Using Data for Evidence Based Decision Making: A Davies Story

Session 196, March 8th, 2018

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    Sr. Director Nursing Education, Cleveland Clinic

COMMITMENT
Conflict of Interest

Has no real or apparent conflicts of interest to report:
DuWayne Willett, MD, MS
Mujeeb A. Basit, MD, MMSc

Reported conflict: VitalScout SM is a proprietary algorithm and service Cleveland Clinic is working to take to market. The purpose of this session is to articulate conceptually how dynamic visualization can drive adaptive care and measurable, tangible outcomes.

Suzanne Fink, MSN, RN
Kathleen Burns, DNP, APRN
Agenda

• University of Texas Southwestern
• Cleveland Clinic
• Questions
Learning Objectives

• Explain why conforming a relatively small set of master dimensions (date, patient, provider, location, organization, diagnosis, treatment, etc.) enables analytic interoperability across a wide variety of data sources

• Justify providing data visualizations to front-line clinicians as well as managers in support of an enterprise initiative

• Articulate how dynamic visualization can drive adaptive care and measurable, tangible outcomes
UT Southwestern Health System

William P. Clements Jr. University Hospital

- 604 Beds
- 1700 Physicians
- 40+ Clinics
- 23,132 Admissions
- 40,813 ED Visits
- 7947 Inpatient Surgeries

Academic Medical Center in Dallas
Partnered with Texas Health Resources

West Campus Professional Building 1
Radiation Oncology Facility
Moncrief Medical Center at Fort Worth
The Challenge

Quality Metrics + Every Department

= Enormous Amount of Work
Data Warehouse Architecture

**Governance Functions**
- Kimball Star Schema
- Reusable Data Model

**Data Quality**
- Executive Steering Committee
- Business Rules Workgroup

**Data Approval**
- Pre-approved and Approved Environments

**Compliance**

**Interoperability**

**Unified Architecture**
- Data Lake Data Model

**Technology**
- Power BI
- Write-back to Epic

**Dictionary**
- Business Definitions
- Technical Documentation
Architecture

65
Epic Modules

Data
Vault

Data
Mapping

Rules
Engine

Applications
241

Microsoft Azure

Microsoft SQL Server
Analysis Services

i2b2

#HIMSS18

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Data Warehouse Cube

12 Terabytes Data

33 Source Systems

Research

Fact

Dim

Cubes

Query Tools

Descriptive, Predictive & Prescriptive Analytics

Self-Service Ad-Hoc Reporting

BIT Tools

Standard Reports

Combined Tools

Self-Service Data Visualization

Write-back

Dashboards

Epic

Research

Dashboards

Standard Reports

Self-Service Data Visualization

Write-back

Epic

Self-Service Ad-Hoc Reporting

Descriptive, Predictive & Prescriptive Analytics

Query Tools
Quality Measure Reporting Framework

FACT_PatientQualityScorecard --
1 row per patient per measure per reporting period per attributed provider
Data Model and Analytic Interoperability
### Data Model and Analytic Interoperability

<table>
<thead>
<tr>
<th>Fact Grain (1 row per)</th>
<th>Metric</th>
<th>Dates</th>
<th>Phonet</th>
<th>Phenit</th>
<th>Ex-sanct/Ext-app</th>
<th>Clin-ical/Enc-ty</th>
<th>Locati-on</th>
<th>Diagnosi-s</th>
<th>Treata-men-t/Proced-ure</th>
<th>Qualit-ity Meas-ure</th>
<th>Risk Event</th>
<th>Concept</th>
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<tbody>
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<td>Medication Order</td>
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<tr>
<td>OR Procedure</td>
<td>OR Case Qty, Case Duration</td>
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<td>X</td>
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<td>Professional Charges</td>
<td>Prof Charge Qty, Charge Amt, RVU</td>
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<td>Hospital Charges</td>
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<td>(X)</td>
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<td>Hospital Account</td>
<td>Hosp Acct Qty, Total Charges, Costs</td>
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<td>X</td>
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<td>X</td>
<td>X</td>
<td>(X)</td>
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<td>Patient-Entered Questionnaire Answers</td>
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<td>Custom Data Concept Value</td>
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<td>Clinical Decision Support Alert Display</td>
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<td>X</td>
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<td>Clinical Quality Measure Value</td>
<td>Denom Qty, Numer Qty, Exception Qty</td>
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<td>X</td>
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<td>Risk Score</td>
<td>Risk Score</td>
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<tr>
<td>Observation (i2b2)</td>
<td>Value</td>
<td>X</td>
<td>X</td>
<td>X</td>
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## Results

