forms and referrals</td>
</tr>
<tr>
<td>Disease surveillance and population health</td>
<td>Delayed and unreliable data for decision making</td>
<td>Rapid case detection and communications applications Health issues monitoring dashboards</td>
</tr>
</tbody>
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Symposium
Overview of UNSW global eHealth R&D program
4 focus areas

1. A common language & data model:
   • Interoperability standards

2. eHealth care of individual
   • Smart tools & teleservices: CDM & CDSM

3. eHealth care of population & environment
   • Smart homes & cities - Internet of Things

4. Governance, ethics, access and equity:
   • Social enterprise - co-creation
   • Digital Health Divide
A common language and data model

interoperability standards
A Health neighbourhood has disparate actors and information systems.

Need a common language to share, coordinate care and assure quality & safety.

“A rose is a rose whatever you call it?”
Laboratory/infrastructure: network of multiple EHRs

- Secure SQL database with GRHANITE™ Linkage
- Standardised database of linked pseudonymised individuals
- Data analytics of data repository

Feedback & Data Quality

- Cohort studies and RCTs
- OHDSI

Health neighbourhood

- GPs
- PROMs
- Others

Pseudonymisation & ETL

ED, CHCs & Outpatient Clinics

Hospital admissions

Network of multiple EHRs
A Common Data Model (CDM)

Comparative Effectiveness Research
Observational Health Data Sciences and Informatics (OHDSI) Collaborative
What is the CDM?

1. Common architecture
2. Common concepts mapped to standardised vocabularies
   - Personal data
   - Health system data
   - Economics data
   - Derived data

➢ Standardised meta-data

Source: https://www.ohdsi.org/
1. Clinical phenotyping and genomics

2. Cohort studies: clinical course of NCDs such as
   - Atrial fibrillation, CVD, Diabetes, COPD, Mental health and other comorbidities.

3. Health services research
   - Continuity of care and service use
   - Study designs: e.g. Interrupted Time Series & Stepped Wedge Cluster Trials
   - Polypharmacy and quality use of medicines
   - Injury and violence

4. Predictive modelling: machine learning and AI
Example: data from CDM-based repository

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>All patients (n=212144)</th>
<th>Atrial Fibrillation (n=1883)</th>
<th>Injury (n=3855)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Count (%)</td>
<td>Count (%)</td>
<td>Count (%)</td>
</tr>
<tr>
<td>0 – 5</td>
<td>5182 (4.7)</td>
<td>5844 (5.8)</td>
<td>0</td>
</tr>
<tr>
<td>6 – 19</td>
<td>18657 (17.0)</td>
<td>20192 (19.9)</td>
<td>0</td>
</tr>
<tr>
<td>20 – 44</td>
<td>43294 (39.4)</td>
<td>37275 (36.8)</td>
<td>32 (3.7)</td>
</tr>
<tr>
<td>45 – 64</td>
<td>27611 (25.1)</td>
<td>24852 (24.5)</td>
<td>146 (16.9)</td>
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<tr>
<td>65 – 74</td>
<td>7903 (7.2)</td>
<td>7280 (7.2)</td>
<td>167 (19.3)</td>
</tr>
<tr>
<td>75+</td>
<td>7202 (6.6)</td>
<td>5845 (5.8)</td>
<td>519 (60.0)</td>
</tr>
<tr>
<td>Total patients</td>
<td>109948 (51.8)</td>
<td>101403 (47.8)</td>
<td>864 (0.8)</td>
</tr>
<tr>
<td>Total distinct conditions</td>
<td>84905</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Average # visits</td>
<td>21</td>
<td>144*</td>
<td>66*</td>
</tr>
<tr>
<td>Total distinct medications</td>
<td>12966</td>
<td>43 (6.6%)</td>
<td>1034 (5.06%)</td>
</tr>
</tbody>
</table>

Top medications:
- **J01 (Antibacterials, Dalacin)**
  - N02 (Fenpatch); N06 (Effexor)
  - G03 (Oestradiol, Black cohosh)
  - C09 (Abisart, Timoptoll); C10 (Fluvastatin); C03 (Lasix oral); A10 (Humulin)
- **J01 (Antibacterials, Amoxil)**
  - B01 (Xarelto, Eliquis)
  - N02 (Endone, Panadeine forte), R03 (Ventolin)
  - A03 (Maxolon); C10 (Statins)
- **M01 (Voltaren, Mobic)**
  - J01 (Amoxil, Keflex)
  - N02 (Panadeine forte)
  - J07 (Boostrix)
eHealth care of individuals

Prof Branko Celler
Prof Nigel Lovell
Telemonitoring of patients with chronic conditions at home.

