One Lab’s Journey up the Laboratory Value Pyramid

Presented by:
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Learning objectives

After this webinar, you will be able to:

• Discuss how leveraging technology and usable data can improve quality and achieve high value patient outcomes
• Evaluate the direct impact of laboratory test results on organizational performance
• Examine the value of laboratory information and impact of the laboratory value pyramid
• Describe how the laboratory can contribute to performance driven healthcare
Mather Hospital Northwell Health

Our Mission is to be the Best Community Teaching Hospital in New York State

- 248 Bed Community Hospital established in 1929
- Located North Shore on Long Island, New York
- Continually changing to meet the needs of the community
- Magnet Status

- NYS and JCAHO accredited Laboratory performs 2.4 million tests annually
- Patient Safety Score "A" from Leapfrog Group, 12 consecutive quarters
- December 2017 - Member of Northwell Health
The Value of Laboratory Information
Laboratory Diagnostics Information…The Case for Investment

• Medical risk and quality management
• Improves medical decision-making
• Changes the course of disease
• Reduces the burden of disease

Total Healthcare Spending:

$3.40 trillion in 2016 or $10,345 per person
$3.20 trillion in 2015 or $ 9,990 per person
$2.60 trillion in 2010 or $ 8,686 per person
$2.00 trillion in 2005 or $ 6,697 per person

Source: CMS.gov
The Case for Investment

Labs are only 3% of

HEALTH
COSTS
Laboratory Value Pyramid

**Figure 2**
The Laboratory Value Pyramid

- **Level 1**: Achieve Normalcy & Predictability
- **Level 2**: Establish & Meet Standards of Value
- **Level 3**: Deliver Value That Exceeds Expectation
- **Level 4**: Use Benchmarks to Achieve Best-in-class

Laboratory Value Pyramid

![Laboratory Value Pyramid Diagram]

Laboratory Value Pyramid

Laboratory Value Pyramid

**Figure 2**
The Laboratory Value Pyramid

- **Level 1**: Achieve Normalcy & Predictability
  - Internal
  - NOT at LEVEL 1?
  - NO WORRIES!

- **Level 2**: Establish & Meet Standards of Value
  - Internal
  - Vision: Deliver Value that Exceeds Expectation

- **Level 3**: Deliver Value that Exceeds Expectation
  - External
  - Visibility

- **Level 4**: Use Benchmarks to Achieve Best-in-class
  - External
  - Value
A thousand mile journey begins with a single step
Vision: Provides the organization with direction for the future and brings the promise of a better future.
From Volume to Value

Don’t abandon your dreams because of those who lack the vision!
Adding Value with Lab Tests

• Goal is to improve patient outcomes while reducing the cost per episode of care
• Lab can spend a bit more money, but contribute to millions in cost savings
• Achieve continuum of quality care throughout the healthcare system with standardized laboratory testing
Process Modification

Define
- Project
- Business case
- Objective
- Team
- Process

Measure
- Map process
- Measure waste
- Measure variation
- Measure performance
- Measurement system

Analyze
- Sources of variation
- Sources of waste
- Sources of overburden
- Root causes
- Bottlenecks

Improve
- Map future
- Plan improvements
- Apply improvements
- Evaluate impact
- Document changes

Control
- Quality control
- Speed control
- Sharing of knowledge
- Standardize
Does your process leave your staff tired?

Let’s take a look at the Lab Value Pyramid Journey…
Laboratory Value Pyramid Level 1 and 2
Laboratory Based Initiatives
Strategic Plan for Laboratory

• Maintain or Improve Quality Levels
• Free Up Valuable Time and Resources
  o Identify biggest productivity barriers
  o Streamline process
  o Eliminate duplicate efforts
  o Create a proactive vs. reactive culture
• Leverage Critical Intelligence to Drive Decisions
  o Rapid TAT
• Create Real Time Knowledge for better patient outcomes
• Assure patient safety with patient centric approaches
Automation and Auto-validation
ED Lactate – Receipt to Release TAT
Integration of Slidemaker and Stainer into Hematology Analyzer
CBC Turnaround Time ED

In-Lab TAT

Old Process
Average TAT
13 min
2014-2015

New Process
Average TAT
7 min
2015-2016
Workflow for Hematology Analyzer Prior to Integration of Slidemaker/Stainer

Sample received at testing station → Sample placed in rack → Rack placed on XN-2000 → XN-2000 processes samples → Acceptable results auto-validated to EMR → Release CBC results to EMR

