Making clinical AI and decision support a reality through adaptive user interfaces

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- ASX listed health informatics company based in Adelaide
- Customers large public hospitals, new in Private
- Miya Platform: Clinical Decision Support (CDS), predictive analytics
  - Logistics (Patient Flow)
  - Efficiency (Revenue)
  - Safety
What’s the problem?

• Large investments in Health EMRs

<table>
<thead>
<tr>
<th>Stage</th>
<th>Cumulative Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Medical record fully electronic; HCO able to contribute CCD as byproduct of EMR; Data warehousing in use</td>
</tr>
<tr>
<td>6</td>
<td>Physician documentation (structured templates), full CDSS (variance &amp; compliance), full R-PACS</td>
</tr>
<tr>
<td>5</td>
<td>Closed loop medication administration</td>
</tr>
<tr>
<td>4</td>
<td>CPOE, CDSS (clinical protocols)</td>
</tr>
<tr>
<td>3</td>
<td>Clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology</td>
</tr>
<tr>
<td>2</td>
<td>Clinical Data Repository, Controlled Medical Vocabulary, Clinical Data Support System</td>
</tr>
<tr>
<td>1</td>
<td>Ancillaries– Lab, Rad, Pharmacy</td>
</tr>
</tbody>
</table>
EMRAM ≠ High Performance Healthcare

Leading Causes of Death in the USA

- Cardiovascular
- Cancer
- Preventable Error
- Chronic Resp Disease
- Accidents
- Stroke
- Alzheimer's
- Diabetes
- Pneumonia
- Renal Disease

Patient harm 10-50%+ of multi-day episodes
Up to 40% of lab results are not seen
30% of AMI patients not on guideline meds
Mis- or late diagnosis in 10%–20% of cases

Performance with a highly educated and dedicated workforce
The Reality of Health IT

“Across clinical settings, new generation CDSSs integrated with EHRs do not affect mortality and might moderately improve morbidity outcomes”

Am J Public Health. 2014. 104:e12–e22

- Productivity loss
- Safety – ? drivers for safety (starting to change)
- Data hiding as a strategy
  - Lack of innovation
- Difficult to support new models of care

AMA College of Physician survey on attitudes to EMRs (2014)
The Future is About Algorithms

More powerful predictive models through machine learning and ‘AI’

The technology is available, how do we make it work in health?

How can we integrate CDS and AI into clinical workflows?

One could consider that paradigm shifts are required either in the design, the development, or the implementation of CDSSs’’

Image Recognition

% Error

Deep Models

Yearb Med Inform 2014:163-6
Making Technology Work

• People will use technology if it saves them time

• Alcidion’s design principles
  1. Access to key data < 1s
  2. Make the right thing to do the easier thing to do
  3. Every click (or tap) is pushing the friendship with a clinician
  4. Each specialty is it’s own business
What is an Adaptive User Interface?

- A user interface (UI) which adapts, that is changes, its layout and elements to the **context** and the **needs of the user**

- What does the user **want** to know
  - Information needs & context?

- What **should** they know
  - Salient past history
  - Current clinical risks
  - Blocking tasks

  This implies a smart, real-time CDS capability that monitors activity & data.
RFID Login
Adaptive, Real-Time User Interfaces

- Login time 1 second
- Important information assembled to the main patient list
- Clinical risks highlighted

