Improving Cancer Diagnosis and Care

Patient Access to Oncologic Imaging and Pathologic Expertise and Technology

February 2018
Intermountain Medical Group

- Diverse group of clinics and services
- 159 primary and secondary care clinic sites
- 38 urgent care locations
- 9 occupational health locations
- 7 on-site employer clinics
- 4 community/school clinics
- 18 retail pharmacies
- 5420 employees
- 1123 physicians
- 289 advance practice clinicians
Landscape—Intermountain Healthcare

• A network of 22 hospitals in Utah and southern Idaho
• Contains a mix of employed and affiliated physicians
• Is an insurance provider
• Manages over 50% of the local market
• Not an HMO
• Not a seamless self-contained system
Ultimately the goal is to improve the quality of care by developing quality improvement strategies that proactively and consistently support clinical best practice.
### Integrated care delivery process

**IDENTIFY**

- **Patients**
  - Expectations
  - Needs for tx

**FOLLOW-UP**

- **Improve**
  - Decrease variations, develop consensus, benchmarks, practice guidelines, etc.

**Cancer care delivery process**

- Access to care
- Assessment
- Diagnosis
- Treatment
- Follow-up

**Method:**
- Develop a flowchart
- Use the flowchart to identify potential outcomes measures
- Select a clinically important and feasible measures
- Develop an operation retrieval data sheet
- List all required data elements
- Select the best data source
- Standardize this data across facilities

**Identify outcome measures**

- Medical appropriateness indicators
- Complications
- Screening and tx goals
- GOL and functional status
- Costs
- Satisfaction

**Generate information and/or new knowledge**

**Data quality check and integration**

**Implement**

**Design**

Store these standard data elements in a central data repository to achieve data integration.
Clinical Programs and Services

Working Together

Nursing  Imaging  Respiratory  Pharmacy  Rehab  Nutrition

Behavioral Health  Oncology  Primary Care  Musculoskeletal  Cardiovascular  Women & Newborns  Surgical Services  Intensive Medicine  Pediatrics  Neurosciences
**Aggregated data repositories**

### Relational Data Warehouse
- Relational Data Store
- Semantic Data Store
- Data marts, cubes, etc.

*Inpatient Clinical, Ambulatory Clinical, Financial, Supply Chain, Health Plan, Research*

**Oracle RDBMS, HDD, SQL Server**

### Data Lake
- Centralized persistence of high volume data
- ELT Repository
- ODS for Relational Data Warehouse
- Schema on Read Repository
- Data Discovery
- Pre-processing for Relational Data Warehouse
- Data Archive

*Genomic Data, High volume Device Data, OLTP transaction Logs, Security transaction logs. Hortonworks Hadoop, Spark*

### Federated Search
- Index of external data
- Index of unstructured data
- Data discovery

*Clinical Documents, Enterprise Documents, Research subscriptions, Government sources, etc.*

**Solr**

### Cloud
- Alternate high volume storage
- Alternate high capacity computing

*Cerner Healthe Intent, AWS, Azure, etc.*
Managing a Process

• Means
  The right data
  In the right format
  At the right time (and place)
  In the right hands (the clinicians who operate the process)
Examples: Tumor-Specific Projects

**Breast Cancer**
- ER/PR Specimen Handling
- Breast Reconstruction
- IHC4 vs. Oncotype DX Testing
- MRI Utilization in Breast Cancer Patients
- Short-Term Imaging Follow-Up
- Sentinel Lymph Node
- Tissue Procurement
- Time to Biopsy
- Mammography Callback Rate
- Early Stage Adjuvant Radiation Therapy
- Node Dissection Rate for DCIS
- DCIS at Diagnosis
- Axillary Dissection Following Positive Sentinel Node Biopsy
- Early Stage at Diagnosis
- Neoadjuvant Chemotherapy
- ER/PR Hormone Therapy
- Micrometastasis
- Hypo-fractionation
- Breast Screening Cost
- BIRADS 3
- False Negative Mammography Project
- Spring-Loaded TruCut vs. Vacuum-Assisted Bx

