Digital transformation of hospital quality and safety: clinical streaming analytics to improve patient care

Dr Clair Sullivan MBBS (Hons) MD FRACP FACHI CHIA
Endocrinologist and Medical Informatician, Chief Digital Health Officer Metro North Hospital and Health Service, Co-Chair Digital Healthcare Improvement Network, Co-Director of HITEC, Queensland Health
Digital transformation of hospital quality and safety: real-time data for real-time action

Amy Barnett BH(Nurs), GradDipHlthServMgt, MPH, CHIA
Michelle Winning BNurs(Hons), CHIA, Co-Director Digital Healthcare Delivery, Healthcare Innovation and Transformation Excellence Collaborative
Stephen Canaris BHealthIM, Director of Data and Analytics
Michael Cleary PSM, FRACMA, FACEM, MHA, AFACHSE, MBBS, Executive Director Princess Alexandra Hospital and QEII Jubilee Hospital Network, Adjunct Professor
Andrew Staib MBBS, FACEM, FACHI,
Clair Sullivan MBBS(Hons), MD, FRACP, FACHI, Chief Digital Health Officer

Metro North Hospital and Health Service  Putting people first
DIGITAL NORTH
REIMAGINING HEALTHCARE
What’s going on?

- Demand for healthcare increasing
- No more resources
- So we need to use existing resources smarter
Demand for healthcare vs available resources

Cumulative real per capita growth in national health expenditures vs GDP, % growth since 1960

McKinsey
Pioneering digital disruption: Australia’s first integrated digital tertiary hospital

Digital transformation has started in Australian hospitals

Digital technology now underpins most industries; however, the health care sector (particularly in hospitals) has been slow to transform from traditional paper-based systems of care. In the United States, for example, federal legislation and financial incentives have facilitated the implementation of electronic medical records (EMRs);¹ but there are only a handful of advanced EMRs in hospitals outside the US.² The roll-out of a digital hospital includes an EMR system and other technical components, such as integrated digital vital sign monitoring and digital electrocardiogram (ECG) records. This transformation prompts revolutionary change in the way health care is delivered and monitored.

The enthusiasm for digital transformation in health has

HITEC Healthcare Innovation and Transformation Excellence Collaboration

Clinical Excellence Division

Our workforce builds digital literacy
Intelligent use of data
Innovative workforce

Integrating information and technology
Transparency to increase efficiency
Digital innovation allows new models of care

Collecting and collating
Live streaming analytics
Predictive and prescriptive analytics available

Broadens workflows to improve care
Establish links between data and analytics
Integrate innovative technology in the digital platform

CULTURAL READINESS
TECHNICAL EXCELLENCE
DIGITAL CLINICAL GOVERNANCE
SINGLE SOURCE OF TRUTH FOR DATA
INFORMATION GOVERNANCE AND TRANSPARENCY
INTEGRATION
DISASTER RECOVERY AND CYBERSECURITY
DIGITAL PARTNERSHIPS WITH RESEARCH TEAMS AND UNIVERSITIES
HORIZON 1   BUILDING DIGITAL FOUNDATIONS: BETTER CARE FOR INDIVIDUAL PATIENTS
▪ Implementing an integrated electronic medical record (ieMR) forms the basic platform of a digital transformation.
▪ An ieMR forms the digital bedrock of a digital health system.
HORIZON 1  BUILDING DIGITAL FOUNDATIONS: BETTER CARE FOR INDIVIDUAL PATIENTS
HORIZON 1 BUILDING DIGITAL FOUNDATIONS: BETTER CARE FOR INDIVIDUAL PATIENTS
HORIZON 2  TRANSFORMING PATIENT CARE: BETTER CARE FOR GROUPS OF PATIENTS
Using our digital workflows, we can start collecting data to understand in real-time how our service operates and how we can optimise the quality and efficiency of our care.
HORIZON 2  TRANSFORMING PATIENT CARE: BETTER CARE FOR GROUPS OF PATIENTS

National Safety and Quality Standards dashboards

Standard 1

Standard 2

Standard 3

Standard 4

Standard 5

Standard 6

Standard 7

Standard 8

Standard 9

Standard 10
HORIZON 3  REIMAGINING OUR FUTURE: NEW AND INNOVATIVE MODELS OF CARE
We leverage our digital platform to integrate with other services and research facilities to innovate and deliver new models of care and research capability.
## Audit Tool: Snapshot

**Patient Information:**

1. Patient Study ID No (to be added at data entry)
2. MR No: 
3. DOB: / / 
4. Age (years): 
5. Gender: M F 
6. ATSI: Yes No
7. Ward Name (eg. 5C,BU): 
8. Ward Type (Tick one): Medical Surgical Psychiatry GARU/BIRU CCU ICU HDU 
9. Specialty of Treating Consultant (one only): 