Specialty Configuration

Patient Streams

1. Specialty Configuration
# Emergency Department Context

<table>
<thead>
<tr>
<th>Bed/Area</th>
<th>Name &amp; Details</th>
<th>Alerts</th>
<th>Triage</th>
<th>Att. Doc.</th>
<th>Admit Resource</th>
<th>First Seen</th>
<th>LOS</th>
<th>Orders</th>
<th>Diagnostic Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Clarke, Elliot</td>
<td>91 y/o</td>
<td>2</td>
<td>John Smith</td>
<td>95% Med</td>
<td>OK</td>
<td>2h 15min</td>
<td>2 Orders</td>
<td>Elects 3 Aug, LFT 3 Aug, FBE 3 Aug</td>
</tr>
<tr>
<td>M2</td>
<td>Morin, Cara</td>
<td>36 y/o</td>
<td>3</td>
<td>John Smith</td>
<td>65% Surg</td>
<td>15/20 min</td>
<td>15min</td>
<td>4 Orders</td>
<td>Elects 3 Aug, LFT 3 Aug, FBE 3 Aug</td>
</tr>
<tr>
<td>M6</td>
<td>Santana, Josh</td>
<td>67 y/o</td>
<td>3</td>
<td>John Smith</td>
<td>20% Med</td>
<td>OK</td>
<td>5h 17min</td>
<td>4 Orders</td>
<td>Elects 3 Aug, LFT 3 Aug, FBE 3 Aug</td>
</tr>
<tr>
<td>M7</td>
<td>Mays, Stacey</td>
<td>37 y/o</td>
<td>3</td>
<td>John Smith</td>
<td>25% Med</td>
<td>OK</td>
<td>2h 17min</td>
<td>1 Orders</td>
<td>Elects 3 Aug, LFT 3 Aug, FBE 3 Aug</td>
</tr>
<tr>
<td>M8</td>
<td>Gonzales, Tabatha</td>
<td>47 y/o</td>
<td>2</td>
<td>John Smith</td>
<td>85% Psych</td>
<td>OK</td>
<td>6h 20min</td>
<td>3 Orders</td>
<td>Elects 3 Aug, LFT 3 Aug, FBE 3 Aug</td>
</tr>
<tr>
<td>M12</td>
<td>Preston, Aileen</td>
<td>51 y/o</td>
<td>5</td>
<td>John Smith</td>
<td>10% Med</td>
<td>OK</td>
<td>2h 15min</td>
<td>16 Orders</td>
<td>Elects 3 Aug, LFT 3 Aug, FBE 3 Aug</td>
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**Predicted Occupancy - Next 6 hours**

- **Predicted**
- **Actual**

Displaying 6 of 36 patients
Flags & Tags

• Tags
  • Can be manually assigned e.g. This patient should be reviewed in the MDT
  • CDS rules can tags to a patients
  • Automatic tags e.g. pre/post-operative

• Flags
  • ‘Detected issues’ in FHIR
  • Highlight dynamic risk for patients
  • Also highlight risks for the organisation e.g. patient flow
## Configuring Specialty Dashboards

### Common Row

<table>
<thead>
<tr>
<th>Location</th>
<th>Patient</th>
<th>LOS</th>
<th>EDD</th>
<th>Med Ready</th>
<th>Risks</th>
<th>Imaging</th>
<th>Observations</th>
<th>Medical Tasks</th>
<th>Nursing Tasks</th>
<th>Phyio Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6F B 07</td>
<td>Bagdatos, Martin</td>
<td>3 days 30-Mar</td>
<td>1</td>
<td>2</td>
<td>High Preop IMH, Surgical Risk</td>
<td>VTE prophylaxis Timing of Surgery</td>
<td>1</td>
<td>Baseline</td>
<td>Neuro</td>
<td>in 2 h</td>
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### Stream Rows

#### Orthopaedics:TKR

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#### Orthopaedics:THR

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#### Orthopaedics:NOF

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### Default

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Miya Platform for Adaptive Solutions

- **Event Pipeline**
  - FHIR Data

- **Integration Engine**
  - HL7 to FHIR

- **Commands & Event Generation**

- **Decision Support Engine, Deep Learning algorithms**

- **Storage**

- **Client Access Context**

- **Client Devices Context Aware**
  - APIs

- **Data Feeds**
  - PAS, Labs, RIS, etc.
Summary

• Health care sustainability relies on IT playing a more integral role
  • To support clinicians
  • To support patients
  • For the sustainability of the health care system

• Adaptive User Interfaces are vital
  • To allow local innovation
  • To support new models of care
  • To integrate smart algorithms into clinical workflows

• The Adaptive UI is one part of an adaptive system
Thank you