Session 14
The Geisinger Hedged Unified Data Architecture

John Kravitz, MHA, CHCIO
Senior Vice President and CIO, Geisinger Health System

Alistair Erskine, MD
Chief Strategic Information Officer, Geisinger Health System
# Healthcare Performance and Outcomes

## Country Rankings

<table>
<thead>
<tr>
<th>Country</th>
<th>AUS</th>
<th>CAN</th>
<th>FRA</th>
<th>GER</th>
<th>NETH</th>
<th>NZ</th>
<th>NOR</th>
<th>SWE</th>
<th>SWI</th>
<th>UK</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Ranking (2013)</td>
<td>4</td>
<td>10</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Quality Care</td>
<td>2</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>11</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Effective Care</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>11</td>
<td>10</td>
<td>8</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Safe Care</td>
<td>3</td>
<td>10</td>
<td>2</td>
<td>6</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Coordinated Care</td>
<td>4</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>11</td>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Patient-Centered Care</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Access</td>
<td>8</td>
<td>9</td>
<td>11</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Cost-Related Problem</td>
<td>9</td>
<td>5</td>
<td>10</td>
<td>4</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Timeliness of Care</td>
<td>6</td>
<td>11</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Efficiency</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Equity</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Healthy Lives</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

Health Expenditures/Capita, 2011**
- $3,800
- $4,522
- $4,118
- $4,495
- $5,099
- $3,182
- $5,669
- $3,925
- $5,643
- $3,405
- $8,508

Notes: * Includes ties. ** Expenditures shown in US PPP (purchasing power parity); Australian $ data are from 2010.

### Doctors in 17837

<table>
<thead>
<tr>
<th>Name</th>
<th>Specialty</th>
<th>Location</th>
<th>Rating</th>
<th>Availability</th>
<th>Book Online</th>
<th>View Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Rachita Bansal MD</td>
<td>Internist</td>
<td>Geisinger</td>
<td>Good</td>
<td>9:40 am</td>
<td>Book Online</td>
<td>View Profile</td>
</tr>
<tr>
<td>Dr. Susannah Kisvarday MD</td>
<td>Internist</td>
<td>Geisinger</td>
<td>Excellent</td>
<td>11:20 am</td>
<td>Book Online</td>
<td>View Profile</td>
</tr>
</tbody>
</table>

**Visit Reason:** Illness

**Search by:** Specialty or Doctor Name
- Primary Care Doctor (PCP)

**Location (Zip, City, State):** 17837

**Insurance:** I'll choose my insurance later

**Sort by:** default order

---

*Powered by Zocdoc*

#HASUMMIT16
Provider Satisfaction Transparency

Kisvarday, Susannah Marie, MD

Practicing Specialties:
Internal Medicine, Board Certified, 2013
Pediatrics, Board Certified, 2014
Internal Medicine - Pediatrics

Education:
Louisiana State University, School of Medicine 2005

Internship:
Geisinger Medical Center 2007

Residency:
U. of Texas Medical Branch Hospitals - Galveston, TX 2007
Geisinger Medical Center 2013

Patient Satisfaction Ratings:

The Patient Satisfaction Rating is an average of all responses to care provider-related questions on our nationally recognized Press Ganey Patient Satisfaction Survey. Responses are measured on a scale of 1 to 5, with 5 being the best score.

1. Friendliness/courtesy of provider
   - 4.8 out of 5

2. Provider explanations of problems/condition
   - 4.7 out of 5

3. Provider concern for questions/worries
   - 4.8 out of 5

4. Provider efforts to include in decisions
   - 4.8 out of 5

5. Provider information about medications
   - 4.7 out of 5

6. Provider instructions for follow-up care
   - 4.7 out of 5

7. Provider spoke using clear language
   - 4.8 out of 5

8. Time provider spent with patient
   - 4.8 out of 5

9. Patients' confidence in provider
   - 4.7 out of 5

10. Likelihood of recommending provider
    - 4.7 out of 5

Aug 2
I love Dr. Kisvarday! I now have my husband and daughter seeing her and have recommended her to friends on several occasions. She is always friendly, caring, and takes the time to come up with a well thought out plan of treatment. She always explains everything. If I message her with a question I always get a response. Great doctor!

