Predicting 30-day Readmissions is THRILing

OUT OF AN OLD MODEL COMES A NEW

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Texas Health Resources

25 hospitals in North Texas

14 wholly owned hospitals

133,903 Inpatient Visits

1,238,392 Outpatient Encounters

469,309 ED Visits

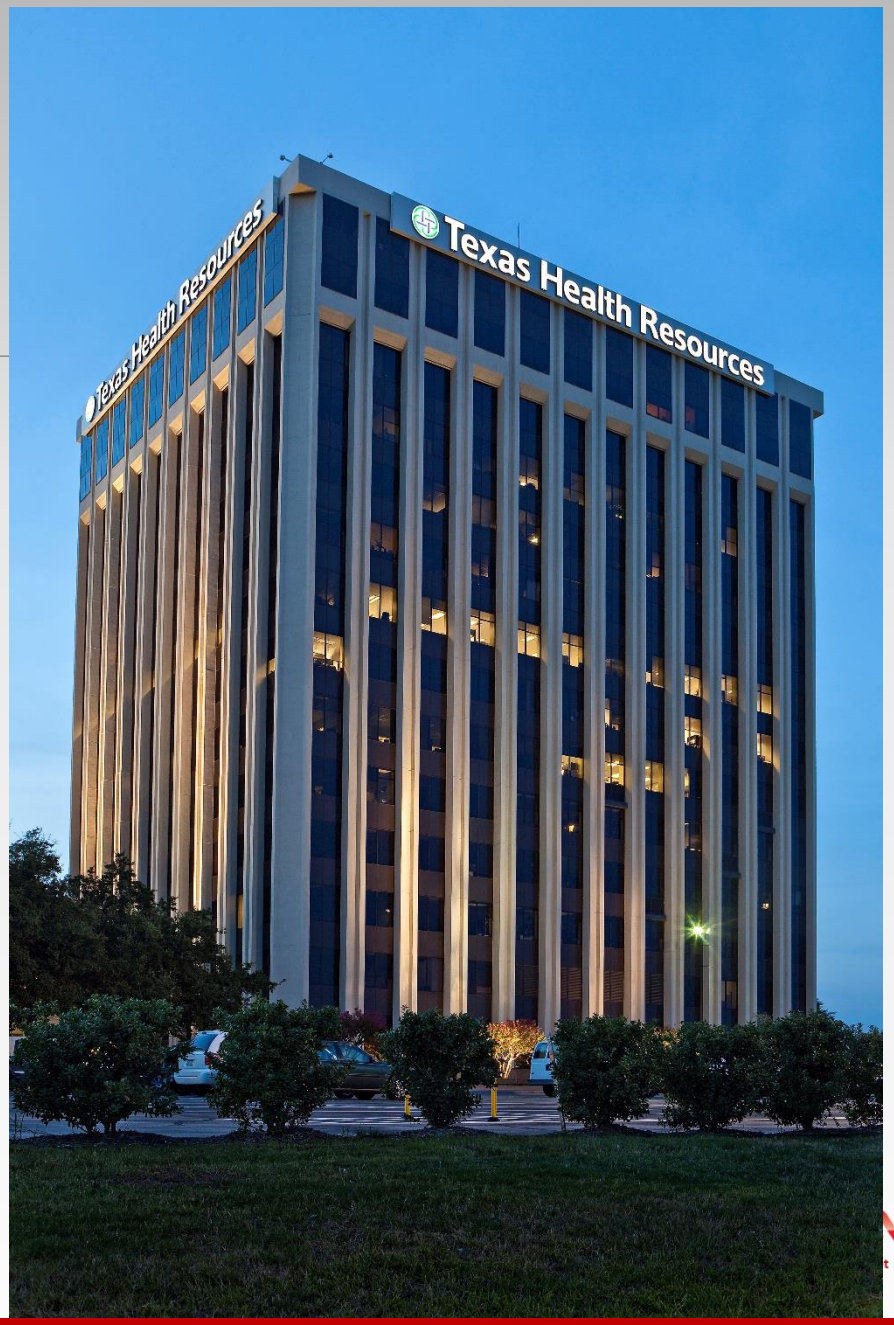
89,452 Surgeries

27,200 Deliveries

5,500 Active Physicians

7,500 RN's

22,000 Employees



Texas Health Resources - Organizational Background

Texas health resources is one of the largest faith-based, nonprofit health care delivery systems in the united states and the largest in north Texas in terms of patients served.

The system's primary service area consists of 16 counties in north central Texas, home to more than 6.8 million people.