<table>
<thead>
<tr>
<th>Item</th>
<th># 2016</th>
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<tbody>
<tr>
<td>Specialties</td>
<td>30</td>
</tr>
<tr>
<td>Registries</td>
<td>43</td>
</tr>
<tr>
<td>EHR Tools Built</td>
<td>111</td>
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<tr>
<td>Measures</td>
<td>163</td>
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<tr>
<td>Dashboards</td>
<td>32</td>
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<tr>
<td>Unique patients tracked on registries</td>
<td>&gt;60,000</td>
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<tr>
<td>Patient-reported outcome questionnaires</td>
<td>&gt;2,100</td>
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</table>

<table>
<thead>
<tr>
<th>Item</th>
<th># currently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registries</td>
<td>52 with CQMs; 81 total</td>
</tr>
<tr>
<td>Unique patients</td>
<td>&gt;80,000 actively managed; 222K on a registry</td>
</tr>
<tr>
<td>Pt-reported outcome questionnaires</td>
<td>&gt;8,500 (by 3,000 pts)</td>
</tr>
</tbody>
</table>

Rheumatoid Arthritis: Quality Measurement & Improvement

**DMARD Compliance**
- 96.3 → 98.6
- 3.7 → 1.4 Defect

**CDAI Assessment**
- 42.7 → 80.9

**CDAI Score Severity: Low Disease Activity (> 2.8 and <= 10)**
- 38.6 → 42.3

**CDAI Score Severity: High Disease Activity (> 22)**
- 13.7 → 10.1
PowerBI Dashboard

Population

- Rheumatology

Measure Performance Rate By Reporting Period

<table>
<thead>
<tr>
<th>Measure</th>
<th>2016-09</th>
<th>2016-10</th>
<th>2016-11</th>
<th>2016-12</th>
<th>2017-01</th>
<th>2017-02</th>
<th>2017-03</th>
<th>2017-04</th>
<th>2017-05</th>
<th>2017-06</th>
<th>2017-07</th>
<th>2017-08</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDAM Assessment</td>
<td>51.3</td>
<td>59.7</td>
<td>63.4</td>
<td>69.7</td>
<td>74.8</td>
<td>76.6</td>
<td>78.9</td>
<td>77.8</td>
<td>78.7</td>
<td>81.0</td>
<td>80.6</td>
<td>80.9</td>
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<tr>
<td>CDAM Score Severity: Moderate Disease Activity (&gt; 22)</td>
<td>13.7</td>
<td>12.3</td>
<td>12.2</td>
<td>11.6</td>
<td>11.0</td>
<td>10.1</td>
<td>10.0</td>
<td>9.9</td>
<td>9.8</td>
<td>9.6</td>
<td>9.5</td>
<td>10.1</td>
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<tr>
<td>CDAM Score Severity: Low Disease Activity (0-2)</td>
<td>33.6</td>
<td>40.0</td>
<td>42.2</td>
<td>42.5</td>
<td>42.8</td>
<td>42.3</td>
<td>42.1</td>
<td>42.0</td>
<td>41.9</td>
<td>41.8</td>
<td>41.7</td>
<td>41.6</td>
</tr>
<tr>
<td>DMARD Compliance</td>
<td>98.6</td>
<td>99.2</td>
<td>99.2</td>
<td>99.0</td>
<td>99.1</td>
<td>98.9</td>
<td>99.2</td>
<td>99.1</td>
<td>98.9</td>
<td>98.9</td>
<td>98.9</td>
<td>98.6</td>
</tr>
</tbody>
</table>

Registry

- Select All
- Rheumatology

Measure

- Select All
- CDAM Assessment
- CDAM Score Severity: High Disease Activity (> 22)
- CDAM Score Severity: Low Disease Activity (0-2)
- CDAM Score Severity: Moderate Disease Activity (23 and <= 44)
- CDAM Score Severity: Remission (> 45)
- DMARD Compliance

Powered by HISP&BIA | Source: EDW
Provider Dashboard

CDAI Assessment

Report completed: Tue 9/19 08:48 AM
Number of patients with CDAI assessment of low, moderate, and high grouped by gender.

