Bending the Outcome Curve in the Fight Against Sepsis

with Real-Time & Predictive Clinical Intelligence

Adam Klass, Chief Technology Officer, VigiLanz Corporation
Bart Abban, Ph.D, Chief Data Scientist, VigiLanz Corporation
About VigiLanz

- **Founded 2001**
- **Nearly 400 hospitals**
- **Offices in Minneapolis & Chicago**
- **Gartner Cool Vendor 2015**
- **Software as a Service (SaaS)**
- **Real-Time Surveillance**

**Our Passion**
Delivering real-time information and insights that healthcare executives and clinicians need to improve patient care and operational performance.
Generates actionable intelligence

Performs asynchronous surveillance

Informs clinicians real-time

Manages all data across the continuum of care

Enables collaboration and interoperability

Continuously learns by the integration of clinical and business intelligence data

Integrates innovative predictive models and analysis

Enterprise Intelligence Resource (EIR)
Intelligence Impacts Key Issues

- Care Management
- Regulatory Management
- Operations Management
- Financial Management
- Research
- Population Health
- Public Health
- Intelligence Platform
Intelligence Impacts Key Issues

- Pharmacy
- Antimicrobial Stewardship
- Sepsis Surveillance
- DVT Prevention
- Glycemic Control
- Fall Prevention
- Zynx Guidance
- Medication Reconciliation
- Infection Control
Intelligence Impacts Key Issues

- Care Management
- Regulatory Management
- Operations Management
- Financial Management
- Research
- Population Health
- Public Health

Regulatory Management
- Direct NHSN
- Quality Reporting
- Antimicrobial Utilization Reporting
- Safety/Risk Management
Intelligence Impacts Key Issues

Operations Management

- Safety/Risk Management
- Readmissions Prevention
- Medication Cost Management
- Core Measure Surveillance
- Quality Indicator Surveillance
Intelligence Impacts Key Issues

- Care Management
- Public Health
- Regulatory Management
- Operations Management
- Financial Management
- Research

Research

- Data Aggregation
- Research Initiative Rule Set
Intelligence Impacts Key Issues

- Care Management
- Regulatory Management
- Operations Management
- Financial Management
- Research
- Public Health
- Population Health

Population Health:
- Risk Stratification
- Chronic Disease Management
- Episodic Care Optimization
- Preventative Health
Intelligence Impacts Key Issues

- Public Health
- Population Health
- Research
- Financial Management
- Operations Management
- Regulatory Management
- Care Management

- Infectious Disease DB
- Syndromic Surveillance

Intelligence Platform
Managing the data deluge

- Large quantities of data are only as meaningful as the insights they yield
- Efficient data analytics are linked to significantly reduced costs, increased business intelligence and improved clinical outcomes

Embracing the care continuum

- As reimbursement is linked to value, clinical outcomes data are more entwined with the revenue cycle
- Anywhere intelligence to make informed decisions

51%

A Stoltenberg Consulting poll found healthcare IT leaders believe the most significant barrier to hospital data analytics is not knowing what data to collect or how much of it.

Becker’s CIO Review, 2016
Sepsis Prediction
Temporalytics® Methodology

Standard Clinical Predictive Models

- Patient Data
  - Retrospective

- BMP
  - Good Medical Practice

Analytics

Stratification & Predictive Alerts

Temporalytics Predictive Models

- Patient Data
  - Retrospective & Real-Time

- Time-Based Meta Data

- Customization
  - BMP
  - Good Medical Practice

Machine Learning Platform

Smart Rules

Prescriptive Insights, Analytics & Risk Scoring

Complete Integration into Workflow

- Powerful proprietary metadata drives cause and effect approach
- Customized to patient population (not one size fits all)
- Universal methodology can be used on any clinical, financial or operational issue
- Machine learning platform enables consistent tuning and optimization
Temporalytics® Predictive Models: Sepsis

Goal: Predict **before** onset of Severe Sepsis

- Admission
- **$T_0 = 0$**
  - Age, BMI, History, Comorbidities, Vitals & Labs

- Severe Sepsis Dx
  - (Infx + Organ Dysf)
  - **$T_{sepsis} = \text{Max}(T_{\text{infx}}, T_{\text{organ dysfn}})$**

- ICU admit
- ICU discharge

- Discharged/Expired

General Models
SIRS Criteria vs. VI Prediction

**SIRS Models**

<table>
<thead>
<tr>
<th></th>
<th>SIR2 (-)</th>
<th>SIRS2 (+)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Sepsis (-)</td>
<td>1,954</td>
<td>730</td>
<td>2,684</td>
</tr>
<tr>
<td>Severe Sepsis (+)</td>
<td>20</td>
<td>139</td>
<td>159</td>
</tr>
</tbody>
</table>

- **Sensitivity:** 87%
- **Specificity:** 73%

**VigiLanz Temporalytics®**

<table>
<thead>
<tr>
<th></th>
<th>Model (-)</th>
<th>Model (+)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Sepsis (-)</td>
<td>2,410</td>
<td>274</td>
<td>2,684</td>
</tr>
<tr>
<td>Severe Sepsis (+)</td>
<td>18</td>
<td>141</td>
<td>159</td>
</tr>
</tbody>
</table>