Jul 12
unfortunately the dr. had zero idea of when this occurred as there was no communication between Evangelical and GMC. This should be corrected.

June 17
Dr. K is amazing and I enjoy my visits to her because she is sincere and listens. She is concerned about her patients all on an individual level. Highly recommend her!
Patient Experience – Refund App

Geisinger

ProvenExperience™
We're here to listen to your feedback.

Tell us about your experience
I'm happy with my experience.
I'm unhappy with my experience.

Your copay was: $1,000
You place your trust in us and we place our trust in you.

How much of your copay would you like back?

*Please enter the dollar amount of your refund
Healthcare Value Equation

Value = Quality + Experience

Quality

ProvenCare
ProvenHealth | navigator

Experience

Geisinger
Caring
Geisinger
ProvenExperience

Health Plan
Geisinger Services
Geisinger Health System
An Integrated Health Service Organization

Provider Facilities $3,147M
- Geisinger Medical Center and its Shamokin Hospital Campus
- AtlantiCare Regional Medical Center- Mainland and City campuses
- Geisinger Wyoming Valley Medical and its South Wilkes-Barre Campus
- Geisinger Community Medical Center, Scranton, PA
- Geisinger-Bloomsburg

Physician Practice Group $1,130M
- Multispecialty group
- ~1,300 physician FTEs
- ~790 advanced practitioners
- ~215 primary & specialty clinic sites (81 community practice)
- 1 outpatient surgery center
- ~3.4 million outpatient visits
- ~520 resident & fellow FTEs
- ~365 medical students

Managed Care Companies $2,395M
- ~500,000 members (including ~84,000 Medicare Advantage members and ~153,000 Medicaid members)
- Diversified products
- ~56,000 contracted providers/facilities
- 45 PA counties
- Offered on public & private exchanges
- Members in 5 states

Moody’s Aa2/Stable
Standard & Poor’s AA/Stable

#HASUMMIT16
Challenges with the existing Enterprise Data Warehouse:
Selected Recurrent Themes

“There are too many undocumented data sources.”

“There is no documented understanding of business requirements for CDIS business analytics.”

“We don’t have the transformations that the business users really need.”

“There are too many business objects views for CDIS.”

“Cannot provide data that is fit for purpose.”

“Data dictionary does not exist today.”

“The CDIS “lift and shift” model perpetuates the problem with too many views/analytics.”

“There are too many pockets of data.”

“Much of my group’s time is spent entering data manually.”

“The platform/architecture in place for CDIS analytics is not correct for the types of work being performed.”

“Clinical data quality problems related to patient safety exist.”

“Hierarchies exist at many levels.”

“Can’t “match” from encounters to bills to claim.”

“The level of detail that I need is not there in the data.”

“Clinical data quality problems related to patient safety exist.”

“Much of my group’s time is spent entering data manually.”

“The level of detail that I need is not there in the data.”
## Why UDA Big Data?

<table>
<thead>
<tr>
<th>CDIS</th>
<th>UDA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Silos</strong>&lt;br&gt;Pockets of Data&lt;br&gt;Undocumented Data Sources</td>
<td><strong>Unified Data Platform</strong>&lt;br&gt;Zones of Data&lt;br&gt;Published Data Models</td>
</tr>
<tr>
<td><strong>Data Sprawl</strong>&lt;br&gt;“Lift and Shift” Model&lt;br&gt;Confusing Views of Data&lt;br&gt;Sparse Data Integration</td>
<td><strong>Data Integration</strong>&lt;br&gt;Enterprise Patient View&lt;br&gt;Integrated Healthcare Model</td>
</tr>
<tr>
<td><strong>Cost</strong>&lt;br&gt;Months to ETL Data&lt;br&gt;10-Terabyte cost ~500K</td>
<td><strong>Cost</strong>&lt;br&gt;Days to Ingest Data&lt;br&gt;10-Terabyte cost ~15K</td>
</tr>
<tr>
<td><strong>Scale</strong>&lt;br&gt;No Unstructured Data Capability&lt;br&gt;Limited Real Time Capability</td>
<td><strong>Scale</strong>&lt;br&gt;Unstructured Data Capability&lt;br&gt;Real Time Capability&lt;br&gt;Data Volume Support</td>
</tr>
</tbody>
</table>
Geisinger Enterprise Data Strategy*