- Female
  - High disease activity
  - Low disease activity
  - Moderate disease activity
  - Remission

- Male
  - High disease activity
  - Low disease activity
  - Moderate disease activity
  - Remission

Ambulatory Quality Metrics

This component displays data on local quality measures from enterprise data warehouse for the Rheumatology Department.

- Rheumatology
  - Percent: 60% 62% 70% 75% 77%
  - Numerator: 314 335 371 394 416
  - Denominator: 616 618 619 617 618
Clinic Medical Director & Quality Leadership Dashboard

Ambulatory Quality - Clinical Quality Dashboard

Population

Rheumatology

Registry-Measure

- Rheumatology - CDAD Assessment
- Rheumatology - CDAD Score: High Disease Activity (≥ 2.0)
- Rheumatology - CDAD Score: Low Disease Activity (< 2.0)
- Rheumatology - CDAD Score: Moderate Disease Activity (2.0-4.0)
- Rheumatology - CDAD Score: Remission (< 2.0)
- Rheumatology - DMARD Compliance
- Rheumatology - PQRS DMARD Compliance

Measure Performance Rate By Provider

Average of Performance Rate

87

Median of Performance Rate

88

Light blue bars indicate measure denominator ≤ 20; performance rate estimates may not be reliable. 95th percentiles indicated by dashed line; percentile value indicated in green.

Measure Performance Rate By Number of Patients

Reporting Period

- 2017-06
- 2017-05
- 2017-04
- 2017-03
- 2017-02

Powered by HSP&A | Source: EDW
Reducing Variation in Provider Clinical Practice

Ambulatory Quality - Clinical Quality Dashboard

Population
- Rheumatology
- Rheumatology

Registry-Measure
- Rheumatology - CDAI Assessment
- Rheumatology - CDAI Score Severity: High Disease Activity...
- Rheumatology - CDAI Score Severity: Low Disease Activity...
- Rheumatology - CDAI Score Severity: Moderate Disease Activity...
- Rheumatology - CDAI Score Severity: Remission (≤ 2.6)
- Rheumatology - DMARD Compliance
- Rheumatology - PQRS DMARD Compliance
Summary

New Patient Encounters (Last 24 months and Next month)
- Completed Encounter Count
- Scheduled Encounter Count

New Patient Encounters (Last 24 months and Next)
- Internal M... 71K
- Surgery 20K
- Obstetrics... 18K
- Orthoped... 17K
- Neurology 16K
- Otolaryng... 16K
- Urology 15K
- Ophthalm... 15K
- Dermatology 13K
- Physical M... 10K
- N/A 9K
- Neurologic... 8K

Fig. 2 ROC curve for logistical regression model for predicting bilirubin <2
Agile Modeling

As a ___, I want to be able to ____ so that ____.

Data Warehouse

Automated Error Detection

Summary

Agile Development

Plan

Act

Study

Do
Question: Two health care organizations are affiliating to form a clinically-integrated network (CIN), to accelerate their journey to providing and measuring high-value care to the patients they serve.

Question: Which of the following will be most helpful in creating analytic interoperability between the two organizations’ data for a 360-degree view of each patient and for population health analytics?

A. Co-locate transaction data from both organizations on a single physical server
B. For key analytic dimensions (patient, provider, diagnosis, treatment), map local codes in each system to a conformed set of standard codes
C. Co-locate analysts working on the data in the same physical location
D. For key analytic fields, update each source system at both health care organizations to use the exact same descriptions/labels for the same data attributes (such as provider specialty: "Cardiology" vs "Cardiovascular Disease")
Additional Questions?

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mujeeb.basit@utsouthwestern.edu

*Friendly reminder - please complete online session evaluation!*
Patient Story

Our mission is to provide better care of the sick, investigation into their problems, and further education of those who serve.