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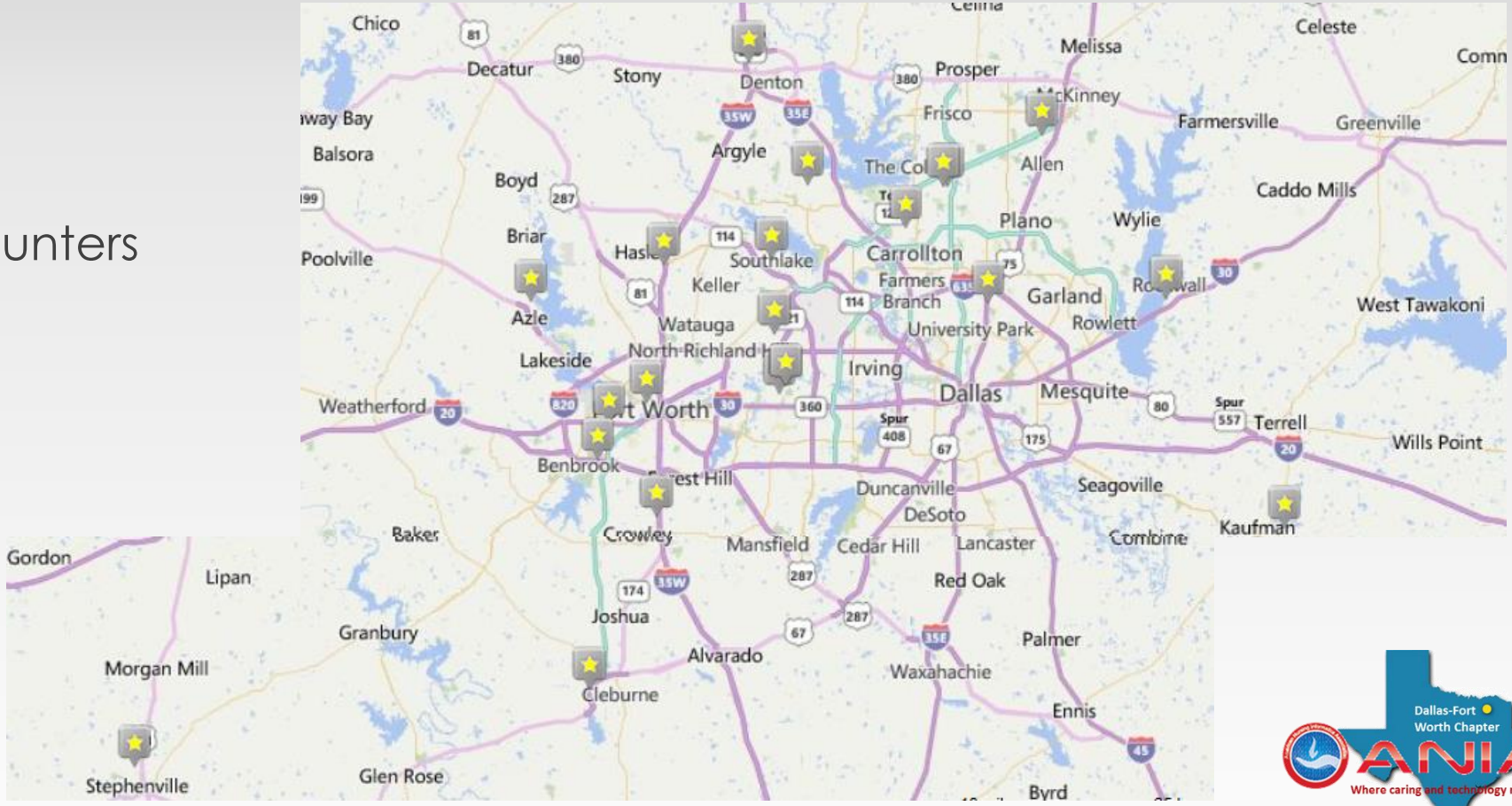

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LEARNING OBJECTIVES

- Understand the reporting requirements and exclusions related to 30-day readmissions
- Identify the elements of LACE+, and the issues related to the tool in today's patient populations
- Learn how THR prioritized readmission risk elements, both existing in LACE+ and new additions to make the project manageable for a small team
- Determine how the organization identified statistically significant patient characteristics that contribute to 30-day readmissions

Business Model

Expense reduction

Decrease unit cost + Decrease utilization

Delivery Efficiency (service/care)

- All care team members practicing at the top of their license
- Streamlined work flow
- Process automation
- Decrease care process variation

Appropriate Utilization (level/type)

- Population health risk management strategies
- Care coordination and navigation
- Decrease variation in diagnosis and treatment

Revenue

Growth

Increase Membership

- Total population risk and global budget arrangements
- Bundle services and payment for episodes of care or chronic health conditions

… while increasing quality and member experience

Texas Health Resources & Readmission Risks

- Used ‘brand’ name readmission risk indicators for 3 years
  - Not effective/efficient enough in targeted outreach
  - Some tools proprietary and risk factors were unknown
- Gap in managing and reducing readmissions
  - Limited resources
  - Can’t reach every patient but need to reach the right patients
- Requested for more data that defined our unique population
- Formation of a Readmission Taskforce