1. Geisinger requires an **in-house data platform** to support operations, timely decision making, and ongoing analytic innovation at the speed of business.

2. **Strategic Integration, Standardization, and Governance of Analytics** the Unified Data Platform is needed to drive alignment across analytics capability development

3. Data Infrastructure and Analytics spend (and resource assignment) will go through a robust **Total Cost Optimization** process that includes cost analysis and ROI estimation with **Quarterly Gating / Recalibration**

4. There is a continued desire to **scale and generalize** Geisinger developed data, reporting and analytics capabilities, with xG Health being the current enabling platform.

5. Geisinger existing EDW platform, reporting and analytics capabilities will **not be sunset/retired** until essential requirements have been met

*Endorsed by Geisinger EDS Steering Committee 11.20.14
Unified Data Architecture
Goals – Unified Data Architecture (UDA)

Improvement to Operating Model
• Create a culture of service excellence
• Focus on operational agility to drive accountability and data-driven workflow

Take advantage of EHR investment
• Epic Cogito Platform (Data Warehouse, Clarity, Radars, Workbench)
• Cerner Healthe Intent® (semantic normalization across EHRs)

Match incoming data structure to the right infrastructure
• Relational: Teradata (CDIS) migration to Microsoft SQL
• Non-relational: Creation of Hadoop Big Data environment
• Governance: model after Knowledgent™ consulting, add semantic layer

Embed security, audit and access controls from ground-up
• Encryption and establish role-based access (e.g. Apache Ranger)
• Preparation for regulatory demands (e.g. Meaningful Use, HIPAA)
Goals – Unified Data Architecture (UDA)

Provide redundant, reliable and hedged environment
• Balance in-house and out-sourced options
• Future proof data management investment on commodity hardware

Establish path to real-time data, and novel data types
• EHR and Analytic App development (e.g. Sepsis dashboard)
• Use Big Data environments for real-time data flow (e.g. longitudinal patient profile)
• Storage and processing of unstructured and Semi-Structured Data
  – Text, diagnostic imaging, genomic, Internet of Things, Technical and log files, extrinsic/ambient/social data
• Rapid integration of merger & acquisition datasets

Provide tiered visualization self-service
• No training: Epic “Slicer-Dicer” clinical data access
• Some training: Current Business Objects user community and Tableau
• More complex: Add Data Engineering services

Establish Data Governance and Semantic interoperability
UDA Big Picture

Infrastructure

Out-source

In-house

Big Data (Unstructured)

HDFS

Cerner

Epic

Hortonworks

Flexibility

Relational (Structured)

Epic

Microsoft SQL Server

Presentation

Key capabilities

Longitudinal Patient Record
Population Health Registries
Clinical data integration

Unstructured, streaming data
Syndicated data landing zone
Large (genomics) dataset

Normalized clinical data
Self-serve visualization
Pre-build dashboards

Departmental systems
Replacement for Teradata

Plug n Play

Out-source

In-house

Flexibility
Poll Question #1

Value of using Hadoop infrastructure include all the following EXCEPT:

A. Use of open-source software and commodity hardware to minimize cost
B. Ability to process unstructured, semi-structured, and streaming data
C. Readily available Hadoop workforce knowledgeable about healthcare
D. Ability to process large volumes of data at huge scale in real-time
Lessons Learned

