Connect Care
A Data and Analytics Perspective

Stafford Dean – Chief Analytics Officer - AHS
Nov 23rd, 2018
AHS’ Data and Analytics Landscape

- A home-grown, well-developed, heavily used Enterprise Data Warehouse and data and analytics eco-system
- Wide variety of data – clinical, capacity, staffing, financial, social, survey, experience… many data sets external to AHS
- Many customers for both data and analytics: AHS (all levels), AH, HQCA, PCNs, Universities…
- Workforce: 450 strong, many highly-trained staff – PhD’s, Masters, HIMs from all analytic disciplines (Epidemiology, Health Economics, Operations Research, Biostatistics, General statisticians, Computer Science, Engineers, Data Science, Business, Accounting…)
- Hub and spoke structure – embedded analysts into the business connected to the hub… still not fully optimized, still have legacy unconnected data and analytic teams
Enterprise Data Warehouse (EDW)

- **Oracle Database** back end, **Informatica** ETL, **Tableau** visualization
- Numerous statistical and specialized analytic tools (Operations Research, Statistics, GIS, …)
- Managed by the Analytics department, with lots of help from IT

**Benefits of the EDW:**
- Increases analytical efficiency – analysts spend more time analyzing, less time looking for and managing data
- Increases the value of information generated from AHS’ data assets by linking data across systems of care
- Enables report automation
- HIA requirements – security and auditing (must have)
# EDW Data Sets

## Core

- DAD (provincial inpatient abstracts)
- NACRs (hospital based ambulatory care abstract (ED, Day Surgery, Clinics))
- PIN (Pharmacy Information Network)
- Vital Stats (births, deaths)
- Claims (Physician payment data)
- Alberta Population Registry
- Lab, DI
- ADT
- LTC, SL, HC; RAI – assessment / utilization
- ED – operational data
- Perinatal (moms and babies)
- Canada Census
- Alberta Community Health Survey
- Patient Experience/Satisfaction
- MIS Expenditures

## Distributed

- Calgary Sunrise Clinical Manager data and analytics
- Meditech data and analytics
- MIS financial/statistical
- Alberta Waitlist Registry
- E-Critical (Tracer)
- Cancer Registry (CMORE)
- OR (Calg)
- Bed Survey (PP)
- Staffing data
- Rheumatology
- Cardiac (Approach)
- EMS
- Primary Care
- Stoke (Action Plan)
- E-Clinician (Edmonton)
- Scheduling (path to care)
- A-CATS – scheduled surgical services
- Anesthesia
- Many more ….
- Lab, DI Pharm
- Community of practice
- A centrally-managed core of data sets (EDW)
- Distributed departmental / zone / subject-area data that can link with the core
- Distributed data analysts and environments mostly within the EDW – 'schema'
- Significant autonomy, close to the business, come with data, then add EDW data
- create reports for their domain, in their domain
- Encourage connections without going through the core EDW
- Shared data model program
Data – Philosophy

- **Continuum of data needs** for analytics – from raw untransformed data to highly-defined dimensional cubed data
- Late binding
- Trust the analysts – allow data access and judge analytic products, not data access
- **Data is shared** and used to improve the system (Secondary Use Data Policy)
- Embrace the value of both primary and secondary use and see them as intimately connected
- Understand what needs to be real time or not
Brent James – Intermountain Health Care

‘You manage what you measure’

‘Our business is clinical medicine’

‘Transformation from an administrative model to a clinical process management model’
Three Systems for Outcomes Improvement

**What should we be doing?**
SCNs

**How are we doing?**
Analysts

**How do we transform?**
Operations, QI

*Courtesy of Health Catalyst*
Heart Failure Outcomes Improvement - Example
Background – Why HF?

- **High Cost:** over $100M annually in Alberta (ranks 4th after births, COPD and rehab procedures)
- **High Volume:** 5th largest inpatient population in Alberta with over 6,300 hospital discharges in FY 2017/18 (>2,200 in Calgary Zone)
- **High Readmissions:** 1 in 5 HF patients is readmitted to hospital within 30 days of discharge
- Care is not **Standardized**
Best Practice – “What Should we be Doing?”