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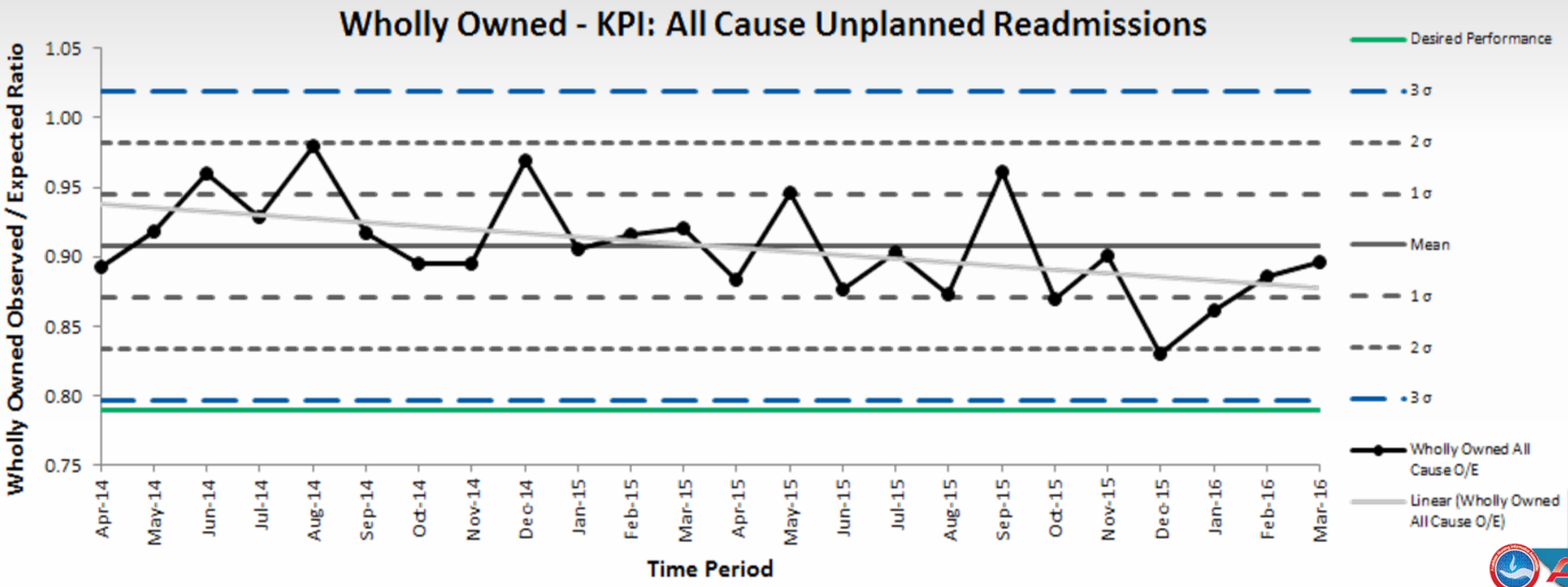
Where Are We Going?



Observed (O) = Actual Rate Expected (E)=Predicated Rate O:E Ratio=Observed Rate/Expected Rate

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LACE+: Part 1

Table 3
LACE+ scoring system to predict risk of 30-day death or urgent readmission

Predictor	Points
Male sex	3
Urgent admission	15
Discharge institution	
Teaching hospital or small nonteaching hospital*	0
Large nonteaching hospital†	−1
Length of stay (days)	
< 1	0
1	2
2	3
3	4
4	5
5–6	6
7–10	7
> 10	9
CMG score	
≤ −2	−13
−2 to −1	−6
0	0
1–2	8
> 2	24
No. of days on ALC status	
0	0
> 0	−1
No. of ED visits in previous 6 months	
0	0
1	3
> 1	6
No. of elective admissions in previous year	
0	0
> 0	6

(van Walraven, Wong, & Forster, 2012)
(Quan, et al., 2005)

LACE+: Part 2

Table 1. Charlson Comorbidity Index Scoring System

Score	Condition
1	Myocardial infarction (history, not ECG changes only)
	Congestive heart failure
	Peripheral vascular disease (includes aortic aneurysm ≥6 cm)
	Cerebrovascular disease: CVA with mild or no residua or TIA
	Dementia
	Chronic pulmonary disease
	Connective tissue disease
	Peptic ulcer disease
	Mild liver disease (without portal hypertension, includes chronic hepatitis)
	Diabetes without end-organ damage (excludes diet-controlled alone)
2	Hemiplegia
	Moderate or severe renal disease
	Diabetes with end-organ damage (retinopathy, neuropathy, nephropathy, or brittle diabetes)
	Tumor without metastases (exclude if >5 y from diagnosis)
	Leukemia (acute or chronic)
	Lymphoma
3	Moderate or severe liver disease
6	Metastatic solid tumor
	AIDS (not just HIV positive)