• **ROI**: use open-source, commodity hardware argument
• **Change**: SQL team are unfamiliar with Big Data ecosystem,
• **Data Load**: Load EVERYTHING into Hadoop by building prototypes, not use cases
• **Self-service**: Push for self-serve as much as possible,
• **Prod-ready**: Create Production-Ready document to avoid perpetual pilot
• **Adoption**: Develop valuable early wins, invest in visualization (e.g. Tableau)
• **Data Zones**: Create separate data zones, and split PHI from non-PHI data
• **Surge capacity**: Pop-off to cloud-based options at surge capacity needs
Build Return of Investment argument

Value

- Commodity Hardware
- Legacy EHR storage
- Open-source software
- Separate storage vs CPU needs
- Auditing and security
Change Management

Migration only if “Meet or exceed” Strategy and inclusive Governance

“What if we don’t change at all ... and something magical just happens.”

Run Hadoop alongside SQL
Consider Apache HUE
Load EVERYTHING into Hadoop

- Clinical data (EHR)
- Claims (Health Plan)
- Financial (Costing)
- Genomics (WES)
- Streaming data
- Network log files
1. System monitoring
2. Data Quality and Validation
3. Data Access (PHI, limited PHI, De-id)
4. Security (Physical and Data)
5. Auditing (Activity logging and threat analysis/alerting)
6. System Performance
7. High Availability and Disaster Recovery
8. Documentation
Push for self-service

Welcome to OurData

Support & Requests
- Ask a question
- Report an Issue
- Request Service or Access

Tools
- Webi
- Altosoft
- Informatica
- Tableau

Platforms
- Hadoop

Education
- Training
- Wiki
- Knowledge Base

Inventory
- Analytics
- Data Sources

For more information, call 4-DATA (x43282)

OurData Portal
- Online Training
- Access requests
- Data requests
- Vendor resources
- Support/Chat
- Governance

#HASUMMIT16
Poll Question #2

Best-practice implementation of a Hadoop environment within a healthcare organization involves

A. Replacing every instance of SQL/Relational with Hadoop infrastructure

B. Loading a variety of data types to take advantage of the Hadoop related modules

C. Support production versions of Hadoop or SQL/Relational environments, but not both

D. Reserving Hadoop environment only for the research community
Potential Investment Returns

Several large evaluations are underway

- Less costly hardware for storing increasing data (structured and unstructured)
- Prevent “one-off” data systems (e.g. IoT data capture, ICU real-time data capture, Cybersecurity)
- Productize Data & Analytic Services
- New Analytic Options and Potential Applications for Operations
- Time Savings
  - Data Federation & Governance → access time (dashboards, reporting)
  - Schema-on-read → modeling time
- Research Funding: Genomics, Imaging, Data Integration
- Brand / Reputation / Marketing
- Security / Breach Costs
  - Average cost of a healthcare breach $2.1 Million*
  - Since 2009, breaches have cost the healthcare industry > $50 Billion **

* Source: Ponemon 2014 Fifth Annual Benchmark Study on Privacy and Security of Healthcare Data
** Source: American Action Forum
Big Data Timeline

- **Big Data - EHR data**: Mar 10
- **Big Data - Claims data**: May 27
- **Big Data - Data Integration**: Jul 21
- **Big Data - Financial data**: Apr 19
- **Big Data - Tokenization**: Jun 20
- **Big Data - Real-time data**: Aug 26
- **ELT Presentation**: Sep 10
- **Cerner Healthe Intent LIVE**: Apr 4
- **Cerner Registries LIVE**: May 16
- **Big Data (Cerner Healthe Intent)**: Sep 11 - May 5
- **Big Data (in-house)**: Sep 11 - Aug 27
Components of Solution Architecture

- Data Zones organizes data for security and access
- SQL Workbench
- Tableau
- Repository
- SOLR
- TSO
- Multiple access patterns - interactive BI, Search Portal, etc.
- Lightly summarized data may be persisted in a separate repository
- Data management services data preparation and end-user-facing
- Metadata/configuration-driven Data Pipeline
- Security at multiple levels
- Internal and external data sources in process and planned
Achieved

