UnityPoint Health

Improving Quality Outcomes with Analytics

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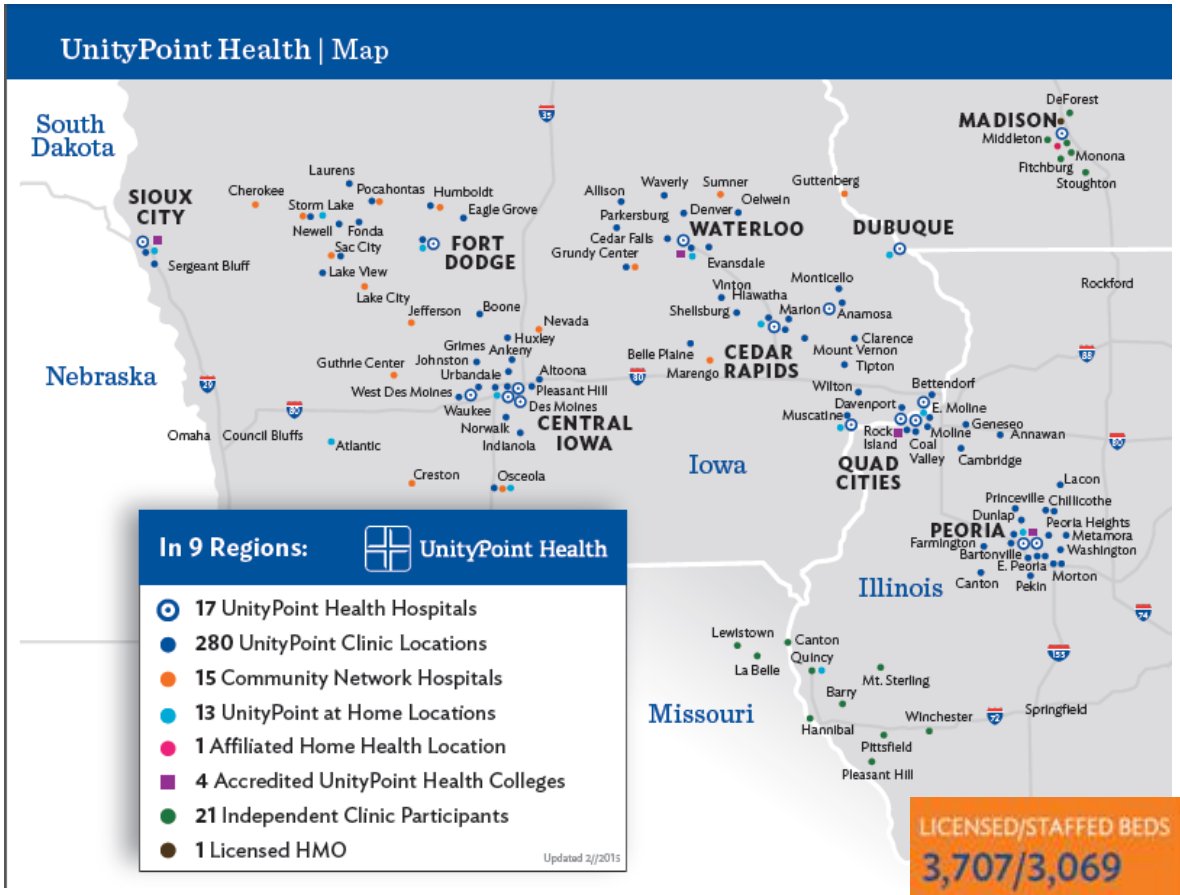
Agenda

- Background
- Analytics Support of Quality: Past, present, future
- Use Case: Blood Utilization

UnityPoint Health



"Best outcome for every patient every time."

LICENSED/STAFFED BEDS 3,707/3,069	BIRTHS 19,786	4.5 Million YEARLY PATIENT VISITS	TOTAL EMPLOYEES 30,701
154,717 ADMISSIONS		TOTAL PROJECTED ANNUAL REVENUE	$3.7 Billion

Originally formed in 1994

Historical Snapshot

2011-2012

- Decentralized reporting
- Decision Support
- Population Health Analytics Tool
- Claims Analytics Tool

2013

January

- Planning to support goal to have a data driven culture that would be successful in a fee for value environment

June

- Strategic Analytics department created

May 2015

- Total unique measures: 1,400+
- Total scorecards/reports: 55
- Projects completed in 2015: 255
- Range of hours per project: 1 – 456
- % of Time Spent on Strategic Initiatives: 84%
- Mthly/Qtrly refreshable tools: 64

- Solution delivery examples :
  - High Risk Patient Population Dashboard
  - Blood Utilization Toolkit
  - Value Based Purchasing Toolkit
  - Patient Experience Scorecard
  - Patient Centered Medical Home Scorecard
  - Readmissions Toolkit
  - Balanced Scorecard
  - Potentially avoidable ED Visits

Supporting Quality – looking back

- Lack of standard platform
  - EHR Hospital: 11/2011 – 5/2014
  - EHR Ambulatory: 3/2014 – 5/2015
  - Madison Integration: 9/13/2015
- Partnerships
  - Leadership
  - Clinician input
  - Regional relationships
- Poorly defined processes
  - Governance
  - Use Case Selection
- Analytics Skillset
  - Reporting SMEs
  - Minimal clinical experience

Supporting Quality – current view

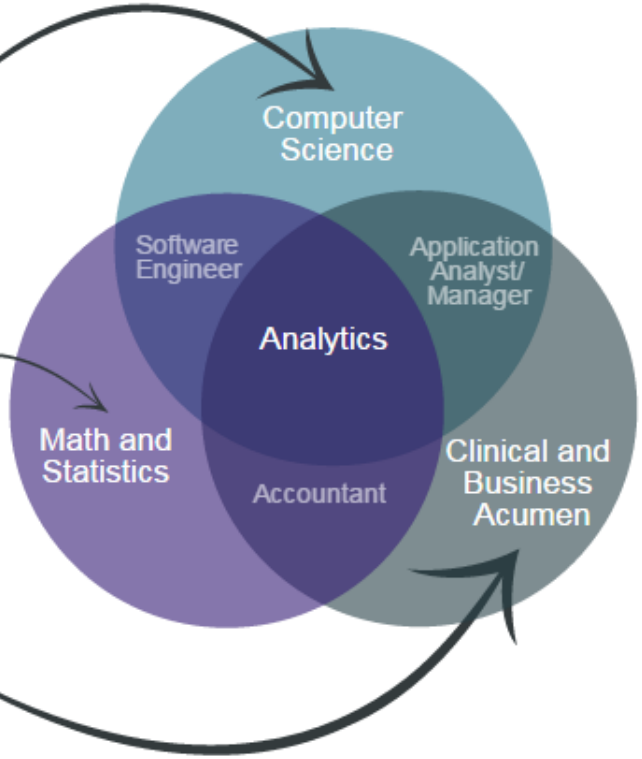
- EHR Optimization
  - Gaps in data from conversion
  - Continued learning
- Partnerships
  - Multi-disciplinary teams (ie: Quality Measures and Performance Compensation)
  - Leadership dyad model
  - Increased clinician input
  - Regional support: access to data, SuperUser groups
- Maturing Processes
  - Cross continuum Quality group
  - Use Case Selection: Intake process, strategic initiative focus
  - Workflow Optimization: removing variation