- Started with a 2009 clinical optimization initiative at FMC which identified several interventions:
  - Admission order set
  - Documenting daily weights
  - Patient education
  - Patient makes appointment with family doctor before discharge
  - Standardized criteria for Cardiac Function Clinic referral
  - Post-discharge surveillance via HF Liaison Nurse (FMC only)
HF Outcomes Improvement at RGH

• **Outcome goals:** reduce LOS & readmissions, improve patient QoL

• RGH outcomes improvement team:
  – Co-chairs: site Cardiology MD Lead (N. Sharma) and Exec Dir (V. Meyer)
  – Others: Hospitalist physician, Hospitalist QI nurse, IM physician, Patient Rep, Unit Managers, QI Consultant, Analyst, Project Manager, SCN rep

• Aligned with the SCN (sponsors J. Howlett, S. Aggarwal)

• Planning began Spring 2017

• Implementation January 2018 (U71/72), spread May 2018 to U93/94

• Analytics developed to monitor outcomes, clinical processes, patient feedback
Aggregate Performance Measures - Process Indicators
HF Teaching in Flowsheet

Instructions:
1) Use the red Global Parameters Box to select the Time Period, Reporting interval and Process indicator.
2) Use the green and blue boxes to select the characteristics of the visits to be displayed.
3) Hover your mouse over the line chart view the Indicator Definition, Numerator, Denominator, and actual Performance. The bar chart shows the number of discharges.
4) This view contains patients with either HF as the first item on the admitting diagnosis list or a Bluedot entry in the MPR.

Set Parameters for Green Line
Site: RGH
Unit(s): (Multiple values)

Set Parameters for Blue Line
Site: RGH
Unit(s): (Multiple values)
### Process Snapshot – CHF Patients in Hospital

#### Instructions:
1. Use the Red Global Parameters Box to select the characteristics of visits you wish to display.
2. To view the definition for the indicators, hover your mouse over the question mark.
3. To view Ejection Fraction and Medical Therapy, hover your mouse over any of the green or grey boxes associated with that visit.
4. While the patient list is updated hourly, the majority of the indicators are updated daily (see timestamp below) with the exception of BNP Ordered.

#### Global Parameters:
- **Site**: RGH
- **Unit**: (Multiple values)

#### Diagnosis Cohort:
- **HF Keyword - 1st Position**: ...
- **Exclude Palliative GCD**: Yes
- **Exclude Pediatrics (<19)**: No

#### Care Providers:
- **Admitting Discipline**: All Disciplines
- **Admitting Physician**: All
- **Attending Group**: All
- **Attending Physician**: All

#### Legend:
- Completed
- Partially Completed
- Not Completed
- Not Applicable

#### Demonstration Mode (No Patient ID):
- No

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<tr>
<th>Patient Name</th>
<th>Admitting Diagnosis</th>
<th>Inpatient Unit</th>
<th>GCD Code</th>
<th># Days in Hospital</th>
<th>Bluedot Pathway</th>
<th>HF = 1st Admit Dx</th>
<th>CHF Order Set Used</th>
<th>HF Teaching in flowsheet</th>
<th>HF Teaching in MFR</th>
<th>BNP Ordered</th>
<th>Up to Date EF Data</th>
<th>Sodium Restrict Diet Order</th>
<th>Weight Daily Order</th>
<th>HF Weight Daily Order</th>
<th>Meeting % days with Daily Weights</th>
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<td>Post-op heart failur...</td>
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<td>retention and BPH...</td>
<td>RGH 72 R2</td>
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<td>Nause, vomiting</td>
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<td>1 - AKI ...</td>
<td>RGH 71 M1</td>
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# CHF Visit List: Site-level view