- No → PBS required based on lab-defined rules

- PBS required based on lab-defined rules → PBS moved along platen → PBS moves along platen → Transfer PBS to Cellavision → Cellavision result reviewed by MT → Results released to EMR

Dry and fix PBS → Prime slide stainer by processing 2 clean slides → Place PBS on stainer → Dispense drop of blood onto slide → Mix sample and place blood dispensing tip into tube → Label slide with patient identifiers → Physically locate sample in testing rack

Acceptable results auto-reviewed by Middleware using lab-defined rules (WARM) → Abnormal results reviewed by MT

Spread blood drop on slide creating a smear with feathered edge
Workflow for Hematology Analyzer with Integrated of Slidemaker/Stainer
Flow Chart for Integrated Slidemaker/Stainer
Manual vs. Automated Slide Preparation

Manual “Hands-On” Slides

Automated Slide Preparation
“Hands-Free” Slides
Clinical Impact and Process Improvement Metrics

<table>
<thead>
<tr>
<th>DECREASED</th>
<th>INCREASED</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Total In-Lab TAT</td>
<td>✓ Slide Preparation Consistency</td>
</tr>
<tr>
<td>✓ Labor Intensive Manual Tasks</td>
<td>✓ Operational Efficiency/ Productivity</td>
</tr>
</tbody>
</table>

![Decrease in In-Lab TAT](image1)

- 58% decrease

![Decrease in "Hands-on" Steps](image2)

- 60% decrease

![Decrease of Total Workflow Steps](image3)

- 42% decrease

![Decrease in Manual Non-Value Added Steps](image4)

- 100% decrease
Lab Goals for Success from Volume to Value

- Drive out waste to drive out costs
- Employ Lean labor planning; manage retention & attrition
- Refocus on reagent and supply savings
- Use Lean management
- Create automated lean work cells—no more silos
- Manage lab orders and test utilization
- Standardize everything—equipment, policies, processes, job descriptions, etc.
- Leverage technology, connectivity, and data mining
Laboratory Value Pyramid
Level 3
Reducing Hospital Acquired Infections (HAIs)
Leveraging Technology

Culture
The Gold Standard

Molecular Diagnostics

1. Insert swab into Sample Reagent vial and break

2. Vertex and dispense Sample into Specimen Port

3. Insert Cartridge and start assay
Active Surveillance For MRSA Cost-Benefit Molecular Testing (PCR)

**Laboratory Costs**

- Screened high risk patients 2008 – 2014
- 12,785 patients (~ 1,825/yr)
- PCR Assay ~ $51 per test
- Total Screening Cost: $657,325
- NO ADDITIONAL FTEs
- MRSA testing performed 24/7

**MRSA Infections** (248 bed hospital)

- 62.0 fewer infections @ $35,000
Financial Impact of Rapid Screening and Reporting For HAI’s

Total Cost Avoidance/Reduction with MRSA Testing/Screening is:

$1,512,675
Clinical Impact and Financial Metrics

- Implementation of an Active MRSA High Risk Screening Program
- Rapid Reporting of Actionable Information
- Increased Awareness of HAI’s

Decreased Infection Rate: - 84%

Cost Reduction: - 84%
Laboratory Value Pyramid
Level 4

Choosing Wisely Initiative
Mission Statement: Propose guidelines for clinical efficiency and effectiveness in the workup and management of common hospital-based conditions to be endorsed by the Medical Board.
Choosing Wisely Objectives

- Better matching of care to needs
- High value, population specific
- Change Practice to Science — is central to addressing underuse of effective care and overuse of ineffective care
Key Performance Indicators

• Challenge/Opportunity
• Process and Quality
• Patient Benefit
  o Patient safety and satisfaction
  o Outcomes (LOS, mortality, re-admissions)
  o Avoid unnecessary treatment(s)
  o Appropriate level of care
• Cost
Key Questions to Consider

- Can patient outcomes and satisfaction levels be improved?
- Can we demonstrate measurable outcomes?
- What are the savings potential?
- Can clinical practice by changed?
Key Questions to Consider

✓ Can patient outcomes and satisfaction levels be improved?
✓ Can we demonstrate measurable outcomes?
✓ What are the savings potential?
✓ Can clinical practice by changed?
Teamwork

