Innovating Predictive Analytics –
Strengthening Data and Transfer Information at
Point of Care to Improve Care Coordination

November 15, 2017
RRHA Healthcare Innovations Conference
Agenda

- Arnot Health Overview
- Readmissions Overview & Care Coordination
- Risk Assessment Tool
- Validation of Tool and Comparison Data
- Care Coordination Model at Arnot Health
- Extra Mile Initiatives
  - Using Real time to capture Chronic patients
  - 20 – 80 Rule – 80% of readmissions caused by 20% of patients
- Monitoring of care transitions
- Summary
- Questions
Arnot Health Overview

Arnot Ogden Medical Center

St. Joseph’s Hospital

Ira Davenport Memorial Hospital
Arnot Health Overview

➢ 3 Hospital System
   • Arnot Ogden Medical Center (AOMC)
   • St. Joseph’s Hospital (SJH)
   • Ira Davenport Memorial Hospital (IDMH)

➢ 3 Emergency Departments
   • 3 campuses

➢ Physician Practice
   • Arnot Medical Services (AMS)
   • Approx. 52 separate locations

➢ Skilled Nursing Facilities
   • 85 beds: St. Joseph’s Skilled Nursing Facility – Elmira, NY
   • 125 beds: Taylor Skilled Nursing Facility – Bath, NY

➢ Behavioral Psychiatric Facility and Alcohol Rehab Unit
Arnot Health Overview - Continued

- **AOMC ED**
  - 42,000 – 46,000 visits per year
  - 20 bed ED
  - 7 bay Fast Track

- **SJH ED**
  - 12,000 visits per year
  - 8 bed ED

- **IDMH ED**
  - 11,000 visits per year
  - 8 bed ED
Medicare and Medicaid are searching for ways to decrease unnecessary spend.

- One way to decrease spend is through the prevention of readmissions within 30 days.

- Readmissions within 30 days may indicate a health care organization’s lack of coordination of post discharge care.

- Although not all readmissions can be prevented, research shows that there are strategies that hospitals can employ to avert many readmissions.

Health Affairs, 2013
CMS Definition of Readmission

Which patients are included?

The 30-day unplanned readmission measure includes hospitalizations for Medicare beneficiaries aged 65 or older who were enrolled in Original Medicare (traditional fee-for-service Medicare) for the entire 12 months prior to their hospital admission (and for readmissions, for 30 days after their original admission). The unplanned readmission measure also includes patients aged 65 or older who were admitted to Veteran’s Health Administration (VA) hospitals. Beneficiaries enrolled in Medicare managed care plans are not included. The unplanned readmission measures do not include patients who died during the index admission, or who left the hospital against medical advice.
Care Coordination

- Obtaining the right information to treat patients at the point of care
- Obtaining the right information for the particular patient so that focused treatment plans could be created
- Care Coordination needs to be provided utilizing the whole team
- Documentation for Care Coordination is extremely important in terms of measuring effectiveness of the program
- Alerts and Notifications to improve workflow in a concurrent fashion is more valuable than retrospective review and notifications
- Lean processes need to be put in place to reduce variation
## Current Lace Index

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Points</th>
<th>Prior Admit</th>
<th>Present Admit</th>
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<tbody>
<tr>
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<td>Less 1 day</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 day</td>
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<td></td>
<td>14 or more days</td>
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<tr>
<td><strong>Acute admission</strong></td>
<td>Inpatient</td>
<td>3</td>
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<tr>
<td></td>
<td>Observation</td>
<td>0</td>
<td></td>
<td></td>
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<tr>
<td><strong>Comorbidity</strong></td>
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<td>0</td>
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<tr>
<td></td>
<td>DM no complications</td>
<td>1</td>
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<td></td>
<td>Cerebrovascular disease</td>
<td>1</td>
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<td></td>
<td>Hx of MI, PVD, PUD</td>
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<td></td>
<td>Mild liver disease</td>
<td>2</td>
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<td></td>
<td>DM with end organ damage</td>
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<tr>
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<td>CHF, COPD, Cancer</td>
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<tr>
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<td>Leukemia, lymphoma, any tumor</td>
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<td></td>
<td>Cancer, moderate to severe renal dz</td>
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<td></td>
<td>Dementia or connective tissue disease</td>
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<td></td>
<td>Moderate or severe liver disease or H7V infection</td>
<td>4</td>
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<tr>
<td></td>
<td>Metastatic cancer</td>
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<tr>
<td><strong>Emergency Room visits during previous 6 months</strong></td>
<td>0 visits</td>
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<tr>
<td></td>
<td>1 visits</td>
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<td>2 visits</td>
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<tr>
<td></td>
<td>4 or more visits</td>
<td>4</td>
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</table>