**Colorectal Cancer**
- Stage III Chemotherapy
- Rectal Cancer – Endoscopic Ultrasound
- Colon Familial Polyp (HICCP-UPDB)
- Metastatic Colon Cancer Tissue
- Colon 12 Node Retrieval
- HPNCC Genetics & Lynch Syndrome Project
- Pancreaticoduodenectomy Study
- Colonoscopy Frequency S/P Definitive Cancer Surgery
**Melanoma**
- Melanoma Database
- Ear Melanoma Study

**Lung Cancer**
- State-Wide Lung Cancer Screening Program
- Pre-Operative Imaging

**GYN Cancers**
- Endometrial Ablation Cancer Study
- Type II Endometrial Cancer and Obesity
- Estrogen Insensitivity Study
- Ovarian Cancer Study
- Endometrial Familiarity Study
- PAP & HPV Testing
- Endometrial Lynch Syndrome Project
- Stage III Radiation

**Urologic Cancers**
- Epidemiology of Testicular Cancer in the Utah Population
- Prostate Quality of Life Study
- Appropriate use of Advanced Imaging in Prostate Cancer
- Radiation Treatment Templates
- Renal Cancer Database
- Finasteride
- Familial Polyp
- Prostatectomy Length of Stay (LOS)
- Prostatectomy Variable Cost Evaluation
- Physician Report Card
- PSA Recurrence
- Prostatectomy Margin Status

* >40 active and on-going projects
Sentinel Node

![Graph showing percent versus month with intervention marked]
**Screening Mammogram**

- **Normal Results (BI-RAD I, II)**
  - Resume Annual Screening in 1 Year

- **Incomplete, Needs additional imaging (BI-RAD 0)**
  - Supplemental Views/Ultrasound
    - **Calcifications**
      - Biopsy required
    - **Mass or Architectural distortion found on imaging**
      - Needle Localization/Surgical Biopsy

- **Probably Benign (BI-RAD III)**
  - **Calcification too widespread for stereotactic biopsy (may lead to sampling error). Breast too thin, Calcification too close to nipple or chest wall. Patient can’t lie flat on stereo table.**
  - **Stereotactic Biopsy Preferred Method (minimally invasive)**

- **Abnormal (BI-RAD IV, V)**
  - Usually not appropriate without follow-up testing (BI-RAD 0)
  - **Suspicious finding (BI-RAD IV)**
    - A – low probability
    - B – intermediate probability
    - C – high probability
  - **Highly suspicious (BI-RAD V)**
  - **Negative (BI-RAD I) Screening abnormally resolved with additional evaluation**
  - **Benign (BI-RAD II) Benign finding. No malignant potential. Requires no special follow-up.**
  - **Probably Benign (BI-RAD III). Very low (<2%) probability of malignancy. Short term imaging follow-up (mammography and/or ultrasound). Usually at 6 months, may be shorter (2 months).**
  - **Benign (BI-RAD II) Benign finding. No malignant potential. Requires no special follow-up.**
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January-June 2006 Callback Rate  
UCR Physicians  
Goal : < 10%
2015: Breast Cancer MRI Use and Practice Variation

Bilateral Mastectomy Rate System Wide 11.8% (562/4,762)
Region A 16.0% (146/913)
Region B 9.7% (205/2,109)
Region C 15.9% (157/986)
Region D 7.2% (54/754)

MRI's Ordered
False-negatives mammography

• Project Purpose: To decrease the rate of false negative mammography in the Intermountain Healthcare system.
• Lead Physician: Brett Parkinson M.D.
• Data Requirements
  • all false negative cases.
    • Defined as screening mammogram with result of BIRADS 1 or 2 who develops a cancer within 1 year of normal screening.
Colon Cancer Staging and Treatment

- **Percent of Stage I-III Colon Cancer Patients with a Minimum of 12 Lymph Nodes Removed During Definitive Surgery**
  - Jan-06: 0%
  - Apr-06: 20%
  - Jul-06: 40%
  - Oct-06: 60%
  - Jan-07: 80%
  - Apr-07: 100%

- **Percent of Stage III Colon Cancer Patients Who Receive Adjuvant Chemotherapy**
  - Jan-08: 0%
  - Apr-08: 20%
  - Jul-08: 40%
  - Oct-08: 60%
  - Jan-09: 80%
  - Apr-09: 100%
UNR Stage I-III Breast Cancer Cases by Hormone Receptor Status