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<tr>
<th>RHRN</th>
<th>Patient Name</th>
<th># Days Adm</th>
<th>Age</th>
<th>GOC</th>
<th>Unit</th>
<th>Attending Group</th>
<th>Admit Dx</th>
<th>Risk Points</th>
<th>30-Day Readmit Prob.</th>
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<td>7</td>
<td>77</td>
<td>R1</td>
<td>RGH-71</td>
<td>RGH Dermatology</td>
<td>AHF/DCM, Persistent AFib, AR.</td>
<td>12</td>
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<td>8</td>
<td>87</td>
<td>M1</td>
<td>RGH-72</td>
<td>RGH Hospitalist Group</td>
<td>Congestive Heart Failure, AKI</td>
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<td>62</td>
<td>57</td>
<td>R1</td>
<td>RGH-56</td>
<td>RGH Sub Acute Family Med Unit</td>
<td>Heart failure</td>
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<td>2</td>
<td>81</td>
<td>R1</td>
<td>RGH-CCU</td>
<td>RGH Dermatology</td>
<td>New AHF + New AFib, RVR + AKI +/- Pneumonia.</td>
<td>10</td>
<td>14%</td>
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<td>22</td>
<td>81</td>
<td>R1</td>
<td>RGH-57</td>
<td>RGH GARP Group</td>
<td>CHF, pleural effusion, pelvic fracture</td>
<td>9</td>
<td>35%</td>
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<td>1</td>
<td>70</td>
<td>M1</td>
<td>RGH-71</td>
<td>RGH Dermatology</td>
<td>CHF, PCOPD, ? pulm HTN</td>
<td>9</td>
<td>34%</td>
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<td>0</td>
<td>82</td>
<td>M1</td>
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<td>RGH Hospitalist Group</td>
<td>AECF</td>
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<td>2</td>
<td>50</td>
<td>R1</td>
<td>RGH-71</td>
<td>RGH Dermatology</td>
<td>Post-op heart failure, wound infection</td>
<td>9</td>
<td>17%</td>
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<td>5</td>
<td>62</td>
<td>R1</td>
<td>RGH-71</td>
<td>RGH Dermatology</td>
<td>Heart Failure</td>
<td>9</td>
<td>16%</td>
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<td>17</td>
<td>80</td>
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<td>RGH-72</td>
<td>RGH Hospitalist Group</td>
<td>Recurrent OLF; Hypoxia-Pneumonia, Hx of CHFpEF</td>
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<td>95</td>
<td>M1</td>
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<td>RGH Hospitalist Group</td>
<td>GLF with insufficiency fractures, CHF</td>
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<td>40%</td>
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<td>42</td>
<td>88</td>
<td>M1</td>
<td>RGH-57</td>
<td>RGH GARP Group</td>
<td>Worsening Heart Failure, ICMP, Recent A. Flutter,...</td>
<td>8</td>
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<td>16</td>
<td>91</td>
<td>R1</td>
<td>RGH-71</td>
<td>RGH Hospitalist Group</td>
<td>CHF</td>
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<td>36%</td>
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<td>89</td>
<td>M1</td>
<td>RGH-72</td>
<td>RGH Hospitalist Group</td>
<td>Congestive heart failure</td>
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<td>R3</td>
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<td>RGH Hospitalist Group</td>
<td>Heart Failure</td>
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<td>8</td>
<td>90</td>
<td>M1</td>
<td>RGH-71</td>
<td>RGH Hospitalist Group</td>
<td>Pneumonia, dCHF</td>
<td>8</td>
<td>21%</td>
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</tbody>
</table>
Monitoring HF Outcomes

Aggregate Performance Trends - Outcome Indicators

Instructions:
1) Use the red Global Parameters Box to select the Time Period, Reporting Interval and Outcome Indicator.
2) Hover your mouse over the time period of interest to view the Indicator Definition, Numerator, Denominator, and actual Performance. The bar graph shows the number of discharges.
3) It is important to note that the data comes from Discharge Abstract Database (DAD) and is subject to data delay.
4) This view contains patients with a DAD record that corresponds to the visit AND one of HF as the first item on the admitting diagnosis list OR a Bluedot entry in the MPR.

75th Percentile Length of Stay

30-Day All-Cause Readmission

Number of Discharges with a corresponding DAD Record
Patient Feedback

Patient Survey (Self Reported Disease Severity and Resources) - Preliminary Results

Instructions:
1. Use the Global Parameters Box to select the characteristics of visits you wish to display.
2. To view information about each measure, hover your mouse over the measure.
3. There is a 3 to 4-month data lag from the time the initial survey was collected as the post survey is completed 3 months after the patient is discharged.

