Session 12:
Leveraging Predictive Models to Reduce Readmissions

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Agenda

• Introduction.
• Our Readmission Story.
• Tools & Technologies.
• Ongoing Challenges.
• Q&A.
Learning Objectives

Describe applicable predictive models useful in reducing 30-day readmissions.

Describe elements of a successful readmissions reduction strategy in an integrated health system.

Describe common obstacles faced in the adoption of analytical tools and how to overcome them.
UnityPoint Health in Nine Regions

19 UnityPoint Health Hospitals
- Communities served by 280+ Clinics
18 Community Network Hospitals
15 UnityPoint at Home Locations
4 Accredited UnityPoint Health Colleges
10 Affiliated Partners

Insurance presence across all UnityPoint Health markets
Analytics at UnityPoint Health (UPH)

Our Purpose:

To lead UPH’s quest to become a **data-driven organization** by:

- **Embedding** analytics into the strategic planning process,
- **Enabling** clinicians and business leaders to use data to make decisions,
- **Identifying** areas of opportunity to improve patient care, and
- **Developing** models used to predict population health and financial trends.

*We serve as problem-solving partners with a focus on delivering the most valuable solution.*
Our Team Capabilities

UPH Analytics teams provide three broad reporting & analytics capabilities:

- **SCORECARDS & DASHBOARDS**
  - Key performance indicators (KPIs).
  - Standardized, on-going reports, broadly accessed with self-enabled interpretation.
  - Highly involved set-up.

- **EXPLORATORY ANALYSIS**
  - Answering unanticipated questions.
  - Exploratory, not standard reporting.
  - Majority of analytics team effort.
  - Not “data-dumping.”
  - Highly consultative.

- **PREDICTIVE MODELING**
  - Advanced analytics.
  - Statistical methodologies.
  - Multivariate.
  - Highly intensive.
  - Highly consultative.
Before Leveraging Predictive Solutions, Build on Current Scorecards and Reports

Additional Views Include:

- Daily retrospective reporting.
- Monthly risk-adjustments and claims views.
- By primary care provider.
- By attending provider.
- By discharge disposition.
- By nursing unit.
- Patient-level details as needed.
Poll Question #1

On a scale of 1 to 5, how effective is your organization in avoiding preventable readmissions?

a) 1-Not at all effective
b) 2-Somewhat effective
c) 3-Moderately effective
d) 4-Very effective
e) 5-Extremely effective
f) Unsure or not applicable
Understanding What Leads to a Readmission

What led to the readmission?

- Investigate caregiver concerns.
- Check attendance at follow-up appointments.
- Look for medication issues.
- Ask the patient directly.
Initiative Background

With 250,000 members in value-based contracts, UPH Analytics was commissioned to build predictive analytics tools that support the transition to value-based care and leverage the clinical expertise from over 2,000 employed providers.
Project Scope

1. Improve model performance from current industry standards like LACE and HOSPITAL.

2. Predict not only which patients are at risk of being readmitted, but also the dates of highest risk.

3. Deliver the predictions in near real-time in an automated, easy-to-understand, cross-continuum tool.
Empowering the Readmissions Journey

2013
Re-established readmissions focus.

2014
Which patients are readmitting?
Why are patients readmitting?

2015
Use data to identify groups at risk for readmission.

2016
Multi-disciplinary team involvement.
Proactive and routine use of data.

2017
Analytics & process optimization

Moving from reactive to proactive readmissions prevention.

#HASUMMIT18
Continuing Deployment Across the Care Continuum

Home Care Deployment Begins

16.1%
15.1%
15.6%
15.2%
15.1%

Apr-17      May-17      Jun-17      Jul-17      Aug-17      Sep-17      Oct-17      Nov-17      Dec-17      Jan-18      Feb-18      Mar-18      Apr-18      May-18
Leveraging a Multi-Disciplinary Approach

**Readmission Risk Tool**
(RN Managers Identify High-Risk Patients)

**Daily Huddle**
(Unit Team)

**Daily Readmissions Meeting**
(Discuss Readmitted Patients)

**Ongoing Data Analysis**
(Readmissions Dashboard)

**Case Management & Chronic Disease Navigators**
(Post-Discharge Planning & Follow-Up)

**PCP, Home Health & SNF**
(Data, Outreach, Partnerships)
Tools & Technologies
Consider the Triggers for a New Analytics Solution

Patient ready for discharge

Low
Discharge Education

Medium
Discharge Education → Telehealth Follow Up

High
Discharge Education → 2 PCP F/U Appointments → 1 Telehealth Follow Up → Care Coordinator Monitoring

When is the ‘best’ time to schedule these?
Are patients likely to go to future appointments?
The Big Three

Which patients do we focus on?

What do we do?

When do we do it?
The Big Three

Which patients do we focus on?

What do we do?