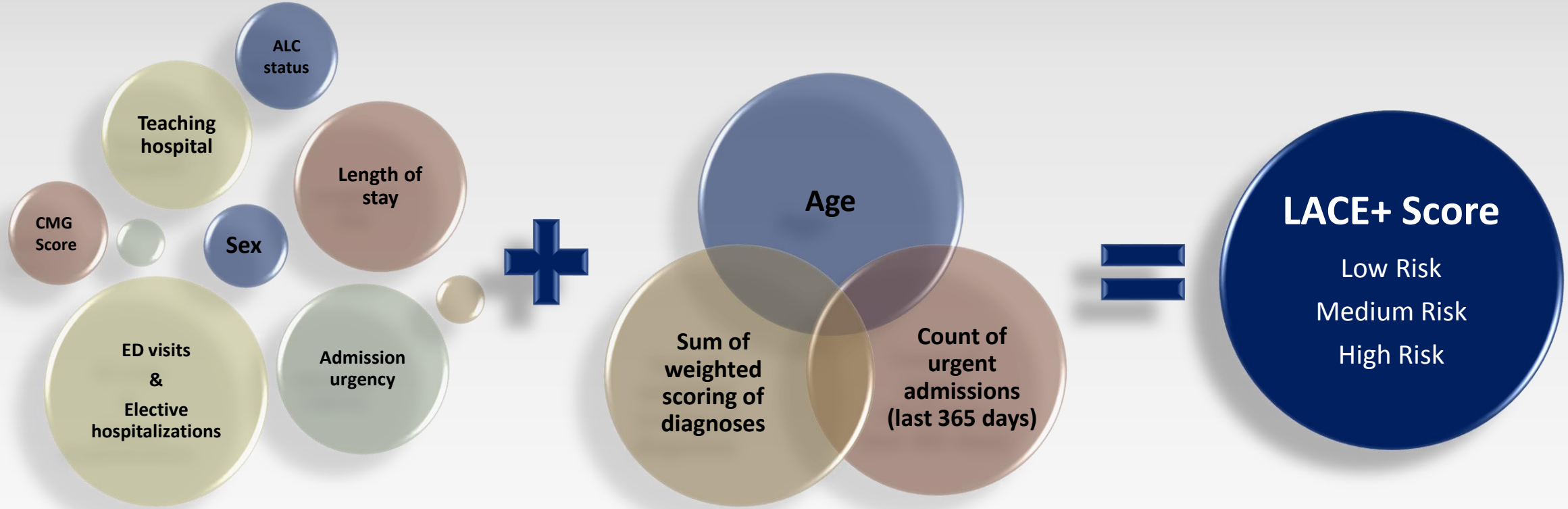
Points for age by Charlson score and number of urgent admissions in previous year

	Previous urgent admissions = 0			Previous urgent admissions > 0		
Age (years)	Charlson 0	Charlson 1	Charlson > 1	Charlson 0	Charlson 1	Charlson > 1
< 32	0	10	30	25	33	48
32–40	2	12	31	26	34	48
41–46	5	15	34	27	35	49
47–52	7	16	34	28	35	48
53–58	9	17	35	29	35	48
59–64	12	20	38	30	36	49
65–69	15	23	40	32	38	50
70–75	18	26	42	33	39	50
76–80	20	27	42	35	40	50
> 80	27	33	47	38	42	51

ALC = alternative level of care, ED = emergency department
* Small nonteaching hospital = nonteaching hospital with < 100 beds
† Large nonteaching hospital = nonteaching hospital with ≥ 100 beds

(van Walraven, Wong, & Forster, 2012)
(Quan, et al., 2005)

How LACE+ Score is Determined



Sum of weighted scores for individual characteristics

Multifactorial Index Calculation score (Charlson Index)

(van Walraven, Wong, & Forster, 2012)
(Quan, et al., 2005)

Challenges with LACE+

- Variables in the LACE+ algorithm aren't in EHR:
  - Case-mix group (CMG) score reduces c-statistic (0.753 vs. 0.743) (van Walraven, Wong, & Forster, 2012)
  - Alternate Level of Care (ALC) Status
- Disease Conditions:
  - Individual ICD codes
  - Difficult to interpret and maintain
  - Documentation inconsistency (Problem List vs. Patient History)
- Risk stratification:
  - Too many high risk patients who did not readmit
  - Resources limited to address all high risk
- Urgent admission source of truth
- Some high utilizers scored as a low risk

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Guide to Classification of C-Statistic (ROC)

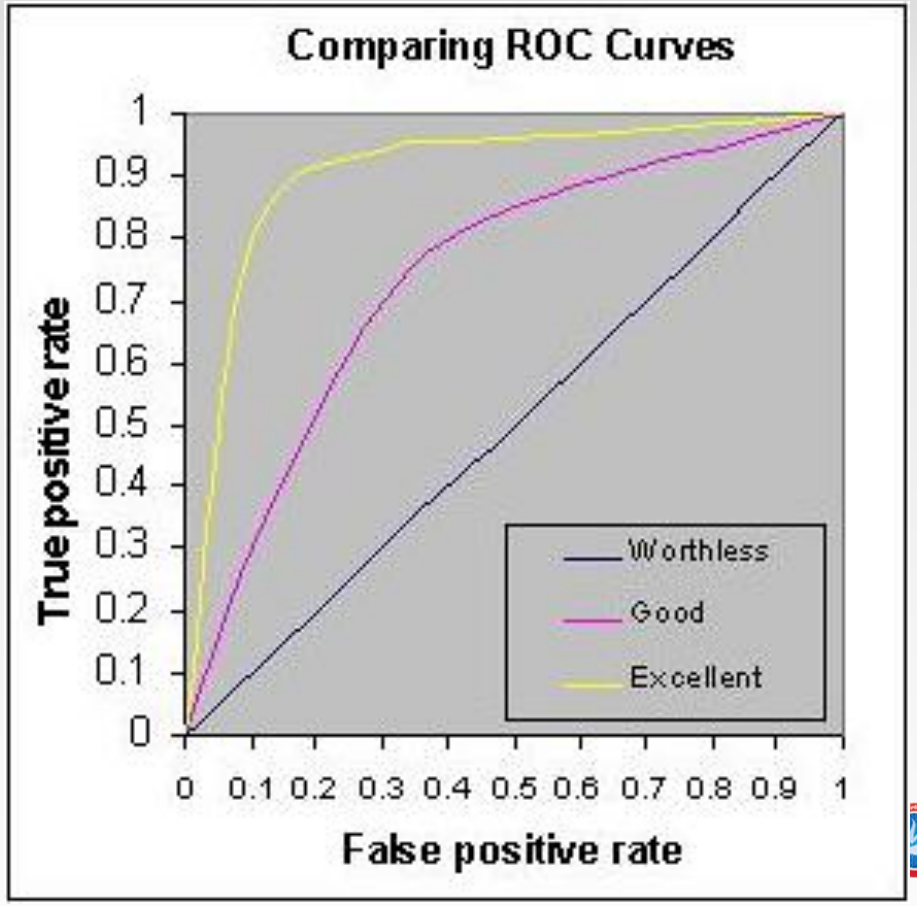
0.90 - 1 = excellent (A)