Supporting Quality – current view

Computer Science:
Management Information Systems, Data Mining and Transformation, Tabular and Multidimensional Analysis, and Report/Dashboard Creation

Math and Statistics:
Math, Statistics, Epidemiology, Engineering, Statistical and Predictive Modeling, and Actuarial Sciences

Clinical and Business Acumen:
Business, Finance, Economics, Clinical, Biology, Sociology, and Underwriting



Supporting Quality – current view

- Clinical Solutions:
  - High Risk Patient Population Dashboard
  - Blood Utilization Toolkit
  - Value Based Purchasing Toolkit
  - Patient Experience Scorecard
  - Patient Centered Medical Home Scorecard
  - Readmissions Toolkit
  - Balanced Scorecard
  - Potentially avoidable ED Visits

Supporting Quality – looking ahead

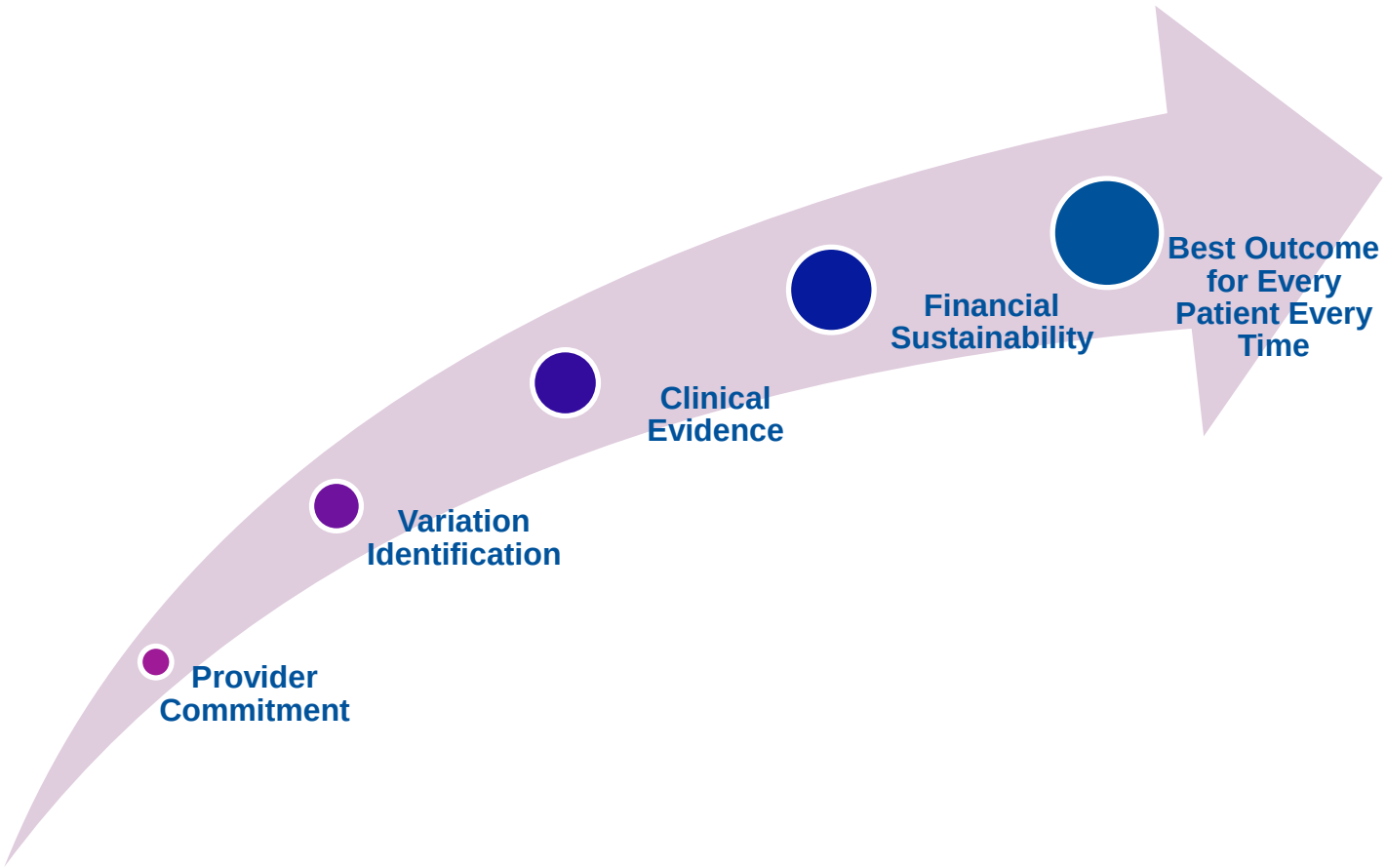
- Partnerships
  - Leadership sponsorship to evaluate metrics & assure alignment with strategy
  - Integrated clinician input
  - Insights: telling the story
  - Action plan creation to drive change in practice and process
- EHR Optimization
  - “Click” balance
  - Preferences (dictation vs. discrete notes)
  - Increase clinician input
- Data Governance, Stewardship

Supporting Quality – looking ahead

- Technical Optimization Roadmap
  - Right Work
  - Right Information
  - Right Person
  - Right Time
  - Right Access
- Skillset: continued evaluation, recruitment, retention of diverse analytics skillsets

Improving Quality of Care Through Analytics

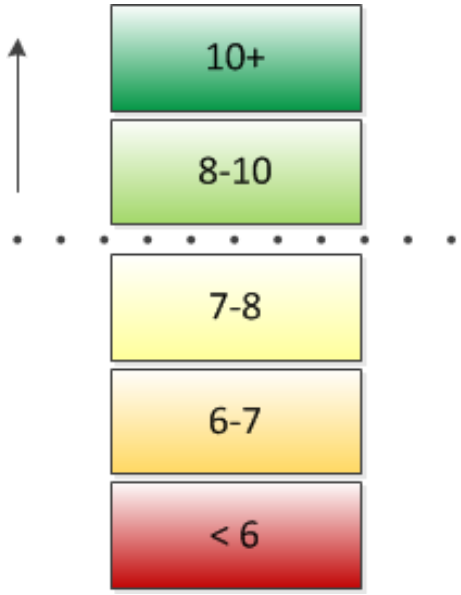
Focus on Best Practice Engagement

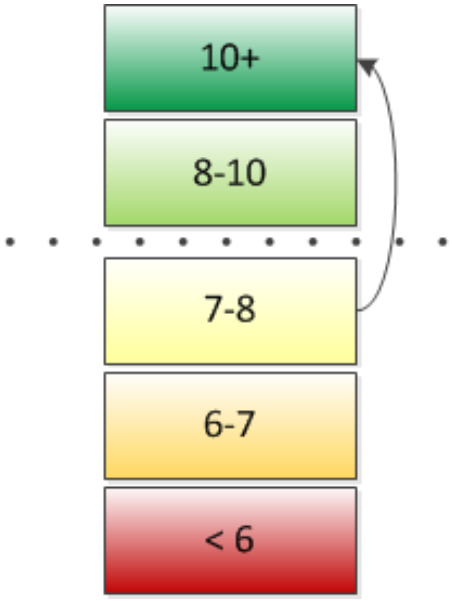


What if you found out your donation *didn't* help save a life?