• Choosing Wisely Committee should include:
  o Senior Hospital Leadership
  o Chief Medical Officer
  o Chief Information Medical Officer
  o Hospitalists
  o Intensivists
  o Cardiologists
  o ED
  o Clinicians
  o Clinical Laboratory
  o Pharmacists
  o Nursing Management/Staff
  o Finance
Choosing Wisely Initiatives

• Clinical Pre-Test Probability and D-dimer
  o Wells Score
  o D-dimer Test

• Chest Pain Accelerated ED Protocol
  o Serial Draws
  o Single Troponins
  o HEART Score

• HF and BNP
  o Pre-discharge BNP
  o NYHA Classification

• HF and Iron deficiency and Anemia
  o RET-He

• Syncope
  o CHESS Score

Work in progress…
Choosing Wisely Initiatives

- Head Trauma
  - Canadian Head CT Rule
- ED CT Ordering
  - Reason for ordering
- Procalcitonin (PCT)
  - Meaningful use
- Cervical Trauma
  - Canadian C-spine Rule
- Echocardiogram
  - List reason for ECHO
- C. diff
  - Algorithm

Work in progress...
Choosing Wisely

Choosing Wisely Initiative
Clinical Pre-Test Probability Assessment and D-dimer as a First Screen for PE and DVT
Statistics

• 99% of ED cases had no documentation of any CPTP assessment
• 1154 - Total Number of D-dimers ordered between May 2015 and April 2016
  o 919 (85%) D-dimer and no angiography
  o 157 (15%) D-dimer and angiography
Statistics

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  - 157 (15%) D-dimer and angiography
Statistics

- ED - 107 (68%) Positive D-dimer (>500ng/mL) had Angiography
- Angiography Results
  - 101 Negative
  - 4 Positive
  - 2 Equivocal
Statistics

- ED - 50 patients (32%) with Negative
- D-dimer (<500 ng/mL) had Angiography
- Angiography Results
  - 50 Negative
  - 32 triple CCTA
  - 2 double
  - 8 single
  - 9 V/Q Scan
Not all D-dimer Tests are Created Equal

- FDA cleared for **Exclusion** of PE and DVT in low and moderate risk outpatients
- Not all D-dimer tests support an exclusion strategy
- Negative Predictive Value- (NPV reflects the ability of a test to rule out the disease)
- NPV > 99% at a cut-off of 500ng/mL
DVT/PE Risk Assessment Algorithm

Clinical Pre-Test Probability (CPTP) Wells Score

Low or Moderate Risk
DVT ≤2  PE ≤5

D-dimer Negative (<500 ng/mL)

STOP

High Risk
DVT ≥3  PE ≥6

D-dimer Positive (>500 ng/mL)

Continue Examination

NPV >99% when CPTP and D-dimer are combined for safe exclusion of VTE in suspected outpatients
- No further testing
- No anticoagulant treatment
- Improved patient management
- No radiation exposure
- Cost savings

Follow-up with imaging procedures such as:
- CCTA/Pulmonary angiography
- V/Q Scan
- Compression ultrasonography (CUS)

Other investigations for differential diagnosis
Cost Savings

• Cost saving for the hospital
  o Avoid unnecessary imaging procedures: CCTA - $1,511
• Contrast Media/Meds - $57.82
  o Contrast Media - $46.98
  o Meds - $10.84
• Human Resources
  o RN and CT Tech - $60.00

Cost savings: $1682/per patient

$1,682/pt. x 50 pts. = $81,441
Effect on ED LOS with Use of Risk Assessment Algorithm for Patients with Suspected DVT/PE

50% decrease in LOS
The Value is Unquestionable…Saves Lived and Dollars

D-dimer…..DVT/PE Exclusion strategy when combined with CPTP

- Cost - $9.00
- Rapid screening in less than 1 hour
- Promotes accurate (NPV >99%) exclusion of VTE in low to moderate risk outpatients
- Improves patient outcomes
- Enhances patient care management by closing the case and avoiding unnecessary diagnostic/imaging testing
- Frees up beds quicker in ED, thereby eliminating bottlenecks and holds
HF and Iron Deficiency
Iron Deficiency is Common in HF Patients

- 37% of 546 CHF patients were iron deficient
- Iron deficiency (ID) was a strong, independent predictor of unfavorable outcome
- 3-year survival rate was 66.7% in patients without ID vs. 53.6% in patients with ID


Figure 2 Kaplan–Meier curves reflecting 3-year event-free survival rates in patients with systolic chronic heart failure with vs. without iron deficiency.
Mather HF and Iron Deficiency Statistics