- **Sensitivity:** 89%
- **Specificity:** 90%

**PPV**

- SIRS: 15%
- VigiLanz: 34%
Cost Savings and Volume Focus

Severe Sepsis Predictive Model Cost Analysis

<table>
<thead>
<tr>
<th>Hospital Severe Sepsis parameters</th>
<th>Model Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Sepsis Incidence (%)</td>
<td>SIRS-based model</td>
</tr>
<tr>
<td>Number of at-risk admissions</td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Cost per case of severe sepsis (Baseline)</td>
<td>87.0%</td>
</tr>
<tr>
<td>Cost per case of predicted severe sepsis</td>
<td>73.0%</td>
</tr>
<tr>
<td>Cost per case of false positive</td>
<td>VI model</td>
</tr>
<tr>
<td>Effectiveness of intervention</td>
<td>Sensitivity</td>
</tr>
</tbody>
</table>

Total cases requiring follow-up

VigiLanz model | 415
SIRS2 criteria | 869

Caseload reduction over 50%

Average cost of sepsis cases: ADP Principal: $19,000; ADP Secondary: $10,500
Sepsis Predictive Intelligence Integration

VigiLanz Intelligence Platform

Clinical Intelligence Portal

Sepsis Risk Scores are Displayed and/or sent through alerts for Clinicians

Pharmacy
Infection Control
Antimicrobial Stewardship

Learning

Collaborate
Customize
Train/Test

Discovery

Temporalytics® Predictive Analytics

Advisory Services

Sepsis Model Results Transparency – See it in Real-Time

Core BI Portal
### Sepsis Risk Display in Workflow Integration

<table>
<thead>
<tr>
<th>Risk Value</th>
<th>MRN</th>
<th>Patient Name</th>
<th>Location</th>
<th>Infection Indicators</th>
<th>Hypotension</th>
<th>Vasopressors</th>
<th>Fluid Bolus Today</th>
<th>CVP</th>
<th>T Max</th>
<th>SSSF</th>
<th>Blood Culture</th>
<th>Lactic Acid</th>
<th>Organ Failure</th>
<th>Respiratory Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Risk 82%</td>
<td>H0001758</td>
<td>Last Name, First Name</td>
<td>Unit5691</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 79%</td>
<td>H0001658</td>
<td>Last Name, First Name</td>
<td>Unit5944</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 78%</td>
<td>H0003250</td>
<td>Last Name, First Name</td>
<td>Unit3595</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 78%</td>
<td>H0002509</td>
<td>Last Name, First Name</td>
<td>Unit3595</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 77%</td>
<td>H0009285</td>
<td>Last Name, First Name</td>
<td>Unit6822</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 77%</td>
<td>H0003514</td>
<td>Last Name, First Name</td>
<td>Unit7610</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 76%</td>
<td>H0003692</td>
<td>Last Name, First Name</td>
<td>Unit5944</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 76%</td>
<td>H0003553</td>
<td>Last Name, First Name</td>
<td>Unit5944</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 74%</td>
<td>H0003523</td>
<td>Last Name, First Name</td>
<td>Unit6932</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 74%</td>
<td>H0004698</td>
<td>Last Name, First Name</td>
<td>Unit6453</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 74%</td>
<td>H0004754</td>
<td>Last Name, First Name</td>
<td>Unit7160</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 74%</td>
<td>H0004772</td>
<td>Last Name, First Name</td>
<td>Unit5552</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 73%</td>
<td>H0002334</td>
<td>Last Name, First Name</td>
<td>Unit7160</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 73%</td>
<td>H0003408</td>
<td>Last Name, First Name</td>
<td>Unit8846</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 71%</td>
<td>H0003608</td>
<td>Last Name, First Name</td>
<td>Unit8846</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
<tr>
<td>Current Risk 71%</td>
<td>H0003864</td>
<td>Last Name, First Name</td>
<td>Unit5534</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>No Results</td>
<td>Y</td>
<td>16</td>
</tr>
</tbody>
</table>
Clinical quality and financial value, driving actionable intelligence with both retrospective and real-time clinical meta data.

**Vital Sign Lag Time**

**Clinical Issue Hot Spots**

**Predictive Model Performance**

**Clinical Process Performance**

**Patient Safety Response Time**

**Medication Safety**

### Lag Time Analysis

- Average Lag (minutes)
- Month Collected: Oct, Nov, Dec, Jan2016
Endless Possibilities

Preventative Care

Readmissions
- Surgery Site Infections (SSI)
- Health Risk Scoring
- Glycemic Control
- Epidemic Outbreaks
- Deep Vein Thrombosis (DVT)

Sepsis

Chronic Disease Management
- COPD
- Diabetes
- CHF

Adverse Drug Effects (ADE)

Morbidity Risk
- Pressure Ulcers
- Pneumonia
- MRSA
- Hospital Acquired Infections (HAI)

Preventative Care
- Sepsis
- CLABSI
- CAUTI
- Cdiff

Stroke

Glycemic Control

Deep Vein Thrombosis (DVT)

Health Risk Scoring

Epidemic Outbreaks

Diabetes

CHF

COPD

Endless Possibilities

VigiLanz INTELLIGENCE
Thank you for joining us!

855.525.9078 and Connect@vigilanzcorp.com