Take the sum of the points and enter the total.
# Current Lace Index

## Modified Lace Index - Readmission Risk Assessment Tool

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Points</th>
<th>Score</th>
</tr>
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<tbody>
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<td><strong>Length Of Stay</strong></td>
<td>&lt;br&gt;Less than 1 day</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 day</td>
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<td>7-13 days</td>
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<tr>
<td></td>
<td>14 or more days</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Acuity</strong></td>
<td>Inpatient</td>
<td>3</td>
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<td>Observation</td>
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<tr>
<td><strong>Comorbidity</strong></td>
<td>Metastatic cancer</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate or severe liver disease</td>
<td>4</td>
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<tr>
<td></td>
<td>HIV Infection</td>
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<td>Moderate or severe liver disease</td>
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</tr>
<tr>
<td></td>
<td>Dementia</td>
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<td></td>
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<tr>
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<td>Connective Tissue Disease</td>
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<tr>
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<td>Mild liver disease</td>
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<td></td>
<td>DM with end organ damage</td>
<td>2</td>
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<td></td>
<td>CHF</td>
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<td></td>
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<td>Cancer</td>
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<td>Leukemia</td>
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<td>Any Tumor</td>
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<tr>
<td></td>
<td>DM without end organ damage</td>
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<tr>
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<td>Cerebrovascular disease</td>
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<td>Hx of MI</td>
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<td></td>
<td>PVD</td>
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<td>PUD</td>
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<td><strong>Emergency room visits during the previous six months</strong></td>
<td>0 visits</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>3 visits</td>
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</tr>
<tr>
<td></td>
<td>4 or more visits</td>
<td>4</td>
<td></td>
</tr>
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</table>

A score of greater than or equal to 10 are high risk for readmission.
Review of Current Lace Index

Dr. Carl va Walraven et al., looked at 48 patient-level and admission-level variables for 4,812 patients discharge from 11 hospitals in Ontario. Four variable were independently associated with unplanned readmissions within 30 days.

L – Length of Stay
A – Acuity
C – Comorbid Conditions
E – Number of Emergency Department Visits (in the last six months)
ARRT – Arnot Risk Readmission Tool

- This tool will be tailored to our unique population of patients.

- We are developing a predictive readmission risk tool that begins in the ED and is updated throughout the stay.

- Patient-specific interventions are triggered to help predict those patients at the highest risk of readmission.
**ARNOT READMISSION RISK ASSESSMENT TOOL**