0.80 - 0.90 = good (B)

0.70 - 0.80 = fair (C)

0.60 - 0.70 = poor (D)

0.50 - 0.60 = fail (F)



(Tape, n.d.)

THR Goal

- Create a predictive scoring tool:
  - Tailored to THR's specific patient populations
  - Variable must be available in EHR prior to discharge
- Decrease the amount of patients designated as High Risk while improving the accuracy of High Risk designation
  - Manageable workload for intervention
  - Trustworthiness of the designation
- C-stat goal of 0.78 to 0.80+
  - Elevate from a fair tool to a good tool

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Formation of Innovation Group

CLINICAL INFLUENCE

- Membership
  - Two physician champions
  - Population Health
  - Care Transition Managers
  - Nursing
- Focus
  - Concept development
  - Version review and approval, ensuring tool fits into provider workflows
  - Development of interventions

TECHNICAL EXPERTISE

- Membership
  - Clinical & Nursing Informaticists
  - EHR builder
- Focus
  - Feasibility
  - Maintainability
  - Replicability in EHR

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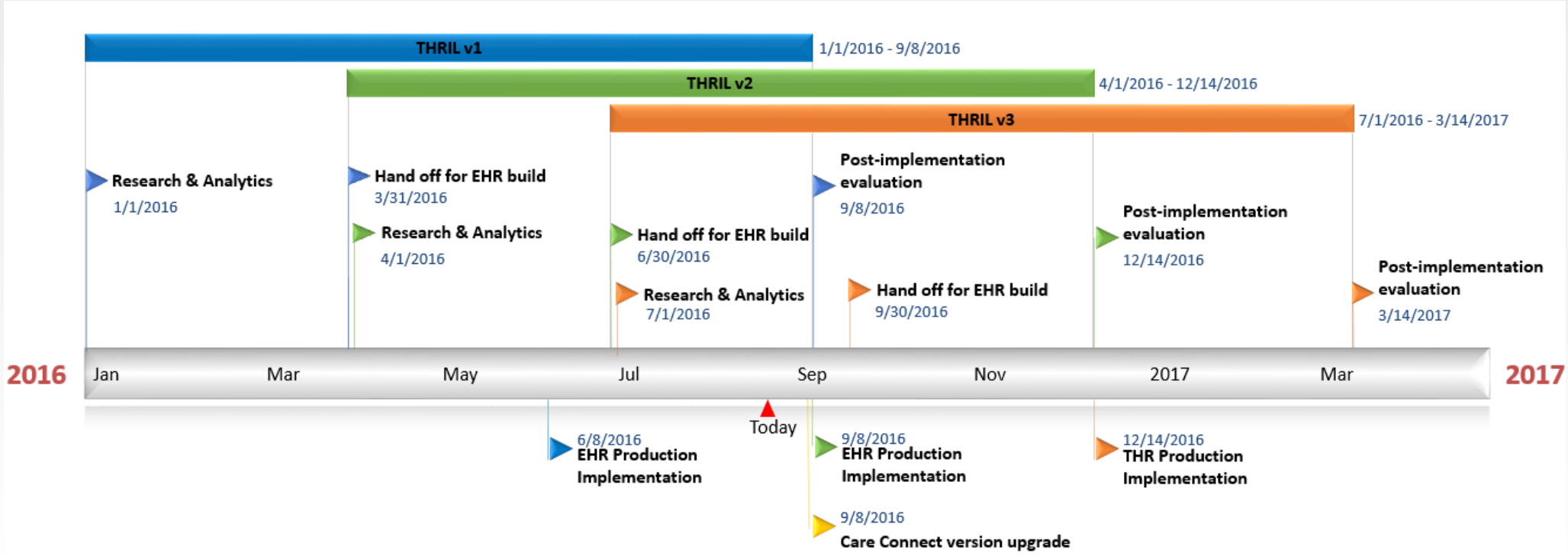
Texas Health Readmission Indicator List (THRIL)

- Systematic approach to development – 4 versions with incrementally increasing levels of depth
- 3 months for analysis and design
- 2 months for EHR build, testing, change management process