<table>
<thead>
<tr>
<th>POD/Time</th>
<th>POD 2 1600</th>
<th>POD 2 2200</th>
<th>POD 3 0708</th>
<th>POD 3 1541</th>
<th>POD 4 0005</th>
<th>POD 4 0839</th>
<th>POD 4 1600</th>
<th>POD 4 2350</th>
<th>POD 5 0758</th>
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</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>94</td>
<td>95</td>
<td>102</td>
<td>116</td>
<td>117</td>
<td>104</td>
<td>115</td>
<td>76</td>
<td>121</td>
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<tr>
<td>Resp</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>BP</td>
<td>152/74</td>
<td>137/72</td>
<td>130/70</td>
<td>102/72</td>
<td>88/58</td>
<td>99/57</td>
<td>73/51</td>
<td>100/54</td>
<td>112/64</td>
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<tr>
<td>SpO2</td>
<td>97</td>
<td>100</td>
<td>97</td>
<td>97</td>
<td>100</td>
<td>95</td>
<td>97</td>
<td>94</td>
<td>93</td>
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<td>O2 Therapy</td>
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<td>RA</td>
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<td>RA</td>
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<td>RA</td>
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<td>NPR Assess</td>
<td>0900</td>
<td>1900</td>
<td>0800</td>
<td>1700</td>
<td>0000</td>
<td>0900</td>
<td>1600</td>
<td>1948</td>
<td>0800</td>
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</tbody>
</table>
Challenges Faced

- Communication
- Chain of command
- Transition to practice gap
- Preponderance of technology
- Workflow variance
Situational Awareness (SA)

Key Components:

• Awareness of information
• Comprehension of its meaning
• Projection of future status

Under stress, SA is adversely effected.

SA is difficult to measure: You can’t process what you’re not aware of!
VitalScout SM Program

Automated Early Warning System

VitalScout SM Screensavers

Shared Report

Accountability tools and templates
DNR-CC – Comfort Care Only (designated by color purple)

*Nursing Staff can *always* escalate to higher level (i.e from green to red)
# Life (Live) Screen “Saving” & Enhancing Situational Awareness

<table>
<thead>
<tr>
<th>Unit</th>
<th>Bed</th>
<th>Room</th>
<th>VITAL SIGN</th>
<th>VITAL CLINICAL</th>
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<td>4D-408D-01</td>
<td>5</td>
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</table>

**LU All Units**

Last Updated: 5/4/2017 - 5:03:31 PM

Sort By: Vital Scout, Bed
Clinical Data
- Request Routing
- Data Validation
- Standardized API
- Composite Services
- Batching

CSL BROKER LAYER
- Access Management
  - Security
  - Logging
  - App Management
  - Reporting
  - Caching
  - Documentation

CSL DATA LAYER
- Application
- Application
- Application

EPIC
ANALYTICS DB
IMAGING
* HIPAA de-identified information outside of Epic (location only) with the screen saver facilitates rapid recognition of patient changes; full workflow remains within EMR.
Assessment → Diagnosis → Planning → Implementation → Evaluation

VITAL SCOUT SCREEN SAVER

Nurse A, PCNA, Physician, Nurse B

Documentation Tools

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Cumulative Patient Hours at High Acuity

% Patient Hours

Month

Pre-Implementation (2015-2016)

Post-Implementation (2016-2017)
Reassessment Times of High Acuity Patients

VitalScout

<table>
<thead>
<tr>
<th>Reassessment Time</th>
<th>Pre</th>
<th>Post</th>
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<tbody>
<tr>
<td>≤ 2 hours</td>
<td>37.7%</td>
<td>83.9%</td>
</tr>
<tr>
<td>&gt; 2 hours</td>
<td>62.3%</td>
<td>16.1%</td>
</tr>
</tbody>
</table>

p = 4.67 x 10^{-92}
## Patient Story

<table>
<thead>
<tr>
<th>POD/Time</th>
<th>POD 2 1600</th>
<th>POD 2 2300</th>
<th>POD 3 0708</th>
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<th>POD 4 0809</th>
<th>POD 4 0939</th>
<th>POD 4 1600</th>
<th>POD 4 2350</th>
<th>POD 5 0758</th>
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<tr>
<td><strong>Pulse</strong></td>
<td>94 95 102 116 117 104 115 76 121 106</td>
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<td><strong>Resp</strong></td>
<td>20 20 20 20 20 20 20 20 20 20</td>
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<tr>
<td><strong>BP</strong></td>
<td>152/74 137/72 130/70 102/72 88/58 99/57 73/51 100/64 122/64 99/61</td>
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</tr>
<tr>
<td><strong>SpO2</strong></td>
<td>97 100 97 97 100 95 97 94 93</td>
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Questions

With a CDS that is visible in real-time (i.e. screen saver), which is the best target audience?

A. Clinical providers
B. Non clinical Support Staff
C. Patients and Family Members
D. All of the above
Questions

Designing analytics for complex CDS cannot be accomplished until the CDS is live and initial data is collected (True/False)?
Additional Questions?

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Friendly reminder - please complete online session evaluation!