Infrastructure
- 32 Node Production Hadoop Cluster
- 500Gb RAM/40 CPU per node, 300Tb
- Landing and Upload Zone for Cerner
- Data Ingestion and Processing Framework
- Security- Data Encryption at Rest and in-motion

Data
- 9,000 EPIC Clarity Tables
- Siemens Financial Data
- Bundled Payments Integrated Model
- Historical Claims Feed to Cerner

Tools
- SOLR Banana Search Interface
- Direct SQL access – SQL Workbench, HUE
- BI tools - Tableau
Planned Targets

- EHR data: Mar 10
- Financial data: Apr 19
- Cerner HealtheIntent: Apr 4
- Epic Chronicles Shadow Server: Mar 31
- Pre-prod & DR Infrastructure: Mar 31
- Claims data: May 27
- KeyHIE data: Jul 15
- Cardio and other clinical data: Sept 15
- Real-time data: Aug 26
- Integrated Healthcare Model: Jun 30
- De-Identification of Data: Jun 20
- Quality Measures: April 15

Infrastructure, data ingestion and new tools will continue to develop with the UDA.
Risks - Mitigation

- Hiring and Retention - Contract to Hire and Consulting Resources
- Demand - Early Expectations and Published Timelines
- Adoption - Release Groups - Early Adopters
A treasure trove of useful, relevant, and unstructured clinical information in the form of text blobs and semi-templated data is locked inside EHRs. We used Solr, a module part of the Apache Hadoop ecosystem, to expose the data and let users perform rapid search.

- The ability to sort through over 184M clinical notes across 20-years worth of in/outpatient records
- Serves a framework to run CTAKES and other Natural Language Processing programs to find signal in the text noise, and make the data actionable.
The organization has participated in a number of population health initiatives over the years. The value of ‘big data’ is the concise analysis of a multitude care settings where a dashboard can present levels of care with LOS and costs.

- The ability to aggregate data from a multitude of systems and environments
- Provides a concise dashboard identifying care delivered and factors contributing to LOS.

**Production dashboards but all patient data has been masked**
## Bundled Payments – Hadoop Use Case

<table>
<thead>
<tr>
<th><strong>Problem Statement</strong></th>
<th><strong>Solution</strong></th>
<th><strong>Value</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to determine where care has been delivered in 90 day look-back in a concise method</td>
<td>Hadoop ingestion of data sources from Geisinger and external to provide a concise roadmap of care delivered by LOS and cost</td>
<td>Concise data to evaluate the Care Management Process to validate for efficiency in meeting expectations</td>
</tr>
</tbody>
</table>
Use Case #2: Bundle Payment
The organization has made the transition from the use of paging devices to the use of smart phone secured texting of providers and staff.

• The ability to send and received secure (encrypted) text messages thru use of wifi or cellular service in a real-time working environment

• Identifies challenges with “dead zones” within the facilities and in the community which exist

• Plan and strategize solutions that abate the problem
Geisinger Communications Patient Experience – Hadoop Use Case

<table>
<thead>
<tr>
<th>Problem Statement</th>
<th>Solution</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>With the transition to new secure system for real-time communication to providers and staff, challenges have existed with regard to delays in communication.</td>
<td>Hadoop ingestion of data sources from text message provider, MDM solution vendor (MAC address, Carrier information) as well as network WAP information.</td>
<td>Create a ‘heat map’ which can identify areas of concern for data loss. Valuable tool for future troubleshooting in other campus facilities or future acquisitions as we migrate the technology.</td>
</tr>
</tbody>
</table>
## Use Case #3: Secured Texting

<table>
<thead>
<tr>
<th>Title(s)</th>
<th>Recipient(s)</th>
<th>Time Period</th>
<th>Send (Mins)</th>
<th>Top Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>(All)</td>
<td>(All)</td>
<td>7/1/2016 12:00:00 A 7/31/2016 11:59:59</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