Prof. Branko Celler
Biomedical Systems Research Laboratory
University of New South Wales
Professorial Fellow, CSIRO eHealth
b.celler@unsw.edu.au
Biomedical Research Laboratory

Key research areas

• Biomedical instrumentation
  o Vital signs, wearables, falls monitoring
• Tele-Monitoring of clinical vital signs
• Biomedical signal analysis
• Tele-rehabilitation and optimising exercise safety
• Predictive analytics and risk analysis
Advanced Vital signs monitoring

Communication Hubs

Smart home technology

Wearable falls monitoring

Telerehabilitation
Tele-monitoring of patients with chronic conditions at home
Gen III: Telemedcare CMU

Telemedcare Clinical Monitoring Unit
Alternative for the Home: The Personal Health Monitor

PHM TABLET + 3/4G Internet

BT BASE UNIT (shown without wired Peripherals, NIBP, PulseOximeter, BT)

Weight Scale

Glucometer

Easy ECG
Alternative for the Home: The TMC Home Hub and its peripherals!

- Home HUB + 3/4 G Internet
- BT BASE UNIT (shown without wired Peripherals, NIBP, PulseOximeter, BT)
- Glucometer
- Easy ECG
- Weight Scale
The CSIRO National Telehealth Trial
CSIRO NBN Telehealth Trial – 6 Sites

- Townsville
- Penrith
- Nepean Blue Mountains / ARV
- Canberra and ACT
- Ballarat and the Grampians
- Launceston / Northern Tasmania

Number of patients at each site

- 25 Test Patients
- 50 Control Patients

Total

- 150 Test patients
- 300 Control Patients

Trial Design

- Case Matched controls
- Before-After-Control-Impact (BACI)
- * One site was decommissioned
The hypothesis!

- Improved & more efficient CASE MANAGEMENT
- Assisted SELF MANAGEMENT
- Better use of available HUMAN RESOURCES

- Empowering the patient
- Improved Outcomes
- Reduced Costs
Summary of Impact of Telemonitoring

- **Rate** of expenditure on medical services fell by **46.3%**
  - Savings over the first year was **23.5%**
- **Rate** of unscheduled admissions to hospital fell by **53.2%**
  - Reduced number of admissions over one year **23.8%**
- **Rate** of length of stay fell by **67.9%**
  - Reduced length of stay over first year **33.8%** (7.5 days)
- **Mortality** was reduced by **> 40%**

- **> 83%** user acceptance and use of telemonitoring technology
- **> 89%** of clinicians would recommend telemonitoring services to other patients
Case Study: Exacerbation event, COPD patient. Hospitalisation NOT avoided! Why?
Thank you!

Branko Celler
b.celler@unsw.edu.au
eHealth care of populations and environments

Dr Nicholas Osborne
Digitising of data: novel opportunities

- 20 years of data digitising
- Health and environmental data
- In high income countries, but also now LMIC
- Numerous data sets: new frontiers
- Data Mashups:
  - Bringing together disparate data sets
  - Integration of two or more data sets in a single graphical interface
  - Results not always planned
  - Allows planned and serendipitous linkage
CKDu in Sri Lanka

- Combining Census, Health Survey for CKDu and GIS data
- Map of Sri Lanka with boundaries of 14008 Grama Niladhari administrative areas
- At district level:
  - Rasnayakpura number screened > 15 yrs = 256
  - Horowpothana number screened > 15 yrs = 333
  - Embilipitiya number screened > 15 yrs = 135
Tap use in North Central Province
Distribution of CKDu – North Central Prov.
CKDu findings

- CKDu villages top 10% cases
- Logistic regression: OR .989 95% CI .98 , .99
- Logged tap
  - OR 0.8 95% CI .70 , .942
  - CKDu >2% of population

