Big Data in Healthcare

Mal Thatcher
Chief Health Information Officer
Queensland Department of Health
Queensland Health comprises of...

- **16** Hospital and Health Services
- **182** hospitals and primary healthcare centres
- **70,000** full-time equivalent staff
  - **3,882** ambulance service staff
  - **8,487** doctors
  - **26,907** nurses

Delivering more than...

- **1,800,000** emergency services
- **40,000** babies
- **10,000,000** non-admitted and **3,200,000** admitted patient services in acute public hospitals each year

With an annual expenditure greater than $19.3 billion
Is big data a big problem in healthcare?
## Diagnostic Data

<table>
<thead>
<tr>
<th>Modality</th>
<th>Storage per Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-RAY</td>
<td>30MB</td>
</tr>
<tr>
<td>Mammogram</td>
<td>120MB</td>
</tr>
<tr>
<td>3D MRI</td>
<td>150MB</td>
</tr>
<tr>
<td>Digital Pathology</td>
<td>350MB</td>
</tr>
<tr>
<td>3D CT</td>
<td>1 GB</td>
</tr>
<tr>
<td>Human Genome</td>
<td>1 TB</td>
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</tbody>
</table>
Big Data Problem

- 800 MB Per Genome
- 300TB+ For 20 Cancer Genomes
- 200TB+ All Known Variants
- 15PB+ Broad & Sanger DB

DNA

- Adenine
- Thymine
- Cytosine
- Guanine

Building Blocks

- 3.2 Billion Base Pairs Per Genome
- 6 ft. Length

Human Cell

- 99.9% Identical DNA w/ Human
- 98.5% Identical DNA w/ Chimpanzee

Human

- 23 Chromosome Pairs
- 23,000 Genes

Chromosome

- 24 Potato
- 28 Elephant
- 39 Chicken
# Explosion in Wearables Market

## Wearable Technology Data Coverage Areas

<table>
<thead>
<tr>
<th>Healthcare &amp; Medical</th>
<th>Fitness &amp; Wellness</th>
<th>Infotainment</th>
<th>Industrial</th>
<th>Military</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure Monitors</td>
<td>Activity Monitors</td>
<td>Bluetooth</td>
<td>Hand-worn Terminals</td>
<td>Hand-worn Terminals</td>
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<tr>
<td>Continuous Glucose Monitoring</td>
<td>Fitness &amp; Heart Rate Monitors</td>
<td>Headsets</td>
<td>Head-up Displays</td>
<td>Head-up Displays</td>
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<tr>
<td>Defibrillators</td>
<td>Foot Pods &amp; Pedometers</td>
<td>Head-up Displays</td>
<td>Imaging Products</td>
<td>Imaging Products</td>
</tr>
<tr>
<td>Drug Delivery Products</td>
<td>Head-up Displays</td>
<td>Imaging Products</td>
<td>Smart Clothing</td>
<td>Smart Clothing</td>
</tr>
<tr>
<td>ECG Monitors</td>
<td>Sleep Sensors</td>
<td>Smart Glasses</td>
<td>Smart Glasses</td>
<td>Smart Glasses</td>
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<tr>
<td>Hearing Aids</td>
<td>Smart Glasses</td>
<td>Smart Watches</td>
<td>Smart Watches</td>
<td>Smart Watches</td>
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<tr>
<td>Insulin Pumps</td>
<td>Smart Clothing</td>
<td>Other and Audio</td>
<td></td>
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<tr>
<td>Smart Glasses</td>
<td></td>
<td>Earbuds</td>
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<td>Patches</td>
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<td>PERS</td>
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<tr>
<td>Pulse Oximetry</td>
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</table>
Wearable technology – Total market size

World Market for Wearable Technology
Revenue by Application
$US Millions, 000 Units, Excludes Service Revenue

$10B from 105M units today, forecast to $35B from 250M units in 2018.

Service revenue to exceed $6B in 2018. Inclusive of remote patient monitoring, support for gaming and enterprise applications, and military research.

North America and Europe contribute to 70% of global revenue.

Source: IHS
If we can bring together activity, clinical and external human behaviour big data, then we can enable:

- Lifestyle choices by better informed consumers
- Evidence-based care driven by AI embedded in clinical systems
- Right Care Settings (e.g. Medical Home)
- Efficiency Revolution (through data-enabled partnerships and collaborations)
- Innovation (through accelerated time to efficiency)