Technical Requirements

Analytics Tools: SAS EG & SPSS Statistics

CLINICAL INFORMATICIST

- Created test environment for algorithm changes
- Projected and actual statistical significance
- Data mining
- Variable weighting
- Data validation

NURSE INFORMATICIST

- Identification of source of truth
- Documentation reliability
- Data mining & Dataset preparation
- Determining clinical relevance of variables
- Evaluation of variables and readmission risk
- Variable weighting/scoring
- Build and testing in EHR
- Training and implementation

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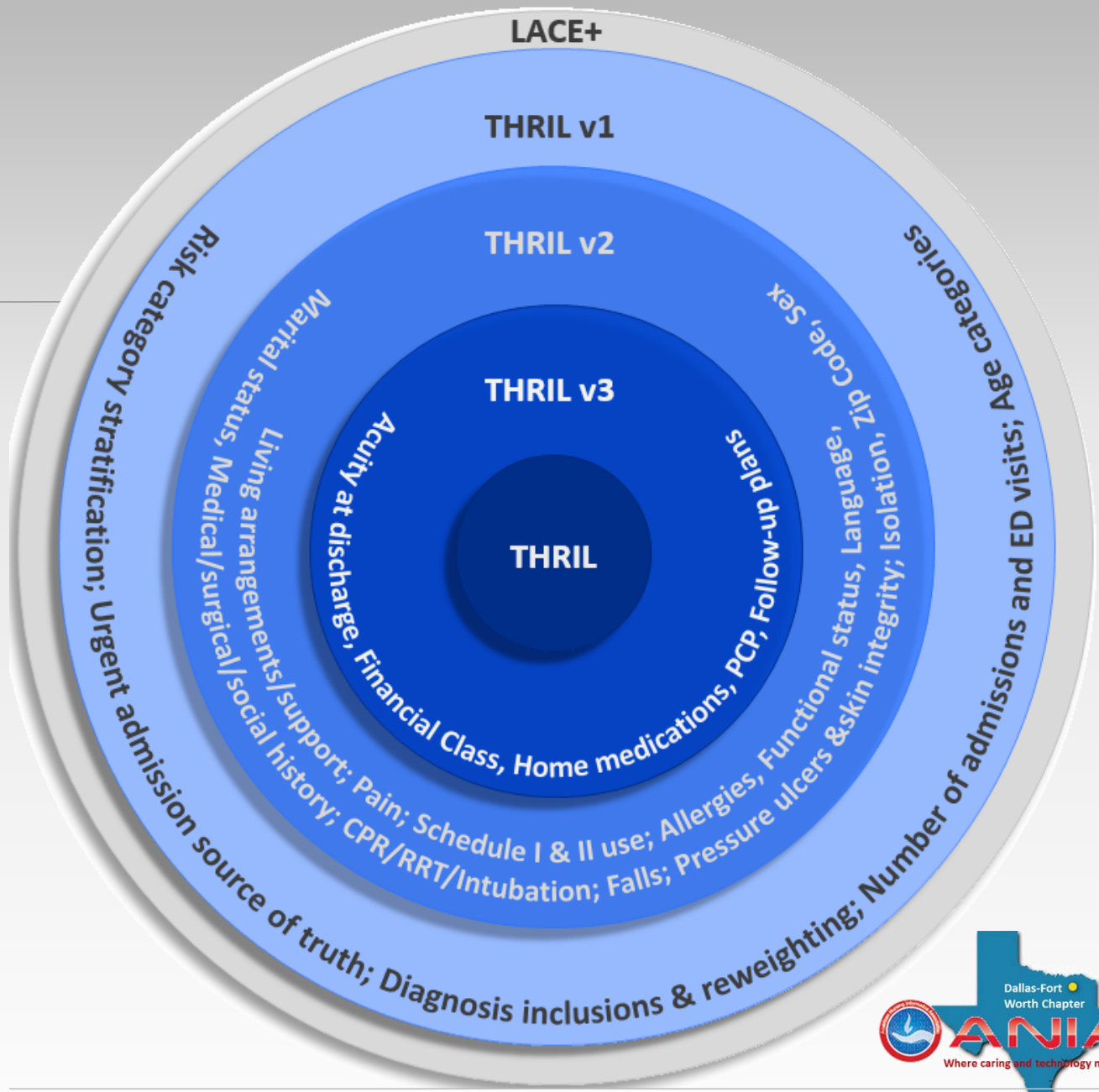
THRIL Version Analysis Example

- Systematic analysis
- Incremental change
- Careful evaluation of impact



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From LACE+ to THRILv1

Texas Health Readmission Indicator List (THRIL)

- Version 1
  - Addressed source of truth issues
  - Reweighted disease conditions
  - Utilized patient history documentation in addition to Problem List
  - Added new conditions (sepsis, antepartum complications, pneumonia)
  - Restratified risk categories
  - Adjusted age ranges, admission counts, point assignments
  - Added raw counts of ED utilization and hospital admissions to target high utilizers

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THRIL v1 (part 1)

Predictor	Points
Sex	
Male	3
Female	0
Urgent Admission	15 (ED acuity)
Discharge Institution	
Teaching or small institution	0
Large non-teaching	-1
Length of Stay (days)	
<1	0
1	2
2	3
3	4
4	5
5-6	6
7-10	7
>10	9
Number of ED Visits Last 6 Months	
0	0
1	3
≥ 2	4 + Raw number
Number of elective admission (last 365 days)	
0	0
>0	6
Raw number of all inpatient admissions (last 365 days)	#
Disease Conditions Score (based on age, # admissions, & weighted disease score)	(see next page)