<table>
<thead>
<tr>
<th>piped water quintile</th>
<th>n</th>
<th>N</th>
<th>uCKD %</th>
<th>OR</th>
<th>95% CI</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>129</td>
<td>14.6</td>
<td>ref</td>
<td></td>
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<tr>
<td>2</td>
<td>24</td>
<td>180</td>
<td>11.8</td>
<td>0.78</td>
<td>0.42, 1.45</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>130</td>
<td>7.8</td>
<td>0.50</td>
<td>0.23, 1.06</td>
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<tr>
<td>4</td>
<td>7</td>
<td>76</td>
<td>8.4</td>
<td>0.54</td>
<td>0.22, 1.32</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>127</td>
<td>5.9</td>
<td>0.37</td>
<td>0.11, 0.26</td>
</tr>
</tbody>
</table>
PollerGEN: grass pollen species and asthma

- Develop a spatio-temporal grass pollen assessment (concentrations and depositions) to species level using molecular genetics.
- Develop novel pollen bio-aerosol models
- Identify species, or combinations of species that are linked to the most severe public health outcomes of the allergic response (i.e. asthma exacerbations).
Greenspace and Wellbeing

- Linkages between greenspace and health can be made
- Type, quality and context of 'greenspace' should be considered
- Data from satellite on greenspace
- Census level data on health
- Age and sex standardised data adjusted for socio-economic deprivation and rurality
- Level of detail on environment increasing…..tree by tree
- Alternate sources of geolocated data ….social media

![Graph showing hay fever and pollen levels in the United Kingdom from 2004 to 2016]
Social enterprise, Citizen Engagement & the Digital (Health) Divide

Prof Teng Liaw
Social Enterprise in Health / eHealth

A. Social Enterprise

B. ‘Intervention’

C. Intermediate effects/‘assets’ developed

D. Long term outcome

Internal Factors
- Size
- Location
- Coverage
- Legal Setup
- Time trading
- People

Social Mission

External Factors
- Policy
- Legal Framework
- Trading environment
- Access to finance

‘directly’
Trading / service delivery

‘indirectly’
Trading → Investment in social mission

Improved health and well-being

Social Capital / Connectedness

Sense of Coherence

Global eHealth, Social Enterprise and Citizen Engagement

CAPITAL

- Financial
- Human
- Social
- Time
- Legal
- Environment

SDG#3: Health;
SDG#8: Work;
SDG#9: Industry and infrastructure;
SDG#10: Income equality
SDG#11: Sustainable cities & communities
SDG#12: Responsible & sustainable consumption and production patterns

Acknowledgment: Dr Myron Godinho, Scientia PhD Scholar

### Some measures & indicators

<table>
<thead>
<tr>
<th>RE-AIM Framework</th>
<th>Social Enterprise</th>
<th>eHealth</th>
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</thead>
<tbody>
<tr>
<td>Reach (Individual)</td>
<td><strong>Entrepreneurship</strong></td>
<td><strong>Awareness, Access, EHR</strong></td>
</tr>
<tr>
<td>Effectiveness (Individual)</td>
<td><strong>Social and health impact</strong></td>
<td><strong>Social and health impact</strong></td>
</tr>
<tr>
<td>Adoption (Organisation)</td>
<td><strong>CSR, political willingness,</strong></td>
<td><strong>Leadership, governance, strategy, investment</strong></td>
</tr>
<tr>
<td>Implementation (Organisation)</td>
<td><strong>Financing, market, social capital</strong></td>
<td><strong>Financing, standards, operational capacity, human resources,</strong></td>
</tr>
<tr>
<td>Maintenance (Individual)</td>
<td><strong>Subscription models</strong></td>
<td><strong>Information, education</strong></td>
</tr>
<tr>
<td>Maintenance (Organisation)</td>
<td><strong>Auditing, evaluation</strong></td>
<td><strong>Auditing, evaluation, Retraining, maintain standards</strong></td>
</tr>
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*Acknowledgment: Dr Myron Godinho, Scientia PhD Scholar*
Summing up
Summary: UNSW eHealth R&D

- Well governed Integrated People-centred eHealth Services
- Mature interoperable Internet of Things infrastructure
- Mature interoperable patient-centred eHealth apps / agents
- Citizen & community readiness & engagement
- CSR & Social Enterprise strategies
- Measure, monitor, evaluate & disseminate
Address and launch of UNSW WHO CC (eHealth)

Professor Vivian Lin
former Director of Health Systems

representing Dr Shin Young-soo
Regional Director
WHO Western Pacific Region