<table>
<thead>
<tr>
<th>Medical</th>
<th>Non-Medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Medicine</td>
<td>Haematology</td>
</tr>
<tr>
<td>Cardiology</td>
<td>Gastroenterology</td>
</tr>
<tr>
<td>Stroke</td>
<td>Neurology</td>
</tr>
<tr>
<td>Geriatric</td>
<td>Other:</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Cardiac Surgery</td>
</tr>
<tr>
<td>Oncology</td>
<td>ENT</td>
</tr>
</tbody>
</table>

10. No. of days i.e. midnight to midnight in hospital to date: 
11. Type of Admission: Elective Emergency 
12. Main Reason for admission (One option only)
   - DKA (Diabetic ketoacidosis)
   - HHS (Hyperosmolar hyperglycaemia)
   - Active Diabetic Foot Disease
   - Hypoglycaemia
   - Other (medical, gastro, resp, etc.)
   - Non-medical (surgical)
   - Psychiatric

13. Diabetes and Endocrine Unit Involved in Care 
   - Endocrinology (Reg Consultant) Yes No 
   - Diabetes Nurse Educator Yes No 

14. Diabetes Type. On admission to the hospital
   - Type 1 Yes No 
   - Type 2 diet only Yes No 
   - Type 2 DHA only or Byetta Yes No 
   - Type 2 insulin +/- DHA Yes No 
   - Other: Yes No 

16. How long has the patient had diabetes years 
17. Diagnosed this admission Yes No 
18. Last HbA1c in notes or on AUSLAB (within 3 months): % Not available:
HORIZON 3  REIMAGINING OUR FUTURE: NEW AND INNOVATIVE MODELS OF CARE
Comparison of manual auditing versus live streaming clinical analytics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Traditional manual auditing for accreditation</th>
<th>Live streaming clinical analytics for accreditation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data age</td>
<td>Retrospective data is presented (often months old)</td>
<td>Current data is presented (15min old)</td>
</tr>
<tr>
<td>Data plasticity</td>
<td>Data are presented in flat PDF files that cannot be easily interrogated</td>
<td>Interactive data visualisations that can be interrogated, filtered and manipulated in real time to answer new questions</td>
</tr>
<tr>
<td>Data sampling</td>
<td>Point prevalence data snapshots with variable sample size and varied or absent state-wide definitions</td>
<td>Data are collected and presented for every patient during every episode of care</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standardised statewide data source and definitions</td>
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</table>
## Lessons learned during the establishment of live streaming clinical analytics for hospital accreditation

<table>
<thead>
<tr>
<th>Issue</th>
<th>Detail</th>
<th>Treatment</th>
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</table>
| Technical complexity of ieMR data tables | Considerable effort required to understand and navigate the database tables within the ieMR  
Knowledge of and ability to interrogate the tables is critical to extracting accurate data; this knowledge is difficult to acquire due to the complexity and labeling of the data tables | Investment in resources to learn tables and knowledge                                        |
| Technical complexity of data labelling | The data storage architecture is complex; the data item entered into the ieMR is written to tables that may lack accurate labelling and individual cells may contain multiple variants of the same data item (Fig.2) | Careful exploration of the data tables  
Analysis and mapping of clinical workflows to data capture and storage  
Clinical consensus to choose the most clinically appropriate data item and define metadata |
| Lability of data elements | Data elements can be labile; front-end configuration changes and code upgrades can alter the data element, corrupting the data extracted | Data validation needs to be a continuous process  
Spot validation should occur at regular intervals and after significant events, such as configuration changes and code upgrades |
| Cultural challenges | Introducing live clinical streaming analytics can be culturally challenging, because data are exposed and careful governance is required | Cultural preparations are required to prepare clinical owners and consumers of the transparency of the data outputs  
Clinical owners are required to manage the allocation of data access and risks of data exposure |
| Governance challenges | Existing siloed information technology and clinical governance models were not mature enough to manage the multidisciplinary nature of the teams required to establish clinical analytics | Temporary multidisciplinary virtual teams were established  
Agile membership to meet varied development demands |
Challenges to achieve large scale data and analytics

- Extraction of Data from the Millennium system
- Validation and cleansing of data
- Defining the data points
- Integrating Millennium data with other data sources
  - e.g. financial, demographic and bespoke clinical sources)
- Meta data dictionary
  - e.g. what paper based data points translate to in the back end of the ieMR)
- Prioritising work
- Governance
- Workforce