Overutilization of Red Blood Cells

Too Often or Too Much





Hemoglobin Level **Hemoglobin Level**

Early Interventions & Engagement

- Education on AABB Standards
  - Led by Lab Directors and Pathologists
- Reporting of historical, descriptive utilization patterns
  - By Hospital, APRDRG, and Attending Provider
- Buy-in on technology solutions
  - BPA

But…

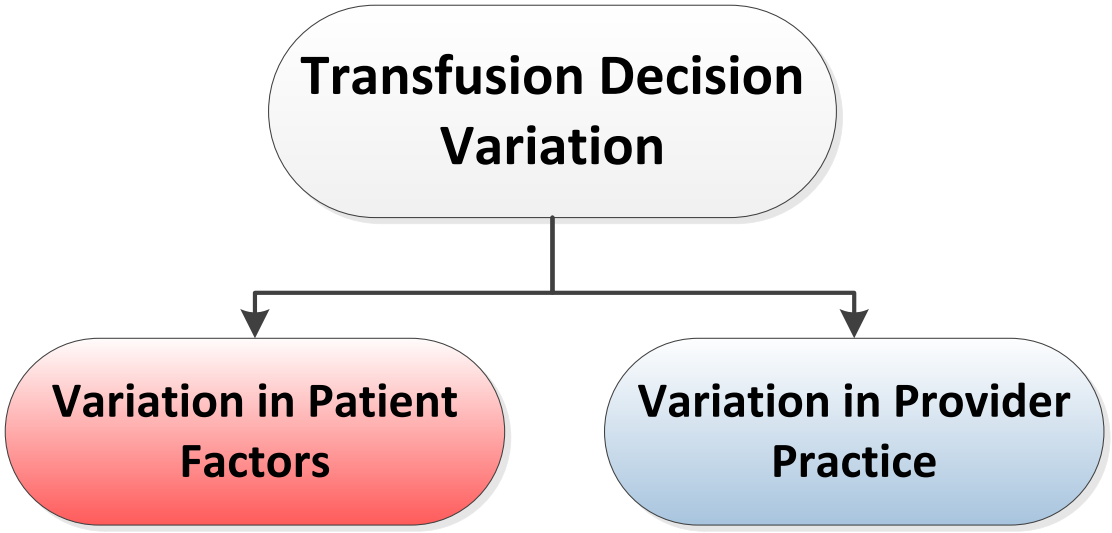
“My patients are sicker.”

Risk Adjustment

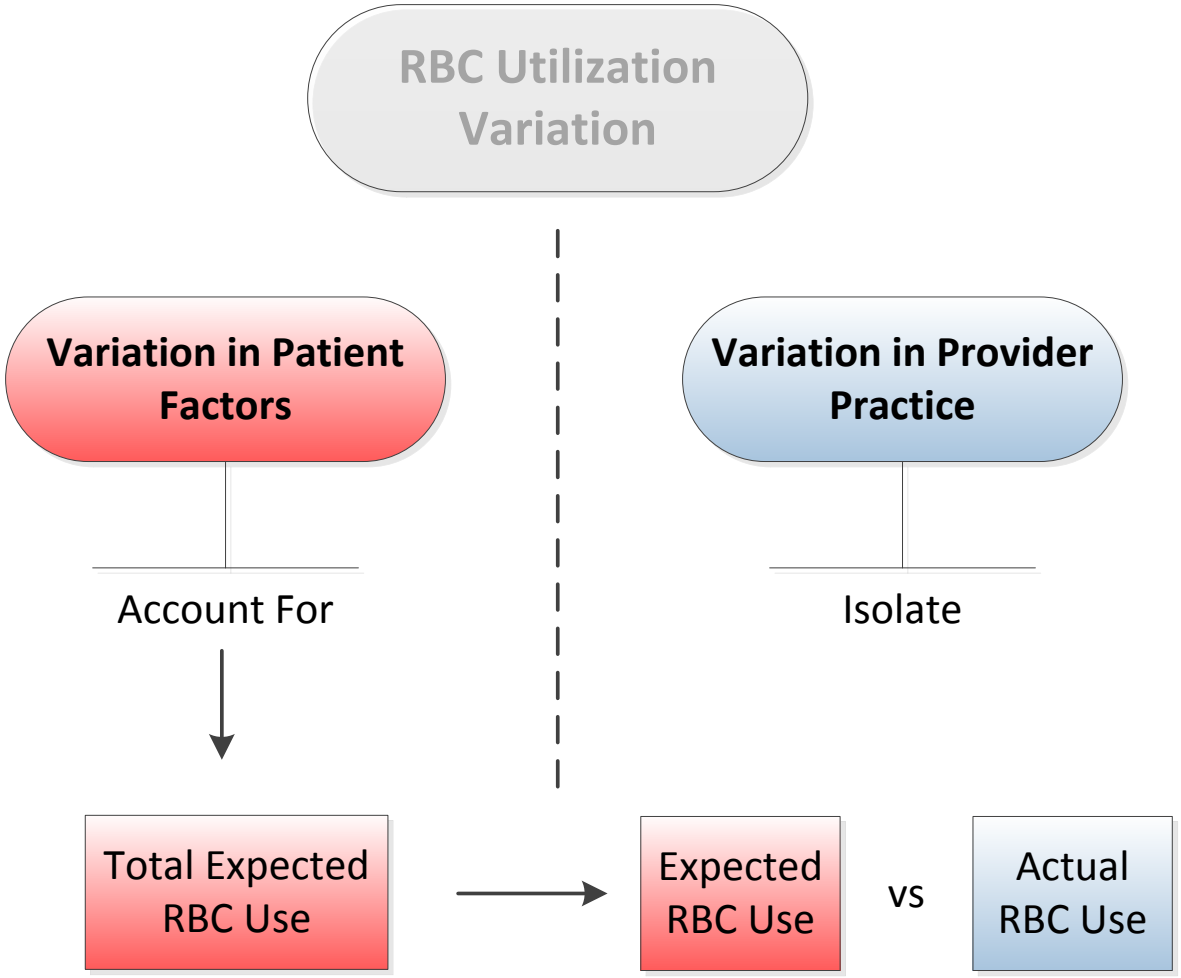
"Risk adjustment describes methods for determining whether *patient characteristics* will *necessitate higher utilization* of medical services."

-American Medical Association

Utilization Variance



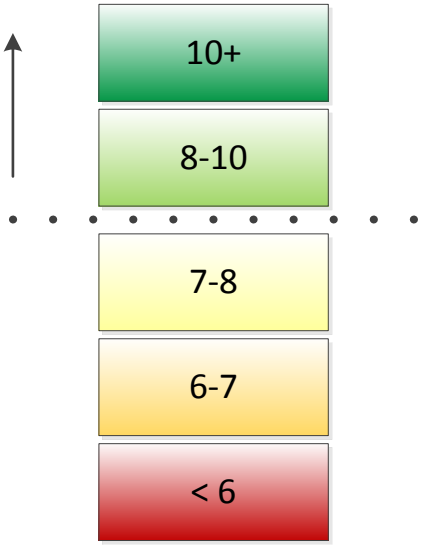
Objective


RBC Utilization Variation
Variation in Patient Factors
Variation in Provider Practice
Account For
Isolate
Total Expected RBC Use
Expected RBC Use
vs
Actual RBC Use