When do we do it?
Readmission Risk Variables Span Four Key Domains

- Healthcare Utilization
- Diagnosis History
- Social Determinants of Health
- Visit Specifics (Vitals, Labs, Meds)
UPH Readmission Risk Variables

Healthcare Utilization
- # of Appointments*
- Number of Late Appointment Arrivals*
- # of Providers.
- % of Appointment No Shows.
- # of ED Visits.
- # of Inpatient Visits.

Social Determinants of Health
- Age*
- Insurance Type*
- BMI*
- Marital Status.
- Sexually Active.
- Hispanic.
- Tobacco Use.
- Illegal Drug Use.
- Female Partner.
- Male Partner.

Diagnosis History
- # of Chronic Conditions.
- Anxiety.
- Cardiovascular Disease.
- Chronic Kidney Disease.
- Dementia.
- Depression.
- Diabetes.
- Heart Failure.
- Hypertension.
- Mood Disorder.
- Obesity.
- Pain.
- Permanent Mental Disability.

* High Relative Variable Importance
## UPH Visit Specific Readmission Risk Variables

<table>
<thead>
<tr>
<th>Visit Specific: Vitals</th>
<th>Visit Specific: Meds</th>
<th>Visit Specific: Labs</th>
<th>Visit Specific: Other</th>
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</thead>
<tbody>
<tr>
<td>• Diastolic BP*</td>
<td>• Anesthetics*</td>
<td>• Calcium*</td>
<td>• Admit Type*</td>
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<tr>
<td>• Systolic BP*</td>
<td>• Biologicals*</td>
<td>• Creatinine*</td>
<td>• LACE Score*</td>
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<tr>
<td>• Pulse*</td>
<td>• Cardio Agents*</td>
<td>• Glucose*</td>
<td>• LOS*</td>
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<td>• Gastro Meds*</td>
<td>• Hemoglobin*</td>
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<td>• Nutrition Meds*</td>
<td>• Potassium*</td>
<td>• Chest Tube.</td>
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<td>• Height.</td>
<td>• Topical Meds*</td>
<td>• Sodium*</td>
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<td>• Temperature.</td>
<td>• Endocrine Meds.</td>
<td>• ABG.</td>
<td>• Weekday.</td>
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<td>• Patient Pain Score.</td>
<td>• GU Meds.</td>
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<td>• Month.</td>
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<td>• Hematology Meds.</td>
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<td>• Infective Meds.</td>
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<td>• Misc. Meds.</td>
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<td>• Neoplastic Meds.</td>
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<td>• Neuro Meds.</td>
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<td>• Resp Meds.</td>
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</tbody>
</table>

* High Relative Variable Importance
Poll Question #2

On a scale of 1 to 5, how effective is your organization in addressing the social determinants of health of the patients and communities you serve?

a) 1-Not at all effective
b) 2-Somewhat effective
c) 3-Moderately effective
d) 4-Very effective
e) 5-Extremely effective
f) Unsure or not applicable
Experience with Social Determinants

Our internal findings are consistent with recent literature regarding the predictive value of social determinants of health:

When considered along with clinical data (diagnoses, meds, labs, utilization hx), SDoH in their current form are not significant predictors of readmission risk.


Readmission Model Performance

Regional Performance:
• Area under the curve (AUC) ranges from 0.75-0.81
• Brier Score: 0.06-0.09

Performance in Literature:
• AUC: 0.7-0.82 (Kansagara, et al. 2011)
• Brier Score: 0.05-0.1

Heat Map Validation

Validation Cohort 4: 46.6% of All Readmissions

Validation Cohort 5: 2.8% of All Readmissions
Solution
Cascading the Same Predictions to the Post Acute Care Team

Patient Look-Up & Summary.

Day-by-Day Risk View.

Scheduled Appointment View.
System-Wide Utilization Continues to Grow

Over the past year, log-ins by care team members to the Readmission Risk Tool have doubled every three months and are now in excess of 130 log-ins per day.

4100 log-ins by 222 unique team members in May.
Additional Opportunities
Integration with Other Care Coordination Tools

Population Management Tools
- Longer prediction time horizon (6-12 months)
- Not triggered by an event
- Not readmission specific

Readmission Tools: Heatmap
- 30 day time horizon
- Triggered by Admission
- Readmission Specific

30 Day Readmission Window
7/25/2017 – 8/23/2017

Overall and Daily Readmission Risk Heat Map

- Pat Name
- Discharge Date
- Readmit Prob
Testing After Deployment

- If the care team acts on the prediction, your new training data will be biased.
- If we successfully prevent high-risk patients from readmitting consistently, theoretically, patients with similar profiles would not be high-risk in future models.
Lessons Learned

Risk scores trigger work lists, risk visualizations trigger conversations.

Conditions for adoption include: the right use case, staff involvement in build, ease of workflow, coaching on interpretation, and peer success.

Be mindful of silo development efforts involving pop health ‘risk’ – these can be contradictory and may create confusion as they flow downstream to care managers.

When identifying machine learning use cases, focus on uncertain “decision points.”
Questions and Answers

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