# Patients Included
74

Heart Failure Symptom Severity (Self Reported NYHA Class)

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<th>Grade</th>
<th>Initial</th>
<th>Post</th>
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<tr>
<td>1</td>
<td>12.33% (9/73)</td>
<td>14.93% (10/67)</td>
</tr>
<tr>
<td>2</td>
<td>36.36% (28/73)</td>
<td>37.31% (25/67)</td>
</tr>
<tr>
<td>3</td>
<td>26.77% (21/73)</td>
<td>32.84% (22/67)</td>
</tr>
<tr>
<td>4</td>
<td>20.56% (15/73)</td>
<td>14.93% (10/67)</td>
</tr>
</tbody>
</table>

Heart Failure Resources (% Yes Responses)

- Have you been told you have Heart Failure?
  - Initial: 79.73% (59/74)
  - Post: 81.16% (56/69)

- Do you have a Heart Failure specialist who looks after you?
  - Initial: 40.66% (33/73)
  - Post: 62.77% (44/69)

- Have you been provided with Heart Failure education material?
  - Initial: 60.63% (55/72)
  - Post: 86.86% (60/69)

- Have you received Heart Failure teaching?
  - Initial: 52.11% (37/71)
  - Post: 55.07% (38/69)

- Have you been informed of community Heart Failure support services?
  - Initial: 15.94% (11/68)
  - Post: 34.33% (23/67)

- Do you know how to tell when your Heart Failure is getting worse?
  - Initial: 61.33% (37/72)
  - Post: 65.67% (44/67)
What Have We Learned?

- Frontline operations & physician leaders must own the work
- All care teams that do the work must be involved
- Outcomes improvement work and adopting clinical best practice and reducing variation is not easy
- No formal accountability for outcomes
- Clinicians need to see data on pathway/order set variations and outcomes to understand where the gaps are and focus improvement efforts
- Clinical data is complicated and messy
AHS Data and Analytics Road Map

- **Data and Analytics Roadmap** approved by Analytics Executive Committee (AEC):
  - **Outcomes Improvement** is the priority for data and analytic capacity (IHOT: Improving Health Outcomes Together)
  - Implement the **analytic functions** required to become high performing – clinical, operational, and corporate
  - **Strategic data** acquisition (Quadruple Aim)
  - Data literacy
  - **Analyst** development
  - **Enterprise Data Warehouse (EDW) Roadmap** – Modernizing The Environment
  - **Secondary Use Data Policy** (data is an organizational asset that should be shared to improve outcomes)
Connect Care
Center of the Universe Shifts

Connect Care

Data & Analytics

Connect Care

Data and Analytics

Ptolemy

Copernicus

Dale Sanders – Age of Analytics
Center of the Universe Shifts

Data & Analytics

Connect Care

Outcomes Management

Connect Care

SCNs

Quality

Clinical Operations

Ptolemy

Copernicus

Dale Sanders – Age of Analytics

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Gaps that Connect Care Will Fill!

- **CLINICAL DATA IS CURRENTLY OUR MOST IMPORTANT DATA NEED!**

- Connect Care will deliver the clinical process, clinical outcome, and operational data needed to help improve health outcomes

- Real time in-system operational and clinical reporting
Connect Care - Analytics - How We See It

• Connect Care will create substantial data
• Implementation will ‘break’ many data streams and data will need to be conformed to meet provincial reporting requirements
• Data streams will become broader - across service domains and geography over time as Connect Care rolls out
• Eventually, EPIC CIS data will be the dominant source
• Reduced AHS analytics resources used to integrate data across disparate systems, and the need to understand multiple IT systems
• Over time, in-system data and analytics to grow and out-of-system will contract
• Epic tools complement the existing EDW and reporting and analytic tools
• Shifting data and analytic support to front line clinical operations to help improve outcomes – rely on EPIC for automated pathway activation, and support clinical workflows and real time decision support at the point of care
Building Our Measurement Systems from the Bottom up

CASCADING ACCOUNTABILITIES FOR ANALYTICS

APPROPRIATE AUDIENCE

Public/Minister

Alberta Health Services Board/Joint Executive

Alberta Health Services Executive/Alberta Health

Zone/Strategic Clinical Network Leadership

Zone

Clinical/Front Line

REPORTING FREQUENCY

Annual

Quarterly

Monthly

Daily

Real Time

Health System Outcome

- 10-12 measures
- Interpretable with public
- Ideally outcome based
- Linkage to Strategic Vision
- Bold statements of key components
- National benchmarks for comparison (i.e., CQI)

Strategic Measures

- 12-16 measures
- Reflective of 3-5 year health system priorities
- Includes focus on system effectiveness / sustainability
- Measure to include key components of health service areas
- Key strategic initiatives link directly to measures
- Focus along continuum of care
- Ideally includes drivers of health system outcome measures
- Set by Alberta Health Services Executive and Board