Expected RBC Use

$$\Pr(Transfusion) \quad \text{x} \quad (Expected\ Units\ |Transfusion)$$

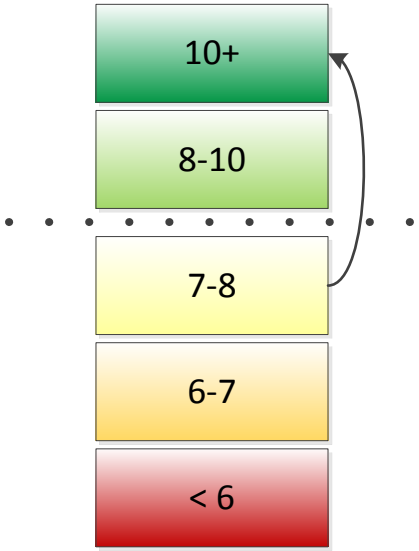
Too Often



Hemoglobin Level

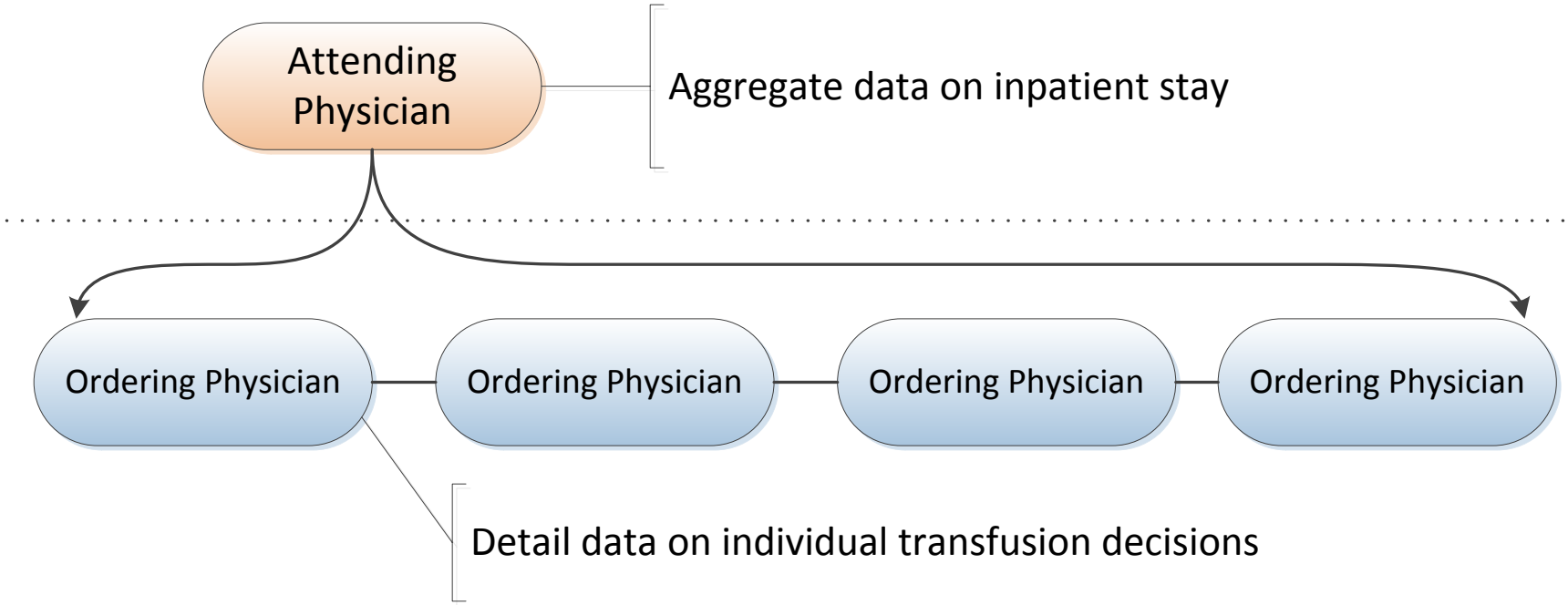
or

Too Much



Hemoglobin Level

Detail Level of the Data



Modeling Strategy

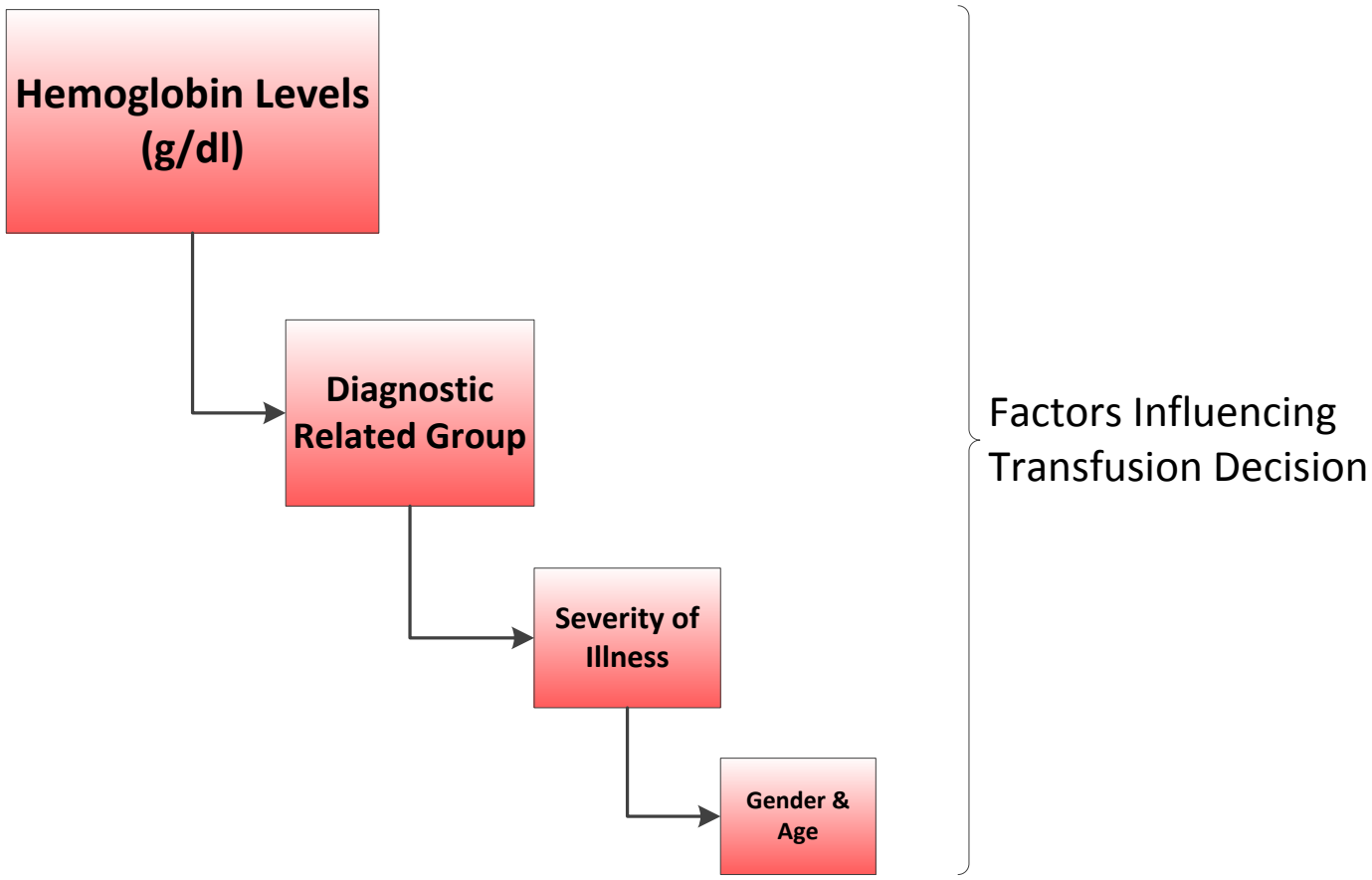
Attending

Binary Logistic Regression: Did patient receive a transfusion at all? (0/1)

Ordering

Multi-Classification: Given a transfusion occurred, how many units were transfused?