### Departments

<table>
<thead>
<tr>
<th>Department</th>
<th>Recipient</th>
<th>Title</th>
<th>Sent</th>
<th>Avg</th>
<th>Total</th>
<th>Count Delv</th>
<th>Avg Delv</th>
<th>Total Delv</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRG-OPERATING ROOMS</td>
<td>Chiaro, Alyssa A.</td>
<td>REGISTERED NURSE</td>
<td>245</td>
<td>29</td>
<td>4,416</td>
<td>7</td>
<td>1,072</td>
<td></td>
</tr>
<tr>
<td>SRG-OPERATING ROOMS</td>
<td>Strouse Jr, James A.</td>
<td>OR SUPPORT TECH</td>
<td>62</td>
<td>35</td>
<td>2,231</td>
<td>3</td>
<td>198</td>
<td></td>
</tr>
<tr>
<td>SRG-OPERATING ROOMS</td>
<td>Rivera, Yahaira</td>
<td>OR SUPPORT TECH</td>
<td>68</td>
<td>50</td>
<td>2,940</td>
<td>1</td>
<td>-66</td>
<td></td>
</tr>
<tr>
<td>SRG-OPERATING ROOMS</td>
<td>Macdonald, Brittany N.</td>
<td>O.R. AIDE</td>
<td>61</td>
<td>29</td>
<td>1,107</td>
<td>1</td>
<td>-68</td>
<td></td>
</tr>
<tr>
<td>SRG-OPERATING ROOMS</td>
<td>Kersey, Matthew D.</td>
<td>RN (INPATIENT)</td>
<td>15</td>
<td>99</td>
<td>1,347</td>
<td>0</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>AD-SYSTEM CLINICAL OPERATIONS</td>
<td>Paolucci Md, Stephen J.</td>
<td>CMD-G-BLOOMSBURG HOSP</td>
<td>13</td>
<td>24</td>
<td>265</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AD-SYSTEM CLINICAL OPERATIONS</td>
<td>Maleoney, Gerald V.</td>
<td>CMO - GWV</td>
<td>20</td>
<td>10</td>
<td>53</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AD-Clinical OPERATIONS</td>
<td>Thompson, Michelle A.</td>
<td>STAFF PHYSICIAN</td>
<td>12</td>
<td>10</td>
<td>55</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SURG-OPERATING ROOMS</td>
<td>Beshore, Kelly E.</td>
<td>PHYSICIAN ASSISTANT</td>
<td>2</td>
<td>7</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AD-SYSTEM CLINICAL OPERATIONS</td>
<td>Aquilina DO, Anthony</td>
<td>CHIEF MEDICAL OFFICER-G-CMC</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>AD-Clinical OPERATIONS</td>
<td>Famiglio, Linda</td>
<td>CHIEF ACADM OFF ACNO ACAD AFF</td>
<td>2</td>
<td>8</td>
<td>88</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SURG-OPERATING ROOMS</td>
<td>Lewis, Anne</td>
<td>PHYSICIAN ASSISTANT</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#HASUMMIT16
Sepsis Dashboard – Hadoop Use Case

Sepsis continues to represent a major area of morbidity and mortality. Retrospective dashboards are only partially helpful given perishable nature of early detection and intervention sepsis measures. Therefore, we developed dashboards that

• Ingest, in real-time, key physiologic monitoring and laboratory data

• Are designed to recognize and alert the Rapid Response and ICU staff of imminent threat

• Still take advantage of patient’s retrospective sepsis journey

Production dashboards but all patient data has been masked
Sepsis Dashboard – Hadoop Use Case
Open Position: Geisinger Chief Data Officer
Analytic Insights

Questions & Answers
What You Learned…

Write down the key things you’ve learned related to each of the learning objectives after attending this session
Thank You
Corporate Communications is working to review and redesign our online patient experience and content management solutions to address:

• Use of personal devices, online media content, and the online personalized experience has become the norm.

• Individuals are looking for the quick solution to their current issue/task.