Tactical Measures

- Substantial total number of measures
- Expands on key drivers of outcome and strategic measures
- Includes both performance measures (outcomes) as well as key inputs and outputs
- Measures reflect key health service areas and key patient populations
- Measures link directly to key activities implemented in support of strategic initiatives
- Measures reflect integrated (across service area) care pathways
- Measures provide feedback for management and operations within clinical and service areas
- With outcome and strategic measures balanced across 6 dimensions of quality
- Inputs (structure, FTEs, $), Outputs (patients served) and Outcomes linked
- Set by Alberta Health Services

Transactional Measures

- Can be unlimited number of measures
- Provides metrics of all types (input, output, outcome)
- Measures allow for real time clinical decision making
- Measures allow for real time case management
- Measures highly focused and specific (micro-system) and drawn from care pathways/protocols
- Measures reflect all health service areas and all clinical populations
- Developed by front line clinicians, operations staff
- Set by Alberta Health Services

(Alberta Health Services [AHS], 2013, p. 5; Alberta Health, 2014, p. 15)
Analytics Requirements From EPIC

1. **Clear documentation** on the back end data models (EPIC Clarity)
2. Access to, and the ability to move, Clarity data into the EDW, go-live
3. **Closed Loop Analytics** - Integrate analytic content from AHS EDW to EPIC CIS at the point of care, real and near real time
4. **Collecting data** during the clinical care process, that is **NOT** captured as a by-product of care delivery (PROMs, PREMs)... (from patients and providers)
5. **Training** developing in-system data and analytic tools – Reporting Workbench, Radar
Closed Loop Analytics Lifecycle

- Connect Care
- New insights and knowledge created
- Questions asked and analysis undertaken
- Real-time clinical decision support
- Data extract, transform and load (ETL)
- Enterprise Data Warehouse
Quadruple Aim

Major Data Acquisition Strategies to Support the Quadruple Aim:

- Clinical CIS data
- Financials
- Clinical and Patient Reported Outcomes
- Patient Experience
- Staff Experience/engagement

Prioritized Strategic Data Acquisition
Patient Reported Outcomes

- APERSU (Alberta PROMs and EQ-5D Research and Support Unit)
- EQ5D
- Connect Care – Patient Portal (MyChart) and integrated into the CIS
Clinical Activity Based Costing

- ACH Demonstration
- Connect Care – clinical costing development outside of the CIS working with Finance
ACH Demonstration – Appendicitis Pathway

Alberta Children’s Hospital was an ideal site for a demo project because:

- An appendectomy pathway was in place
- SCM fully implemented across all service areas
- Clinical and operational leadership very keen and engaged
Clinical Costing – SCM Example

\[ \text{Patient Cost} = \sum \text{Patient Activities} = \$4,027 \]
Utilization & Costing Detail

### Variable Cost Per Visit

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR (Claims + Supplies)</td>
<td>$1,528.61</td>
</tr>
<tr>
<td>Consults (Claims)</td>
<td>$621.20</td>
</tr>
<tr>
<td>SCM Non-Med Orders</td>
<td>$1,686.52</td>
</tr>
<tr>
<td>SCM Medications</td>
<td>$291.48</td>
</tr>
<tr>
<td>Miscellaneous (Claims)</td>
<td>$97.70</td>
</tr>
</tbody>
</table>

### Non-Medication Orders

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
<th>Avg. Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic Imaging</td>
<td></td>
<td>$158.64</td>
</tr>
<tr>
<td>Ultrasound of Bladder, Female</td>
<td>9</td>
<td>$158.64</td>
</tr>
</tbody>
</table>

### Medication Administrations

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactated Ringers</td>
<td>$38.32</td>
</tr>
</tbody>
</table>

Total Variable Cost Per Visit: $4,225.59
Experience

- Broader capture of experience across the continuum
- Connect Care – out-of-system near real time feedback

Child Inpatient Survey: Composite Scores for Province
Composite scores are aggregates of questions contained within each measure. Averages of question responses are taken and weights are applied.