Patient Factors Governing Transfusion Decisions



Logistic Regression: Stratify by DRG, Train on Attending, Apply to Ordering

Attending

First Hb on Record + Minimum Hb on Record + Severity of Illness + Age + Gender = Transfused (0/1)

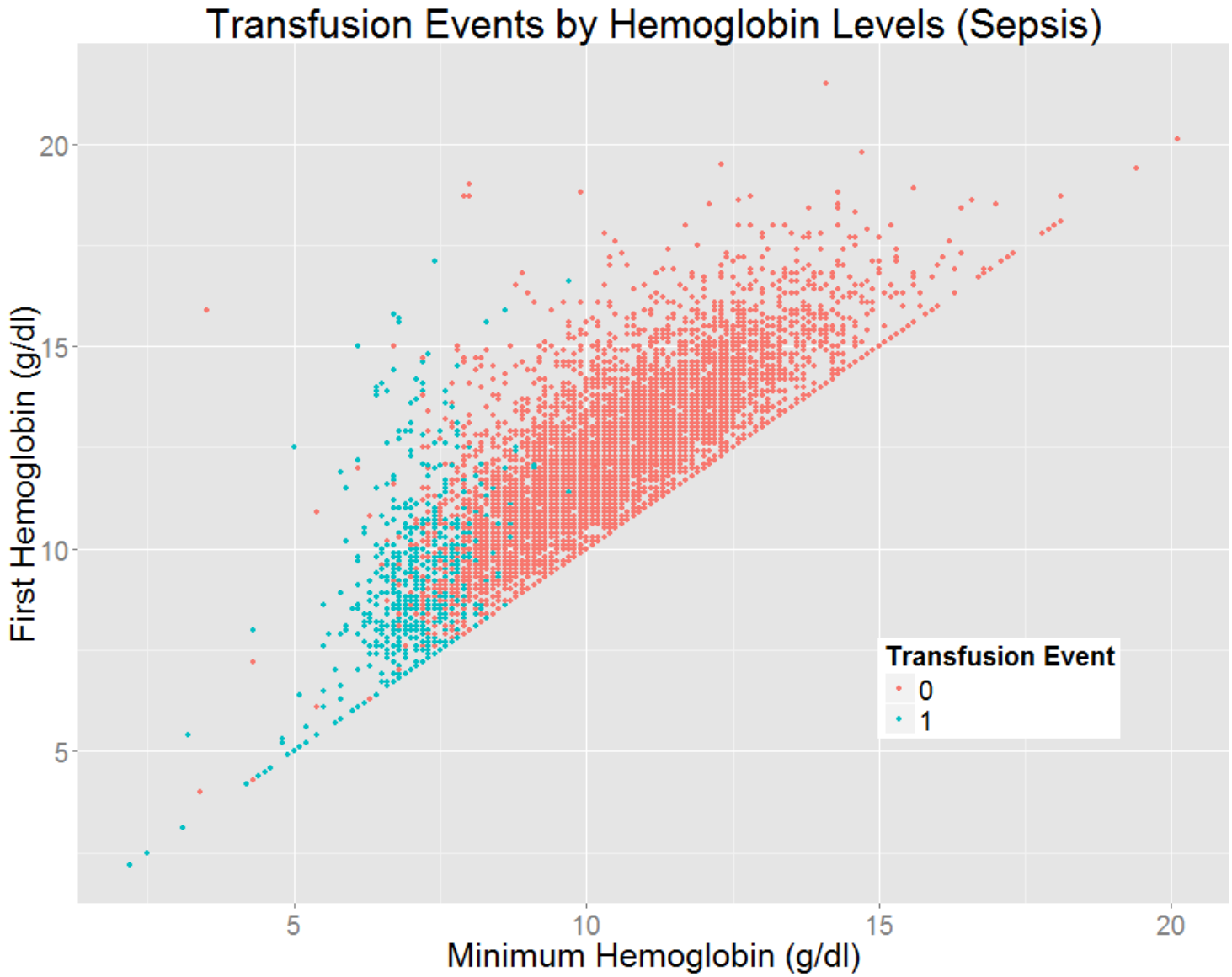
Ordering

First Hb on Record + Hb at Transfusion + Severity of Illness + Age + Gender = Transfused (0/1)

-Restrict variables in training to those that would be accessible to a physician when they are ordering a transfusion

-As an ordering physician would not necessarily know the minimum Hb level and we are assessing their individual transfusion decision , substitute “Hb at Transfusion” for “Minimum Hb on Record” when applying the model