• Meeting the patient’s needs online and in real-time is becoming a competitive advantage with tele-medicine, content delivery, scheduling online, issue resolution, and tracking health.
# Geisinger Communications Patient Experience – Hadoop Use Case

<table>
<thead>
<tr>
<th>Problem Statement</th>
<th>Solution</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to see linked utilization by patient across the various media solutions</td>
<td>Hadoop ingestion of Geisinger online media source utilization logs (geisinger.org, MyGeisinger, Facebook, etc.)</td>
<td>Real-time routing and monitoring of contact us requests, same day touch</td>
</tr>
<tr>
<td>Unable to tailor communications based on patient persona/profile</td>
<td>Integration of utilization logs with internal Geisinger data to create user persona/profiles</td>
<td>Tailored communications based on patient’s care delivery population</td>
</tr>
<tr>
<td>Unable to link online appointment request with internal scheduling systems</td>
<td>Extraction of relevant data elements/records</td>
<td>Patient profile/persona for personalized online experience and content delivery</td>
</tr>
<tr>
<td>Online contact us routing and closed loop monitoring is a manual process</td>
<td>Natural Language Processing (NLP) of contact us request form text</td>
<td>Integration of online appointment request with appointment services for real-time appointment scheduling</td>
</tr>
</tbody>
</table>
Overview:
- RSA Web Access Manager provides secure access to web applications such as MyGeisinger, GeisingerConnect, Geisinger Online Learning Management System (GOALS), Midas Incident Reporting and TheHealthPlan.com.
- The RSA solution infrastructure includes 3 separate groups of servers with specific security roles.
- Over 5 million access transactions are logged daily in a proprietary format.
## RSA Transaction Analysis – Hadoop Use Case

<table>
<thead>
<tr>
<th>Problem Statement</th>
<th>Solution</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inability to monitor in real-time 5 million+ access transactions</td>
<td>Hadoop ingestion of all RSA Web Access Manager system logs (Geisinger has format specification)</td>
<td>Preemptively identify security risk/breaches in real-time</td>
</tr>
<tr>
<td>Proprietary format disables the use of standard log viewer applications for trending and analysis</td>
<td>Normalization of log file format</td>
<td>Mine data for security access trends and pattern matching algorithms for security protocol event rules</td>
</tr>
<tr>
<td>Unable to parse the high volume of transactions for utilization analysis and creation of breach protocol rules</td>
<td>Integration of RSA system logs and internally accessed system logs</td>
<td>Security Access Protocol rules engine for real-time alerting</td>
</tr>
<tr>
<td>Unable to integrate access logs from the RSA servers and systems being accessed for full view into user utilization</td>
<td>Integration with semantic layer reporting tools</td>
<td>Extraction of relevant data elements interfaced into FairWarning System for centralization of access reporting</td>
</tr>
</tbody>
</table>

Utilization of standard reporting tools for real-time and historical trending and analysis
RTLS Transaction Analysis – Hadoop Use Case

Overview:

The current RTLS system utilized throughout the Geisinger Health System provides real-time views into the location of over 5500 assets along with patient flow and resource management for various initiatives by tagging physicians, nurses, and patients. GCMC began tagging inpatients to assist with early discharge notification to provide a room turnover trigger event when the patient is leaving the room.
## RTLS Transaction Analysis – Hadoop Use Case

<table>
<thead>
<tr>
<th>Problem Statement</th>
<th>Solution</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current RTLS system does not have analysis reporting capabilities.</td>
<td>Hadoop ingestion of RTLS transaction data</td>
<td>Integration of staff and patient movement to analyze patient interaction</td>
</tr>
<tr>
<td>Manual analysis of RTLS data is challenging and resource intensive</td>
<td>Extraction of relevant data records</td>
<td>Real-time location systems</td>
</tr>
<tr>
<td>RTLS system maps raw data to attributes about the asset but is not integrated with data about the event.</td>
<td>Integration with relevant data sources for process/time/resource/event analysis</td>
<td>Confirm and validate if an event happens, when it happened, where it happened, who was part of the event, and with what assets</td>
</tr>
<tr>
<td></td>
<td>Predictive modeling based on integrated data</td>
<td>Identify and act in real-time to patient bottlenecks within the system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Real-time regulatory alerts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Location based supply and demand resourcing</td>
</tr>
</tbody>
</table>