THRIL v1 (part 2)

Disease Conditions & Point Value (Sum total points)

1 point	2 points	3 points
Peripheral Vascular Disease (current or history)	**Myocardial Infarction** (current)	**Congestive Heart Failure** (current or history)
Cerebrovascular Disease (current or history)	**Diabetes w/o complications** (current or history)	**Chronic Pulmonary Disease** (current or history)
Dementia (current or history)	**Tumor/Cancer/Leukemia/Lymphoma** (current)	**Moderate to severe renal disease** (current or history)
Connective tissue disease (current or history)		**Diabetes w/complications** (current or history)
Ulcer disease (current or history)		**Moderate to severe liver disease** (current or history)
Mild liver disease (current or history)		**Sepsis** (current or history)
Hemiplegia/paraplegia (current or history)		**Antepartum complications** (current)
AIDS (current or history)		**Pneumonia** (current)
Hypertension (current or history)		**Metastatic tumor** (current)

THRIL Disease Scoring Index

	Previous admissions 2 or less (including current admission)			Previous admissions 3 or more (including current admission)		
Age (years)	Point Value ≤1	Point Value = 2-3	Point Value >3	Point Value ≤1	Point Value = 2-3	Point Value >3
<32	0	10	30	25	33	48
32-40	2	12	31	26	34	48
41-46	5	15	34	27	35	49
47-52	7	16	34	28	35	48
53-58	9	17	35	29	35	48
59-64	12	20	38	30	36	49
65-69	15	23	40	32	38	50
70-75	18	26	42	33	39	50
76-80	20	27	42	35	40	50
81-85	27	33	47	38	42	51
>85	30	35	52	41	44	53