BREAST CANCER CASES 2005-2006

<table>
<thead>
<tr>
<th>STAGE</th>
<th>ER+ OR PR+</th>
<th>ER-/PR-</th>
<th>ER+/PR-</th>
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<tbody>
<tr>
<td>0</td>
<td>47</td>
<td>28</td>
<td>75</td>
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<tr>
<td>1</td>
<td>90</td>
<td>17</td>
<td>107</td>
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<tr>
<td>2</td>
<td>53</td>
<td>33</td>
<td>86</td>
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<td>3</td>
<td>25</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>3</td>
<td>13</td>
</tr>
</tbody>
</table>
ER/PR Project

ER negative results by hospital: Jan 1997-Sep 2003

Data source: CR

ER negative results by the day of the week: Jan 1997-Sep 2003

Data source: CR
Data Sources

• **Genomic Health**
  Oncotype DX test scores
  (Working to get results reliably in PowerPath / Help 2)

• **CCF Database**
  Oncotype DX Order Date  Pathology Date
  Chemotherapy Given  Hormone Tx Given

• **Tumor Registry**
  • ER Status  PR Status
  • Stage  Grade
IHC4 vs. Oncotype

Update on breast cancer
Hormone receptor testing initiatives

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Challenges

• Clinical Program historically no authority
• Regional Hospitals had independent priorities and budgets
• Medical staffs nonaligned
• Medical staffs have variety of incentives and reimbursement models
• No unified system organization
• Providers in fact compete internally for services and revenue
Opportunities

• Restructure management team
• Eliminate regional competitive model and centralize budget
• Centralize low volume procedures
• Restructure reimbursement to fit with a value based model
• Develop system wide data systems (ASCO Cancer LinQ, Via Oncology, Unified tumor registry)
• Strengthen physician alignment
• Leverage Select Health
• Authority to Clinical Programs
Molecular Tumor Board

• Multi-institutional participants

• Experts in Cancer Genomics

• Interpretation of Findings
Cancer Genomics Workflow

- Personalized Medicine Clinic
- Tumor Biopsy
- Pathology Review
- Sample Prep

Day 1
- Molecular analysis (NGS)

Day 2-3
- Analytics

Day 4-5
- Molecular Tumor Board

Day 6-7
- Results and Treatment

Day 8-9

Day 10-13

Day 14-15

Day 16-17
Setting: Integrated non-for-profit healthcare system

- 1 academic medical center
  - Multiple ICU’s
  - All 24/7 intensivist staffed

- 4 regional/referral hospitals
  - 24/7 intensivist staffed

- 7 community hospitals
  - ICU staffed by non-intensivists

- 7 rural hospitals
  - No ICU

- Life Flight – air and ground transport
## Results: Mortality

<table>
<thead>
<tr>
<th></th>
<th>Pre-TCC N (%)</th>
<th>Post-TCC N (%)</th>
<th>Total</th>
<th>Relative Risk of Mortality (OR) (95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survived to ICU discharge</td>
<td>3,295 (97.40)</td>
<td>3,234 (98.18)</td>
<td>6,529</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Died in ICU</td>
<td>88 (2.60)</td>
<td>60 (1.82)</td>
<td>148</td>
<td>0.66 (0.45-0.97)</td>
<td>0.034</td>
</tr>
<tr>
<td>Survived to hospital discharge</td>
<td>3,283 (97.04)</td>
<td>3,226 (97.94)</td>
<td>6,120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Died during hospitalization</td>
<td>95 (2.96)</td>
<td>68 (2.06)</td>
<td>163</td>
<td>0.67 (0.47-0.96)</td>
<td>0.029</td>
</tr>
</tbody>
</table>

- Multivariate analysis
- Logistic regression model included age, sex, acute physiology score, and TCC status (pre- versus post-)
- Excludes comfort care/withdrawal of life support
Tele-Health for Oncology

• Ability to provide oncology care anywhere
  • Opportunities to tap into system resources and expertise
  • Subspecialty experts opinion
  • Standardized treatment, flow and services
Results of Tele-Oncology

- Over 500 visits completed
- 4 different locations
- High patient satisfaction
- Patient stays close to home
- Revenues stay in the community
Key Requirements for Quality Improvement

• Culture (constructive not punitive)
• Infrastructure (data systems and analyst)
• Leadership (clinical and operational)
• Engagement (appropriate metrics)
• Bandwidth (overwhelming extramural, nonpatient care requirements)