<table>
<thead>
<tr>
<th>Score</th>
<th>Medication @ Admission Criteria / Points</th>
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<tbody>
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<td>1 day / 1</td>
<td>0 to 5 / 0</td>
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<tr>
<td>2 days / 2</td>
<td>6 to 10 / 1</td>
<td></td>
</tr>
<tr>
<td>3 days / 3</td>
<td>11 to 15 / 2</td>
<td></td>
</tr>
<tr>
<td>4-6 days / 4</td>
<td>16 or more / 3</td>
<td></td>
</tr>
<tr>
<td>7-13 days / 5</td>
<td></td>
<td></td>
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<tr>
<td>&gt; 14 days / 6</td>
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<table>
<thead>
<tr>
<th>Los Criteria / Points</th>
<th>Max 6</th>
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</thead>
<tbody>
<tr>
<td>Acuity Criteria / Points</td>
<td>Max 5</td>
</tr>
<tr>
<td>ED Triage Red -Critical / 5</td>
<td>6 to 10 / 1</td>
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<tr>
<td>ED Triage Orange- Emergent / 4</td>
<td>11 to 15 / 2</td>
</tr>
<tr>
<td>ED Triage Yellow- Urgent / 3</td>
<td>16 or more / 3</td>
</tr>
<tr>
<td>ED Triage Green- Non Urgent / 1</td>
<td>Number of ED Visit in Previous 12 months / Points</td>
</tr>
<tr>
<td>ED Triage Blue-Routine / 0</td>
<td>0-1 visits / 0</td>
</tr>
<tr>
<td>Direct Admit- ICU / 3</td>
<td>2-3 visit / 1</td>
</tr>
<tr>
<td>Direct Admit- non ICU / 2</td>
<td>4-5 visits / 3</td>
</tr>
<tr>
<td>Admission follow SP stay / 2</td>
<td>6 or more / 4</td>
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<table>
<thead>
<tr>
<th>Co-morbidities Criteria / Points</th>
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<tr>
<td>CAD/Previous hX Ml / 1</td>
<td>1-2 stays / 1</td>
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<tr>
<td>Cerebrovascular disease / 1</td>
<td>3-4 stays / 2</td>
</tr>
<tr>
<td>Peripheral Vascular Disease / 1</td>
<td>5 or more stays / 4</td>
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<tr>
<td>Diabetes Mellitus / 2</td>
<td>Admission Source / Points</td>
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<td>Congestive Heart Failure / 2</td>
<td>Home / 0</td>
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<tr>
<td>Chronic Lung Disease / 2</td>
<td>Home with Homehealth services or Adult care setting / 1</td>
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<tr>
<td>Chronic Moderate to Severe Renal Disease / 2</td>
<td>Skilled Nursing Facility / 2</td>
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<tr>
<td>Moderate or Severe Liver Disease / 2</td>
<td>Another Acute Inpatient setting / 2</td>
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<tr>
<td>Any tumor- including leukemia or lymphoma / 2</td>
<td>Discharge Disposition / Points</td>
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<tr>
<td>Metastic Solid Tumors / 5</td>
<td>Home / 0</td>
</tr>
<tr>
<td>Dementia / 3</td>
<td>Home with Homehealth services or Adult care setting / 1</td>
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<tr>
<td>Immune System Compromise/Disease / 3</td>
<td>Skilled Nursing Facility or AMA / 2</td>
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<td>Problems related to social environment / 1</td>
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<td>Male / 0</td>
<td>Primary Support System issue / 1</td>
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<td>31 to 50 yrs / 0</td>
<td>Substance Use/Abuse Disorders / 1</td>
</tr>
<tr>
<td>51 to 60 yrs / 1</td>
<td>Primary Support System issue / 1</td>
</tr>
<tr>
<td>61 to 70 yrs / 2</td>
<td>Housing Issue / 1</td>
</tr>
<tr>
<td>71 to 80 yrs / 2</td>
<td>No health insurance coverage / 1</td>
</tr>
<tr>
<td>80 yrs and over / 2</td>
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</tr>
</tbody>
</table>

**FINAL TOTAL RISK SCORE :**

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**Comments:**

- **Completion of Arnot Readmission Risk Tool**
- **Update Arnot Readmission Risk Assessment Tool**
- **Assignment of Level of Care**
- **Discharge Medication Reconciliation**
- **Documentation of patient-COC discharge plan**
- **Clear discharge instructions and education/ Provider, Nsg**

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**ED Check Point/Responsible Discipline**

- **Completion of medical screening exam/ED**
- **Completion of diagnostic work up/ED**
- **Consultation with primary care/ED provider**
- **Consultation with specialty care/ED provider**
- **Medication Reconciliation/ED MD, pharmacy tech, RN**
- **Arnot Readmission Risk Tool**

**Comments:**

- **Update patient white board with providers, plan, goals/Nsg**
- **COC assessment and plan development/COC**
- **Discharge Medication Reconciliation/ Providers**
- **Discharge Medication Education/Nsg**
- **Specific follow up appointment with primary and specialty providers(high risk 3 days, moderate risk 7 days)/Nsg**
- **Implementation of patient-COC discharge plan/COC**

**Transition of Care #1/Responsible Discipline**

- **Communication with primary care provider/ED provider**
- **Communication with specialty care provider/ED provider**
- **Discharge Medication Education/ Providers**
- **Discharge Medication Reconciliation/ Providers, pharmacy tech, RN**
- **Update Arnot Readmission Risk Assessment Tool**

**Comments:**

- **Notification of primary care provider of discharge/UC**
- **Communication of high risk for readmission to next level of care and Health on Demand/ Nsg, COC**
- **Update Arnot Readmission Risk Tool/COC**
- **Communication of all discharge information for transition of care to next level /All**