THRIL v1 Risk Stratification

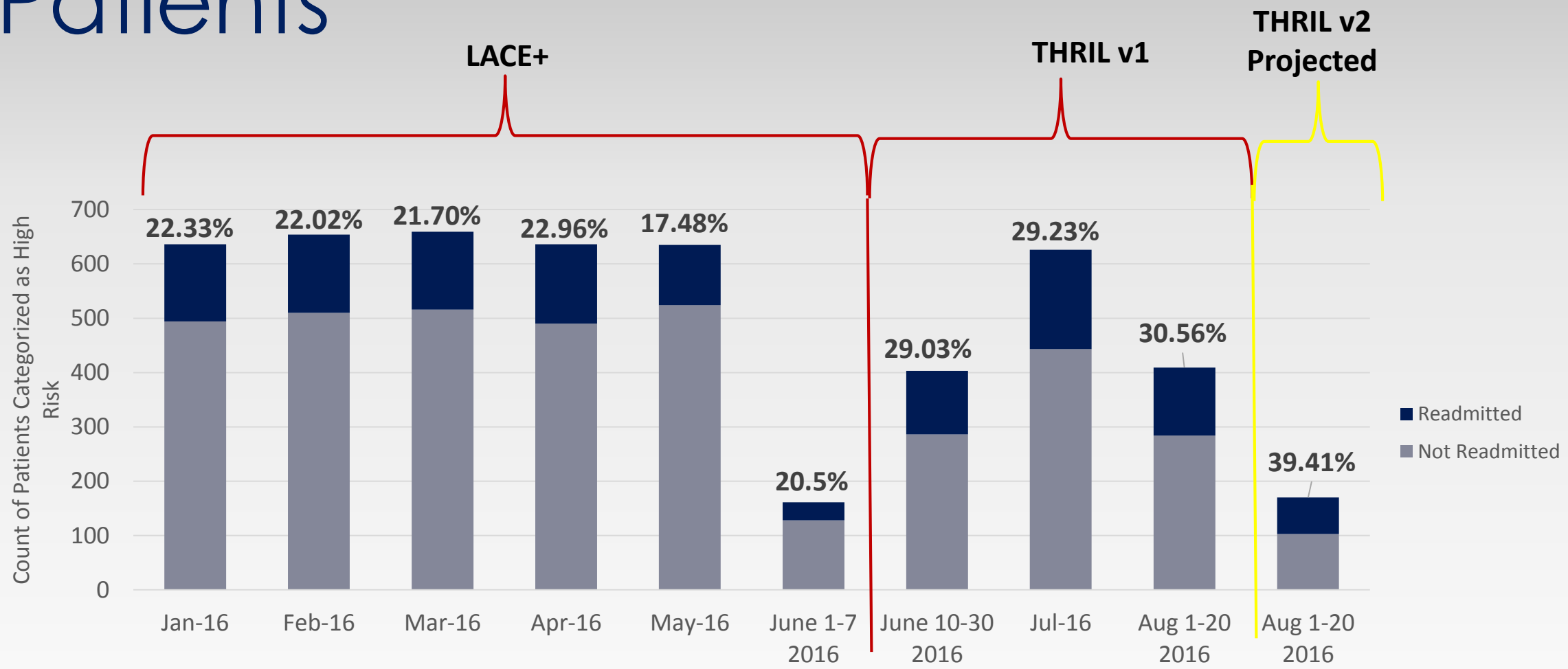
Low risk = ≤ 28

Medium risk = 29-58

Medium-High risk = 59-80

High risk = ≥ 81

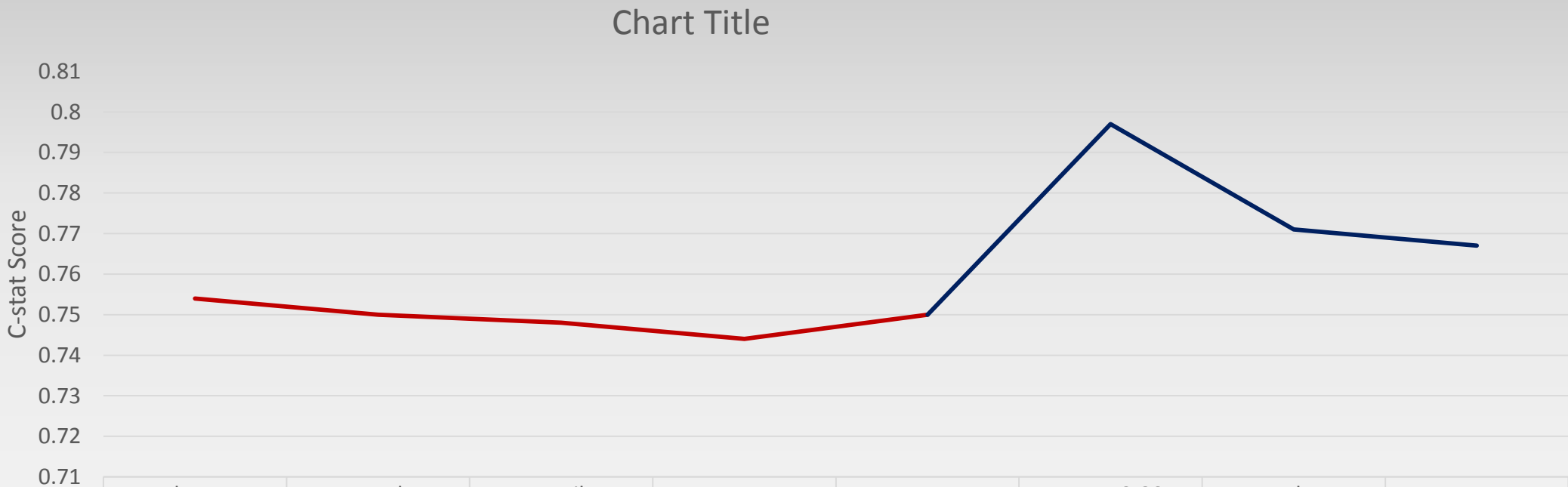
Readmission Rate for ‘High Risk’ Patients



The height of each bar represents the total number of patients categorized as ‘High Risk’ for readmission.

The percentage displayed above each bar is the readmission rate for the ‘High Risk’ patient population. Higher percentages are better, meaning we are identifying more readmitters in the High Risk bucket. 28.5% increase readmissions to the high risk bucket.

Comparison of LACE+ to THRILv1



	February	March	April	May	June 1-7	June 10-30	July	August
LACE+	0.754	0.75	0.748	0.744	0.75			
THRIL v1 production					0.75	0.797	0.771	0.767

The graph displays the statistical c-stat score for each month. A c-stat is a statistical calculation that determines the predictive power of the LACE+/THRIL v1 score (A higher c-stat score is better).

The red line represents the current LACE+ c-stat scores from February 2015 - June 7, 2016. As you can see, the c-stat scores levelled off around 0.748

Good news: The THRIL v1 score that went into production on June 8 has the highest c-stat to date of .780. This was even slightly better than our projected THRIL v1 test c-stat scores.

From THRILv1 to THRIL v2

Highest areas of impact

- Medical History list count
- Surgical History list count
- Allergy list count
- Schedule I & II allergy count
- Braden Score <19 at discharge
- Existence of a Pressure Ulcer
- How many times a pain score of 10 is reported
- Isolation status

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Case Management Interventions

Low risk = ≤ 28

DC Education begins on day of admission; meds reconciled; follow-up appointment made by the CNL.

Medium risk = 29-58

DC Education begins on day of admission; find a PCP if necessary; CTM makes follow-up appointment; Meds reconciled; community resources as indicated

Medium-High risk = 59-80

DC education begins on day of admission; CTM arranges home health, rehab, skilled care based on criteria and patient acuity. Refer to Transition Housecalls if possible.

High risk = ≥ 81

Complex case management; assessment for advance directives, end of life planning, palliative care / hospice appropriateness

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Lessons Learned

- Research, front-line providers, and organizational leaders all impact analytic tools
- Leverage existing providers and technology to develop foundational tools to develop reliable baseline processes
- The making of a predictive tool is not a short-term project
- Allow for ample time to test and adjust scores and weights
- Avoid scope-creep
- Study the marketplace for areas to study
- Be patient

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PRESENTER CONTACT INFORMATION

TannaNelson@TexasHealth.org

QUESTIONS & DISCUSSION