Hemoglobin Levels for CHF Inpatients
Admissions April 1, 2015 - March 31, 2016

- <10 (n=115) 21.31%
- >=10 and <12 (n=166) 24.26%
- >=12 and <=13 (n=92) 19.41%
- >13 (n=101) 35.02%

N = 474 Patients

<table>
<thead>
<tr>
<th>Hgb Level</th>
<th>Count of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>281</td>
<td>59.28%</td>
</tr>
<tr>
<td>&gt;=12</td>
<td>193</td>
<td>40.72%</td>
</tr>
<tr>
<td>Total</td>
<td>474</td>
<td>100.00%</td>
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Population: Inpatients admitted between April 1, 2015 and March 31, 2016 with a primary discharge diagnosis of CHF.
Source: SCIM
## IDA and HF Patients

Serum Iron & Ferritin Levels for CHF Inpatients
Admissions April 1, 2015 – March 31, 2016

<table>
<thead>
<tr>
<th>Serum Iron Level</th>
<th>Last Ferritin &lt; 100 ng/mL</th>
<th>Last Ferritin &gt;= 100 ng/mL</th>
<th>No Ferritin Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 40 ug/dL</td>
<td>36</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>&gt;= 40 ug/dL</td>
<td>23</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>35</td>
<td>5</td>
</tr>
</tbody>
</table>

Population: Inpatients admitted between April 1, 2015 and March 31, 2016 with a primary discharge diagnosis of CHF.
Source: SCM

Only 53% (19/36) of patients with Fe <40 and Ferritin <100 left with a prescription for Fe at discharge
Laboratory Anemia Work-up Diagnosis of Iron Deficiency

• Biochemical parameters
  o Serum iron
  o Ferritin
  o Transferrin
  o Transferrin saturation (TSAT)
Laboratory Anemia Work-up Hematology Parameters

• Based on entire RBC population
  o Hgb
  o HCT
  o MCV
  o RDW

• Based on reticulocyte population
  o Reticulocyte Hemoglobin (RET-He/CHr)
What is Reticulocyte Hemoglobin?

• Measured at cellular level
• Early detection of iron deficiency
• Monitors acute changes in hemoglobin incorporation into the erythron
• More sensitive than indirect chemical measurements
Reference Range for RET-He

• RET-He > 28 pg/cell indicates that sufficient iron is available for incorporation into the red cell
• RET-He < 28 pg/cell indicates that not enough iron is available to produce healthy RBC’s
• Reference Range: Adults: 28.2 – 36.6 pg/cell
Screening Assessment for ID/IDA in Heart Failure Patients*

- Hgb is ≤ 12 gm/dl
  - Reticulocyte count and RET-H\% if RET-H\% ≤ 28 pg/cell
    - Fe- ≤ 40\mu g/mL
    - TIBC- ≤ 20%
    - TSAT- ≤ 20%
    - Ferritin- ≤ 100ng/mL

*Mather Hospital Northwell Health

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The Value is Unquestionable…

- RET-He….Anemia management test
  - Cost < $1.00
  - Rapid screening
  - Prevents progression to Iron deficiency anemia
  - Promotes rapid intervention….. reduced blood collection……improves patient outcomes… enhances patient care management
Choosing Wisely can successfully shift us from Volume to High Value Based Patient Outcomes and Improved Patient Satisfaction!
Lessons Learned

✓ Continuous assessment of the initiatives
✓ Keep communication open
✓ Information Technology role is essential
✓ Change is slower than expected
✓ Collaboration among all stakeholders is paramount for success
✓ Demonstrate your knowledge
✓ Education and be prepared
We Must Break Out of Our Silos for High Value Cost Appropriate Care
There has to be something for everyone!
Executive Summary

• The Laboratory Value Pyramid (LVP) provides an essential and strategic roadmap for making the transition from volume to value.

• Implementation of the LVP demonstrates how the Laboratory can directly contribute to enhanced patient care and outcomes at each level by implementing advanced technology and data to support evidence based practices.

• The LVP provides a communication forum that fosters Laboratorian/clinician collaborations and engagement, that enables initiatives that results in reduce costs and infection rates, effective test utilization for improve quality, patient management and reduce costs.

• The LVP allows the Laboratory to increase their value proposition and visibility, while becoming an integrated member of the healthcare delivery team.
A thousand mile journey begins with a single step
Questions?

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