**Transition of Care #3/Responsible Discipline**

- **Completion of diagnostic work up/ED**
- **Assignment of Level of Care**
- **Discharge Medication Reconciliation/Providers**
- **Discharge Medication Education/Nsg**
- **Specific follow up appointment with primary and specialty providers(high risk 3 days, moderate risk 7 days)/Nsg**
- **Implementation of patient-COC discharge plan/COC**
- **Clear discharge instructions and education/Provider, Nsg**

**Comments:**

- **Notification of primary care provider of discharge/UC**
- **Communication of high risk for readmission to next level of care and Health on Demand/ Nsg, COC**
- **Update Arnot Readmission Risk Tool/COC**
- **Communication of all discharge information for transition of care to next level /All**

**Transition of Care #4**

- **Notification of primary care provider of discharge/UC**
- **Communication of high risk for readmission to next level of care and Health on Demand/ Nsg, COC**
- **Update Arnot Readmission Risk Tool/COC**
- **Communication of all discharge information for transition of care to next level /All**

**Comments:**

- **24 hour post discharge follow up call/HOD.AMS CM**
- **Follow up appointment is kept**
- **Call placed to patient if follow up appointment is missed/AMS,HOD**
- **Documentation of CHHA referral case not opened/COC**
- **Notification of primary care provider of discharge/UC**

**Transition of Care #5**

- **Notification of primary care provider of discharge/UC**
- **Communication of high risk for readmission to next level of care and Health on Demand/ Nsg, COC**
- **Update Arnot Readmission Risk Tool/COC**
- **Communication of all discharge information for transition of care to next level /All**

**Comments:**

- **Clear discharge instructions and education/Provider, Nsg**

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ARRT – Arnot Risk Readmission Tool

Elements added:

- Age categories
- Gender categories
- Number of Medications
- Number of IP or SP - Observation stays previous 12 months
- Admission Source and Discharge Source (SNF, home, rehab…)
- Abnormal lab values
Number of Readmissions by Gender and Age Groupings
Number of Readmissions by Age Grouping
Automated ARRT

- Developed an algorithm to calculate Readmission Risk Score for every inpatient admission real time.
  - Integrated inpatient EMR, ED Visits and all ICD9 diagnosis codes associated with the encounter.
  - Developed handful of mapping tables and SQL stored procedure
  - High risk readmission patients tagged with ARRT score distributed through texts and exported crystal reports in an email.
ARRT – Validation

Using Current Modified LACE Score: Sample Size
15 Patients who were not readmitted
15 Patients who were readmitted

Not readmitted  Were readmitted
ARRT – Validation II

Non Readmitted Patients

- Not readmitted
  - Modified LACE Score Greater than 10
- Not Readmitted ARRT score greater than 15

<table>
<thead>
<tr>
<th>Patients</th>
<th>Not Readmitted</th>
<th>Not Readmitted ARRT score greater than 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>50%</td>
<td>60%</td>
</tr>
<tr>
<td>50</td>
<td>55%</td>
<td>70%</td>
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</tbody>
</table>
Observations

- Reviewed an additional 50 charts of readmitted patients
- Average days to readmission = 13.3
- Average ARRS Score: 22 (Mod LACE average 10)
- ARRS Threshold > 15:
  - # of readmits > 15 = 46
  - # of readmits < 15 = 4
- We will be able to target ≥ 90% of readmissions
- Compared to the Modified LACE, we are looking at much higher accuracy in terms of tagging. (Mod Lace 68%)
Arnot Health Readmission Reduction: A Multidisciplinary Approach

“Coming together is a beginning; keeping together is progress; working together is success.”

Henry Ford
What is Predictive Analytics?

- Reading and understanding data, big data to predict events or an outcome

- Predictive Analytics is the application of mathematical models

- It is usually used to predict potential cost or risk associated with managing a specific patient population

- Predictive Analytics is most useful when data or the knowledge could be transformed to Action

- Actions could be more efficient if we could provide information at the point of care or more real time
Risk Reduction Team

- Chief Medical Officer
- Medical Director of Care Coordination
- Chief Quality & Innovation Officer
- Director of Quality Management
- Outpatient Case Management
- Inpatient Case Management
- Director of Skilled Nursing Facility
- Director of Nursing
- Cardiac Management Nurse
- Transitional Care Managers
- Geroulds Pharmacist
- Chemung County Health Services
- Care First/Palliative Care Services
- Kindred Home Health
Alerts and Notifications