Exploratory Analysis



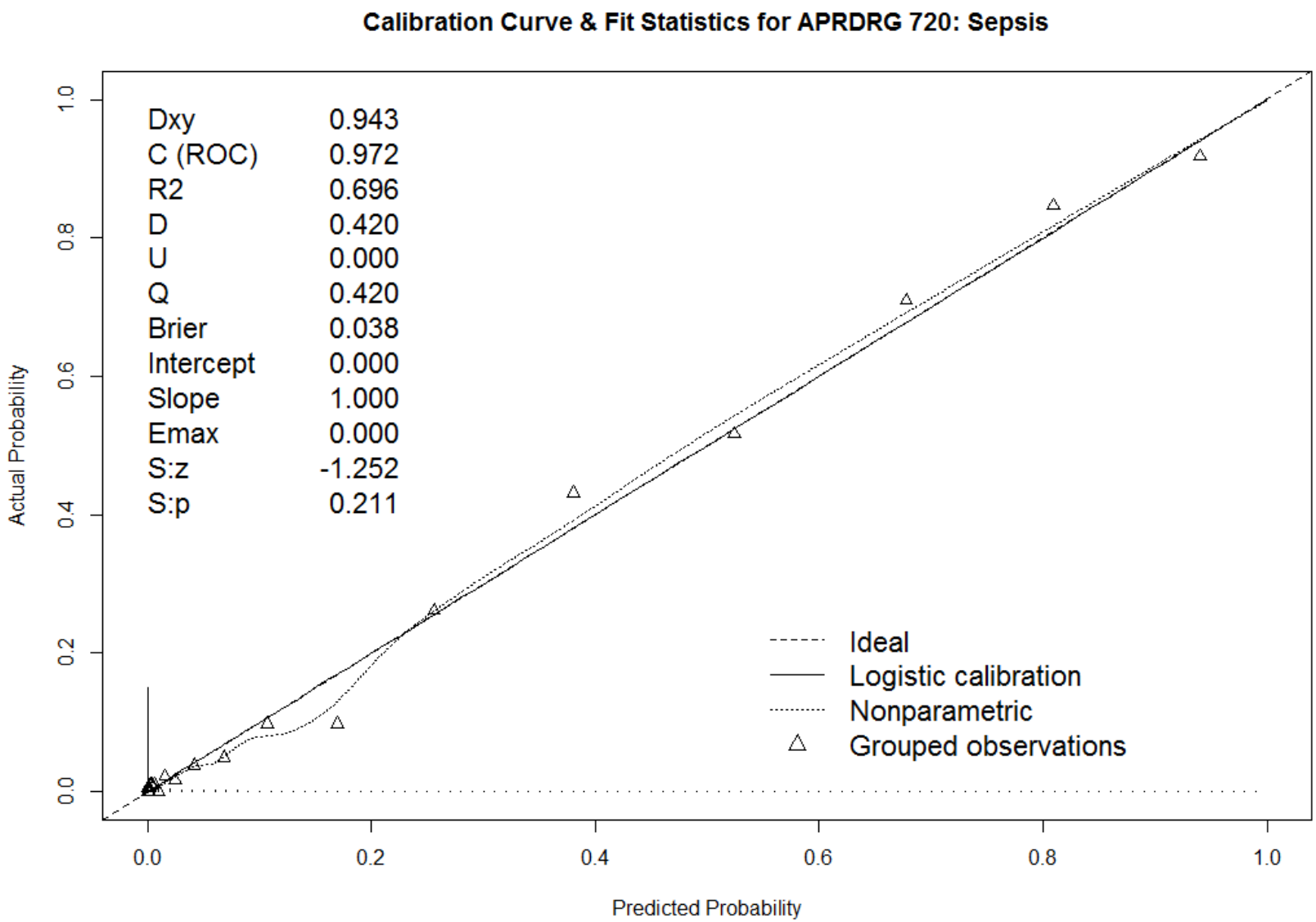
Logistic Regression Output

$$
\begin{aligned}
X\hat{\beta} = \; & \\
& 16.88 \\
& -2.18\,\text{Minimum_Hb} \\
& -0.18\,\text{First_Hb} \\
& +0.74[SOI = 2] \\
& +1.26[SOI = 3] \\
& +1.50[SOI = 4] \\
& -0.02[Sex = \text{M}] \\
& +2.60 \times 10^{-5}\,\text{Age}
\end{aligned}
$$

Table 1: Wald Statistics for Tranfusion Event

	χ^2	d.f.	P
Minimum Hb	516.00	4	< 0.0001
Nonlinear	9.19	3	0.0269
First Hb	25.63	4	< 0.0001
Nonlinear	5.89	3	0.1171
Severity of Illness (SOI)	14.66	3	0.0021
Sex	0.13	1	0.7198
Age	0.01	1	0.9196
TOTAL NONLINEAR	17.84	6	0.0067
TOTAL	767.31	13	< 0.0001

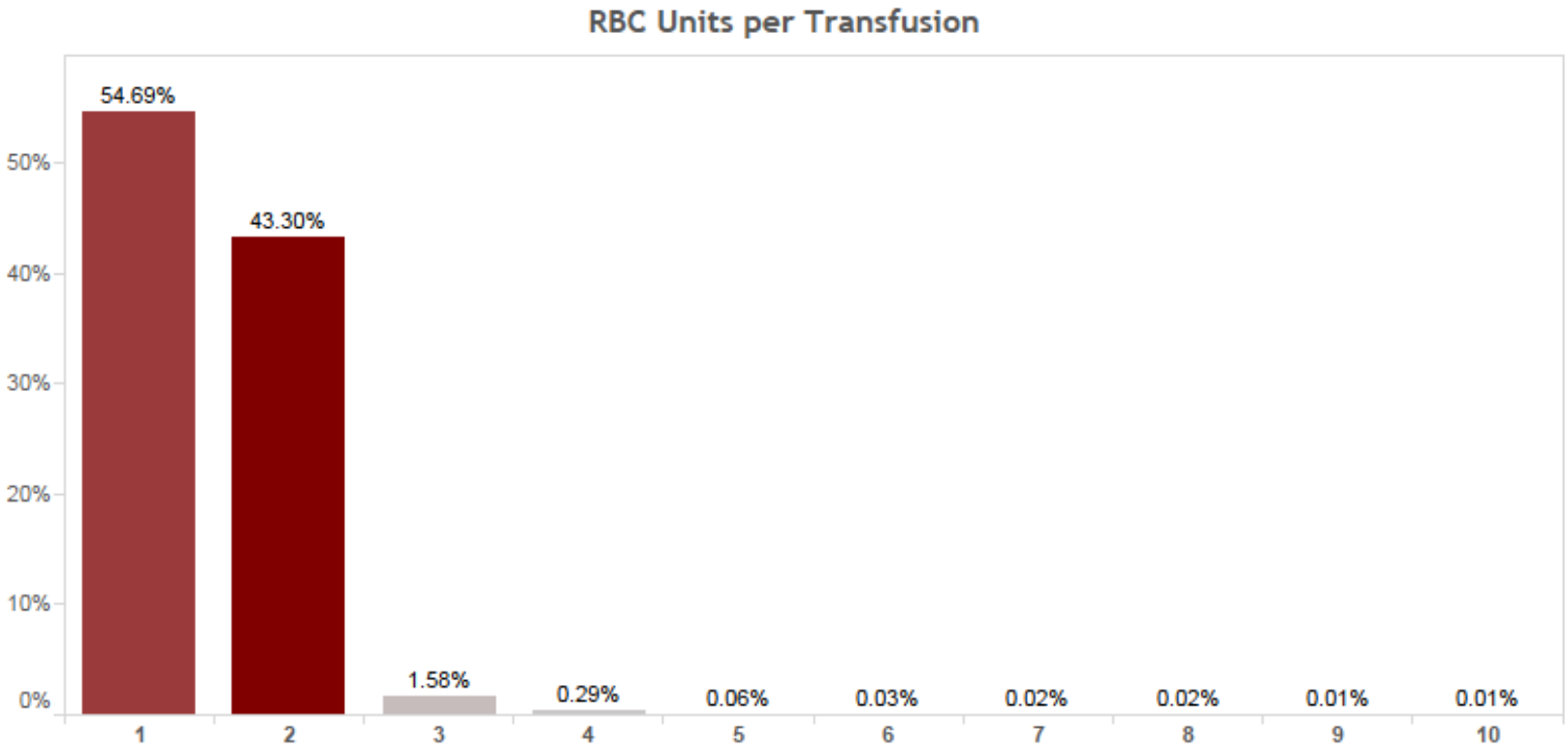
Calibration & Fit



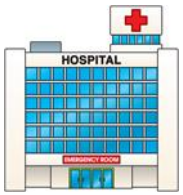
Validation

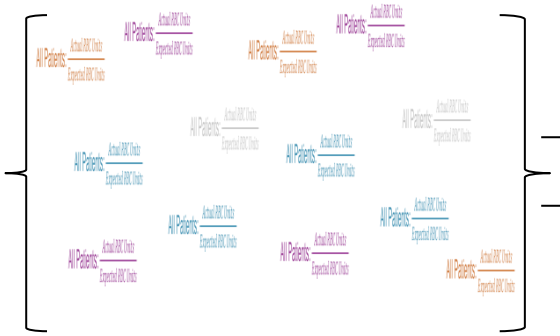
Index	Original Sample	Training Sample	Test Sample	Optimism	Corrected Index	n
D_{xy}	0.9440	0.9434	0.9428	0.0007	0.9434	125
R^2	0.6958	0.6958	0.6931	0.0028	0.6931	125
Intercept	0.0000	0.0000	−0.0127	0.0127	−0.0127	125
Slope	1.0000	1.0000	0.9932	0.0068	0.9932	125
$E_{\max}$	0.0000	0.0000	0.0039	0.0039	0.0039	125
D	0.4198	0.4207	0.4178	0.0030	0.4169	125
U	−0.0003	−0.0003	0.0001	−0.0004	0.0001	125
Q	0.4201	0.4210	0.4177	0.0033	0.4168	125
B	0.0382	0.0383	0.0385	−0.0003	0.0385	125
g	3.5378	3.5466	3.5217	0.0248	3.5130	125
g_p	0.1793	0.1798	0.1791	0.0007	0.1786	125