Keeping parent informed about the child’s care in ER: 51%
Overall nurse rating: 89%
Overall pharmacist rating: 88%
Overall doctor rating: 88%
Overall hospital rating: 82%
Willingness to recommend the hospital: 83%
Parents’ involvement in child’s care: 83%
Doctors and parent communication: 81%
Nurses and parent communication: 79%
Discharge preparation: 78%
Providers introductory: 77%
Privacy when talking to providers: 75%
Communication about medicines: 73%
Paying attention to child’s pain: 72%
Involve teens in their care: 71%
Cleanliness of hospital room: 70%
Keeping patient informed about the child’s care: 66%
Responsiveness to call button: 66%
Coordination of care: 66%
Nurses and child communication: 66%
Doctors and child communication: 66%
Provider follow-up on concerns: 64%
Guests of hospital room: 63%
Preventing mistakes and helping report concerns: 48%

Composite Measures: Adult Inpatient
This dashboard compares the provincial scores to the individual zone scores. Hovering over each zone score displays the scores for each site. Composite scores are aggregates of questions contained within each domain. Averages of top box responses are taken.

Hovering over zone scores produces a pop up with site scores for each zone.

Composite Scores for All

<table>
<thead>
<tr>
<th>Zone</th>
<th>Composite Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial</td>
<td>80%</td>
</tr>
<tr>
<td>North Zone</td>
<td>77%</td>
</tr>
<tr>
<td>Edmonton Zone</td>
<td>80%</td>
</tr>
<tr>
<td>Central Zone</td>
<td>80%</td>
</tr>
<tr>
<td>Calgary Zone</td>
<td>81%</td>
</tr>
<tr>
<td>South Zone</td>
<td>77%</td>
</tr>
</tbody>
</table>

Global Rating
How would you rate the quality of care you most recently received at the hospital?
Using any number from 0 (worst hospital possible) to 10 (best hospital possible), what is your overall rating of your stay in the hospital?
We want to know overall, do you feel you were helped by your hospital stay? Please answer on a scale where 0 is “not helped at all” and 10 is “helped a lot”.
We want to know your overall experience with your hospital stay. Please answer on a scale where 0 is “I had a very poor experience” and 10 is “The experience was excellent”.

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Research

- Embraced the value of research
- Leverage the data environment we have for SPOR
- Standardized friendly consistent research support process
Connect Care Wave 1 Sites -

- Wave one sites will be the data and analytics development sites
- Focus on OpTime OR Epic Module
- Clinical Activity Based Costing
- PROMs
- OR operational reporting
- Near real time patient experience capture
- OR triggers and other safety management data
Flow of Data

Operational Reporting
- Hyperspace
- Hierarchical database with real-time data
- Reporting
  - Workbench Reports (RWB)
  - RWB Extracts
  - Radar
  - Application Reports KB_SQL, etc.

Analytical Reporting
- Clarity
- Relational database with a normalized data model
- Crystal Reports
  - BOE
  - SSRS
  - BO Universe, etc.

- Caboodle
- Dimensional data model for ease of reporting and data exploration
- SQL Management Studio
  - SSAS (Cubes)
  - BO Universe
  - BI tools (Tableau, QlikView, etc.)

Data warehouse
- AHS EDW
Provincial Perspectives

- AHS is only part of the system – EPIC is largely a hospital EMR
- Need to integrate across other parts (primary care, community specialty care, community diagnostics)
- One data system to serve them all – AH, AHS, HQCA, AMA, PCNs, College, Universities…
- Health and Non-health data
- Unique opportunity
- Data lab – 4.2M individuals
- Data can be Alberta’s next big asset!
The Human Data Ecosystem

Dale Sanders – HAS 2017
AI/ML Buzz

- AI
- ML
- NLP
- Streaming analytics
- Video analytics
Challenges

• Need use cases
• Complexity of data
• Quality of data
• Outcomes improvement is hard work
• How to support access for AI and ML applications
Imagine If:

- Between a clinician and their patient you could say:

  "I can make a health optimization recommendation for you, informed not only by the latest clinical trials, but also by local and regional data about patients like you; the real-world health outcomes over time of every patient like you; and the level of your interest and ability to engage in your own care. In turn, I can tell you within a specified range of confidence, which treatment or health management plan is best suited for a patient specifically like you and how much that will cost."*

This statement embodies outcomes and cost data, predictive analytics, machine learning, social determinants data, recommendation engines, personalized medicine.

*—Inspired by the Learning Health Community – Dale Sanders