Follow-up Appointments
Specialty (2-3 Days)
Primary Care (7-10 Days)

Alerts and Notifications

Post-Discharge Follow-up by Outpatient Case Management

High Risk Patient Population for Readmission

End of Life / Palliative Care Initiatives

Communication with ED Providers and Specialists

Medication Reconciliation
Arnot Health Readmission Reduction - Current Initiatives

- PCMH with Case Managers
- Home Health Referral within 24 hrs. of Discharge
- Med Techs in Emergency Department
- Health Homes for care management
- Disease Prevention and Management Programs:
  - Cardiac Point of Care/Prevent the Event
  - Heart Failure
  - Diabetes Center
  - Pneumonia Readmission Reduction
  - Telephonic Disease Management-Health on Demand
  - Evidenced-Based Chronic Disease Self Management Programs
Arnot Health Readmission Reduction - Current Initiatives

- Population Health Initiatives
- DSRIP-II Projects for Medicaid Readmission Reduction - MAX
- Care Navigation in Emergency Department
- Community Outreach and Preventative Screenings
- Collaborative Partnerships for Care Coordination
- Case Management/Inpatient Utilization Review
- IT Infrastructure Development (eCW/EMR)
- Working with Payers on Care Transitions
Notifications Strategy

Notifications were automated through algorithms based on:

- Accurate Primary Care Provider Identification
- 15 Minutes Lag
- Internal Email Notifications
- Secured Cell Phone Texts
How does Predictive Analytics Help us?
Real-Time Readmission: Real-Time Dashboard – Arnot Health Analytics

<table>
<thead>
<tr>
<th>EncLoc</th>
<th>PllcNrsStL</th>
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<td>A0MC 3B</td>
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</tr>
<tr>
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Admissions by patient

[Graph showing admissions by patient with dates and numbers]
Email Triggered on automated basis

Subject: Readmission risk notification 353969

Hello Dr. K,

At 2017-11-14 23:12:00.397000, Patient First, Last Name MRN# 1234567 was in SJH Emergency Dept.

Patient was earlier discharged on 2017-10-27 with High risk for readmission. Patient was discharged with MS DRG HEART FAILURE & SHOCK W CC. Ref[Case Manager=Kim M Enc# ]

This is an automated email.
* As always we look forward to feedback, suggestions and questions.
Kind Regards,
Automated Report Delivery

ArnotHealth
Real-Time Notifications / Texts

MSG: Your patient just arrived in AOMC Emergency Department at 10/4/2015 7:10:00 PM.
19:25
High Risk and Low Risk populations are being set using the ARRT Tool into 3 major categories.
Annual Readmission Trends

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<th>Patient Group</th>
<th>Low risk</th>
<th>Readmission Risk</th>
<th>High risk</th>
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## Annual Readmission Trends

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1. Reduction in Readmission O/E in a 12 month period –
2. Reduction in Readmission Rate during the 12 month period –
3. Overall Focussed readmission O/E reduction in Pulmonary - , Cardio - , Ortho - ????????
Readmission Reduction – Annual Comparison

Focused Population - All Payer (%)

- 2014: 13.71%
- 2015: 12.17%
- 2016: 10.85%
- 2017: 9.02%

Focused Population - All Payer (O/E)

- 2014: 1.383
- 2015: 1.221
- 2016: 1.103
- 2017: 0.910

Focused Population - Medicare (%)

- 2014: 14.93%
- 2015: 13.68%
- 2016: 12.42%
- 2017: 9.47%

Focused Population - Medicare (O/E)

- 2014: 1.428
- 2015: 1.296
- 2016: 1.174
- 2017: 0.902

Arnot Health
Palliative Care Program

Auto Alerts Between ED, PCP, and Specialists

Improved Patient Care

Digital Medication Adherence at Home

Health to Home

Meds to Beds

Single Medication List
Summary

- Readmission rate is a key indicator of the effectiveness of population health initiatives.
- Larger percentages of reimbursement will be at risk based on readmission rate.
- A corporate goal is, and should continue to be the reduction of readmission.
- Several initiatives are underway at Arnot Health to reduce readmissions, and the coordination of those initiatives within Arnot Health and with our community based organizations will be critical to success.