$(Expected\ Units\ |Transfusion)$: Random Forests

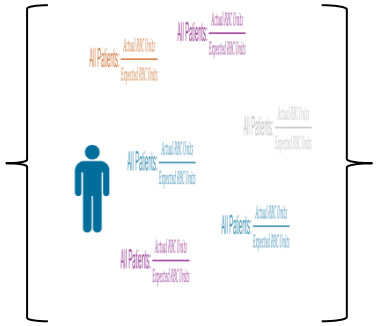


Aggregating Results – Use Ratio for Each Level

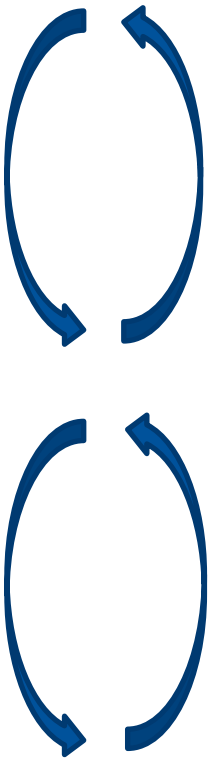




$$\frac{\textit{Total Actual RBC Units}}{\textit{Total Expected RBC Units}}$$

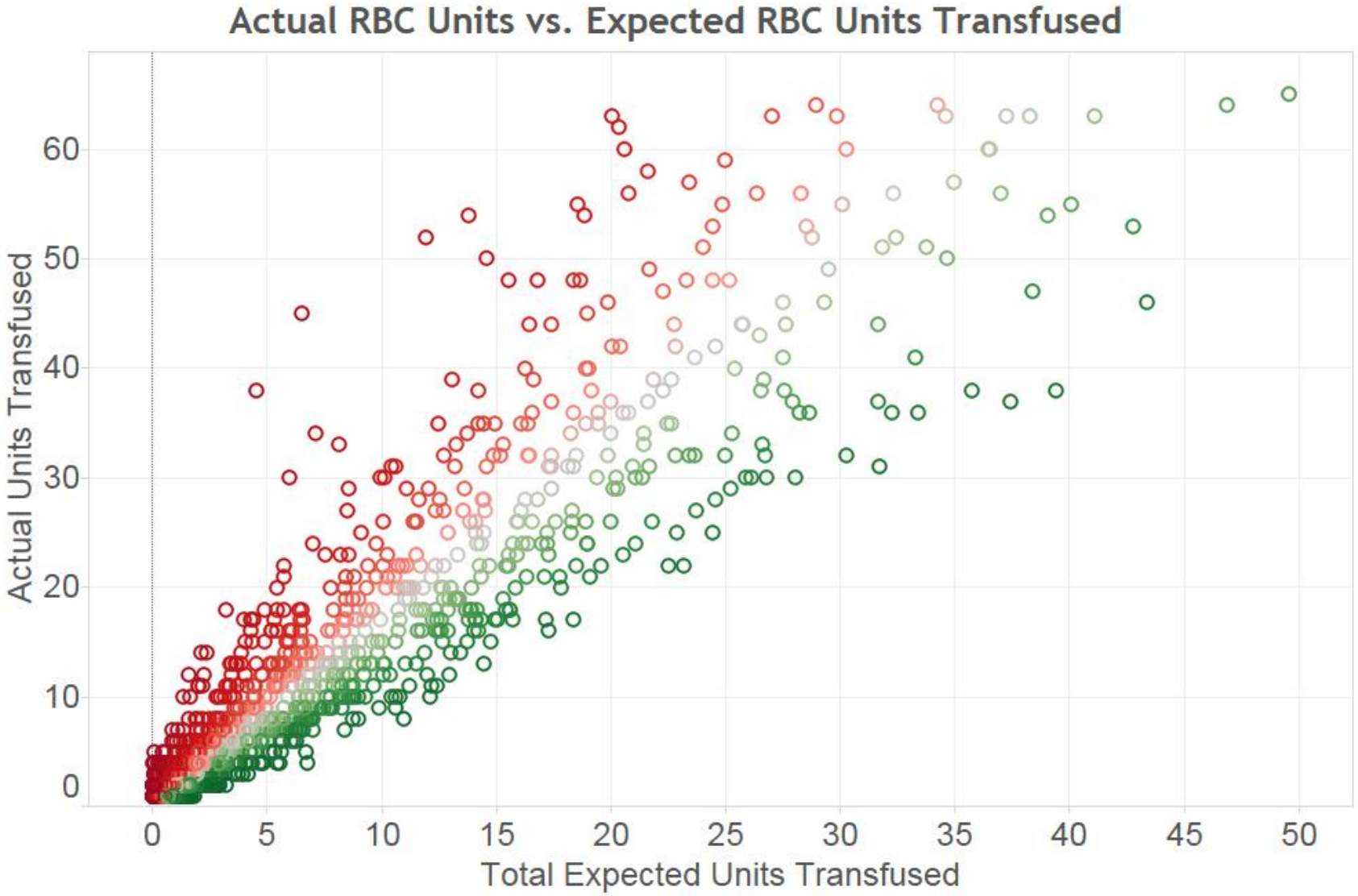


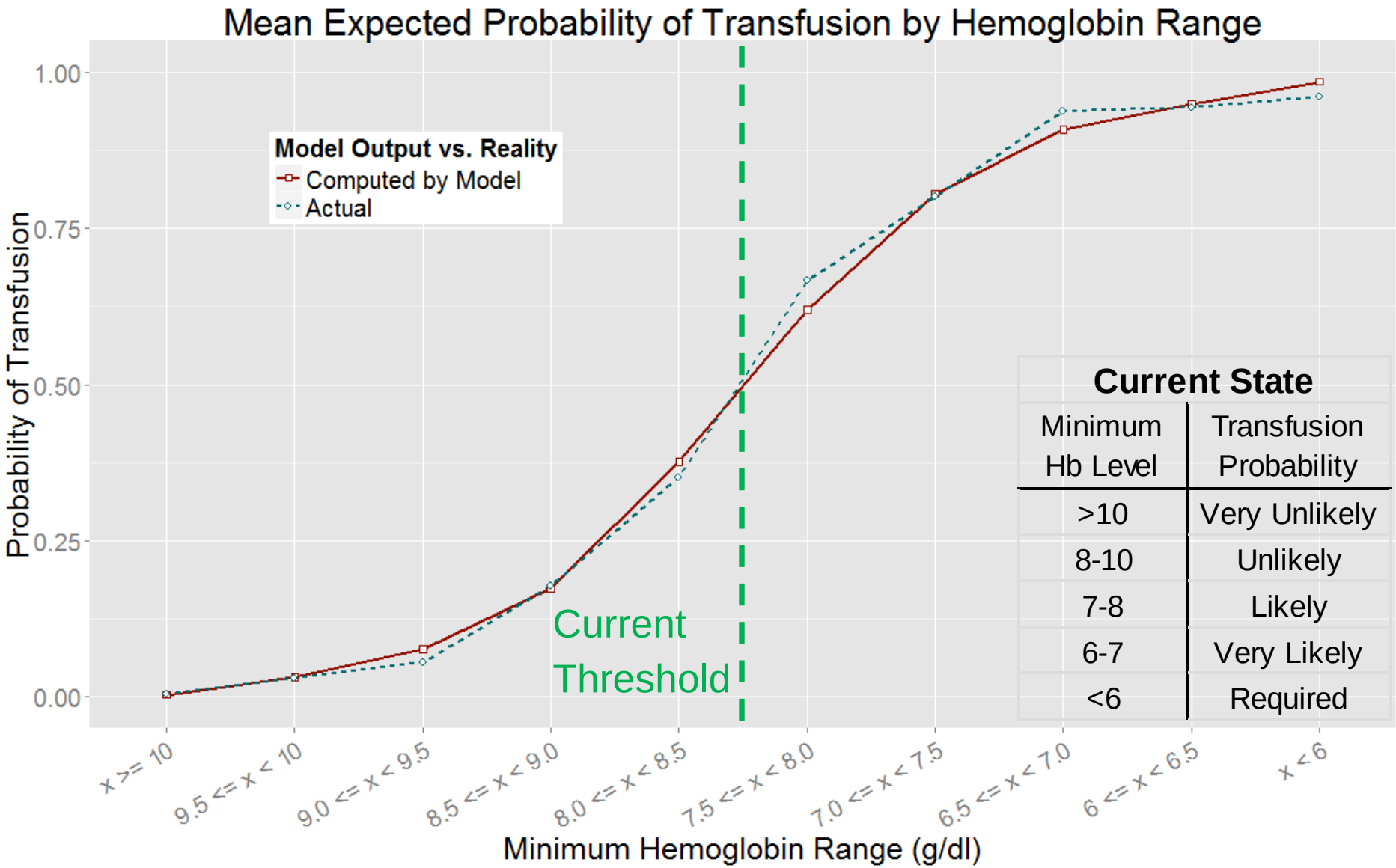
$$\frac{\textit{Total Actual RBC Units}}{\textit{Total Expected RBC Units}}$$



All Patients: $\frac{\textit{Actual RBC Units}}{\textit{Expected RBC Units}}$

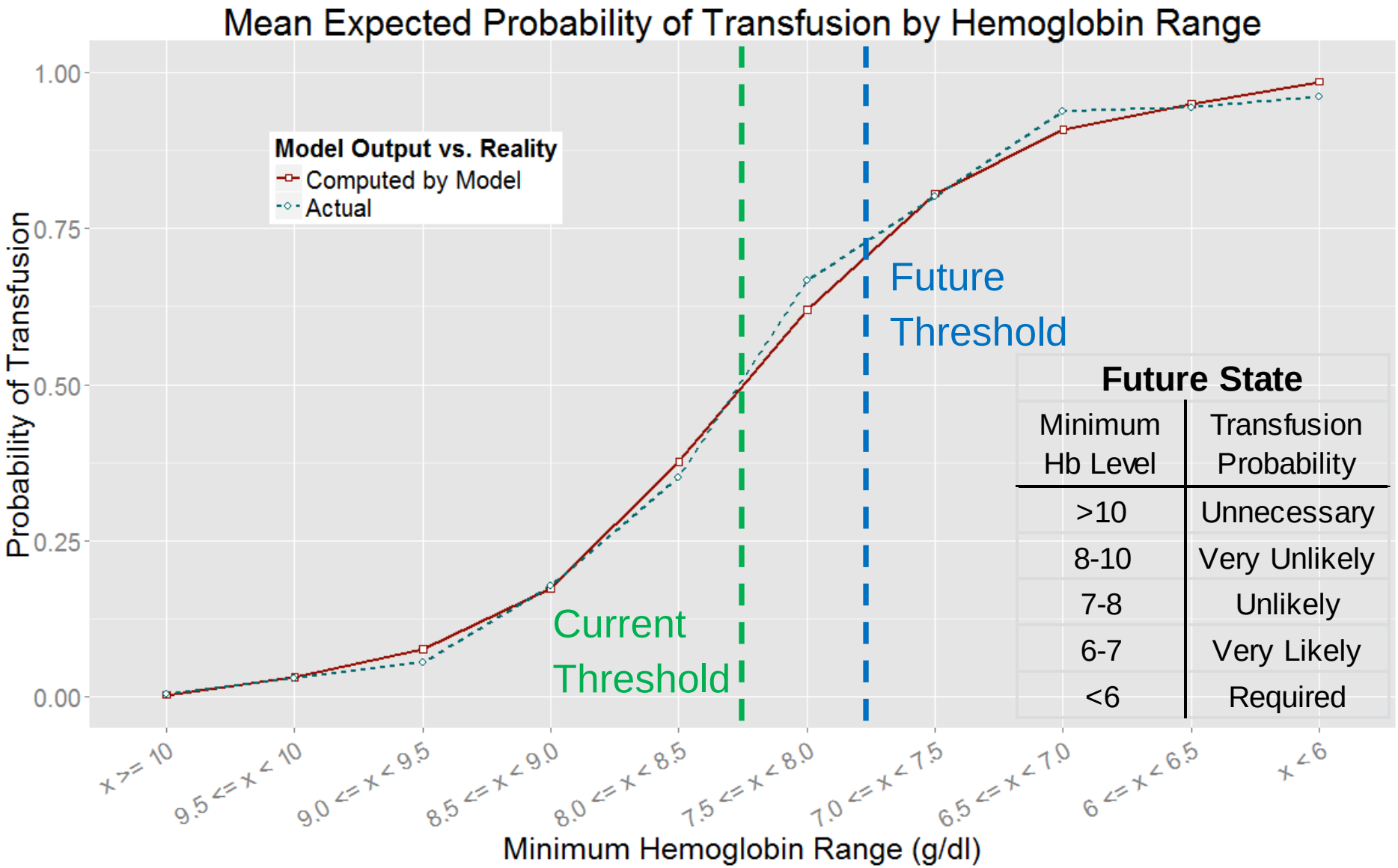
Example: Physician Level Analysis





Current State

Minimum Hb Level	Transfusion Probability
>10	Very Unlikely
8-10	Unlikely
7-8	Likely
6-7	Very Likely
<6	Required



Future State

Minimum Hb Level	Transfusion Probability
>10	Unnecessary
8-10	Very Unlikely
7-8	Unlikely
6-7	Very Likely
<6	Required

Results

- Improvements in Patient Safety
  - Hundreds of patients impacted
- Significant Savings Realized
  - Over a million in savings
- Culture of Excellence
  - Supported by analytics

Conclusion: Future Extensions

- Extend Methodology to Other Utilization Areas
  - Length of Stay Analysis
  - Advanced Imaging
  - Lab Test Ordering
  - Medications
  - Etc.

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Questions?

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