Clinical performance improvement with Electronic Medical Records

West Midlands AHSN Digital Health Conference

Justin Whatling

Senior Director, Cerner’s European Advisory Practice
Chair, BCS Health, The Chartered Institute for IT
Slow innovation adoption

From time new knowledge discovered until ½ of physicians act on that knowledge = 15 - 17 years

“Finish medical school and residency knowing everything...read and retain 2 articles every single night...at the end of 1 year you're only 1,225 years behind.”

4 Diffusion of Innovations, Everett Rogers, 1995
5 Managing Clinical Knowledge for Health Care Improvement, , Balas, Boren, Yearbook of Medical Informatics, 2000
6 Jamia 2005; 12:113-20
Enabling Evidence, Quality and Efficiency

Design

Develop

Discover

Deploy

Cerner
‘Passive’ decision support
Evidence-based pathways of care
75% of decision support interventions succeed when the information is provided to clinicians automatically, whereas none succeed when clinicians are required to seek out the advice.

### Predictors of Success

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Adjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic provision of decision support as part of workflow</td>
<td>112.1</td>
</tr>
<tr>
<td>Provision of decision support at the time and location of decision making</td>
<td>15.4</td>
</tr>
<tr>
<td>Provision of recommendation rather than just an assessment</td>
<td>7.1</td>
</tr>
<tr>
<td>Computer-based generation of decision support</td>
<td>6.3</td>
</tr>
</tbody>
</table>

- HCIT evaluation of 167,233 patients at 41 hospitals
- Clinical decision support associated with:
  - 21% mortality reduction for pneumonia
  - 16% reduction in patient complications

#### Electronic Process

<table>
<thead>
<tr>
<th>Process</th>
<th>Cost Savings Per Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision support</td>
<td>$538</td>
</tr>
<tr>
<td>Order entry</td>
<td>$132</td>
</tr>
<tr>
<td>Test results</td>
<td>$110</td>
</tr>
<tr>
<td>Notes and records</td>
<td>$-2</td>
</tr>
</tbody>
</table>

#### Potential US Implications:

- $19 billion savings per year
- 10,055 lives saved for patients with CAP
- 25,141 patient complications avoided

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7. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success
8. Clinical information technologies and inpatient outcomes: a multiple hospital study
Dynamic decision support – alerting

Temperature Oral
Temperature Tympanic
Apical Heart Rate
Peripheral Pulse Rate
Heart Rate Monitored
Respiratory Rate
SBP/DBP Cuff
Mean Arterial Pressure, Cuff
SBP/DBP UAC
Mean Arterial Pressure UAC
SpO2
Blood Glucose, Capillary

Discern Advisor® - Rapid Response Team

Patient is at risk for developing an adverse outcome based on the following findings. Please review available documentation and answer questions 7 and 8. If necessary, click below to notify the Rapid Response Team (RRT).

Criteria | Clinical Information | Criteria Not Met
--- | --- | ---
1. Resuscitation Status | Documentation Not Found | No
2. Heart Rate ≤ 40 bpm or > 130 bpm | Peripheral Pulse Rate ≤ 34 as of 03/22/13 09:00:00 | Yes
3. Systolic Blood Pressure ≤ 90 mmHg | Systolic Blood Pressure ≤ 90 as of 03/22/13 09:00:00 | Yes
4. Respiratory Rate ≤ 8 or > 30 breaths/min | Respiratory Rate ≤ 12 as of 03/22/13 09:00:00 | Yes
5. Pulse Oximetry Saturation ≤ 90% despite oxygen administration | SpO2 = 87 as of 03/22/13 09:00:00 | Yes
6. Altered Mental Function | Documentation for Level of Consciousness Not Found | No
7. Decreased Urine Output ≤ 50 ml in 4 hours | Documentation for Orientation Not Found | No
8. Are you simply worried about patient? | Yes/No | No

Based on recent changes in patient condition, please page the RRT.

Suggested plans of care

Morse Fall Risk Scale

- History of Fall in Last 3 Months: Yes
- Presence of Secondary Diagnosis: Yes

Discern Notification Message

Subject: Discern Alert
Priority Status: High
Priority Value: 100
Event Date/Time: 03/04/2013 16:22:56
Message class/subclass: APPLICATION/DISCERN

NAME: Jurek, Scott
DATE: 03 April, 2013 16:22:56 WEST
MRN: BWMC 007-615

Morse Fall Risk Management

Orders for Signature
- Suggested Plans
  - Fall Prevention and Management
    - Interdisciplinary
    - Communication
    - Consultation
- Orders
  - Patient Status
  - Vital Signs
  - Activity
  - Diet
  - Patient Care
  - IV Solutions

Outcomes
- Verbally describes understanding of Fall Risk/Precaution
- Patient-specific risk factors
- Takes action to control fall-related risks
- Adherence to Fall Risk-specific precautions

Interventions
- Fall interventions
  - Education Fall Risk Prevention
  - Communication Environmental Safety Plan
  - Fall Risk Alert System in Place
  - Work with physician to assure assistive device eval is complete
  - Collaborate with physician for Physical Therapy to evaluate gait, balance, and transfer mobility
Venous Thromboembolism (VTE) Management

Incidence of VTE in hospitalised patients ranges from 20% to 70%
VTE – adapting behavior

In 3 years at TMC:
- 45% fewer Hospital Acquired VTE’s
- 1,509 high acuity patient days avoided
- 5 lives saved

Over the next 5 years:
- Save an estimated US $1.49 million
- Avoid 186 VTEs
- Save 12 more lives

Unexpected Finding:
- 50% fewer 30 day readmissions

Donald Schreiber, Deep Venous Thrombosis and Thrombophlebitis emedicine.com; Last updated: October 27, 2005

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Using technology to improve clinical algorithms

- Original alerting 35% of the time
- Need good specificity and sensitivity, but less alerts
- Health Facts® identified over 68,000 patients that met study criteria
- We ended up with a with a Negative Predictive Value of 0.98

<table>
<thead>
<tr>
<th>SIRS</th>
<th>V1</th>
<th>V6</th>
<th>V13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp.</td>
<td>&lt;36°C or &gt;38°C</td>
<td>&lt;36°C or &gt;38°C</td>
<td>&lt;36°C or &gt;38.3°C</td>
</tr>
<tr>
<td>HR</td>
<td>&gt;90 bpm</td>
<td>&gt;95 bpm</td>
<td>&gt;95 bpm</td>
</tr>
<tr>
<td>RR</td>
<td>&gt;20 bpm</td>
<td>&gt;21 bpm</td>
<td>&gt;21 bpm</td>
</tr>
<tr>
<td>Glucose</td>
<td>&gt;120 mg/dL</td>
<td>&gt;120 mg/dL</td>
<td>&gt;120 mg/dL and &lt; 200 mg/dL</td>
</tr>
<tr>
<td>WBC</td>
<td>&gt; 12k or &lt;4k</td>
<td>&gt; 12k or &lt;4k</td>
<td>&gt; 12k or &lt;4k</td>
</tr>
<tr>
<td>Bands</td>
<td>&gt; 10%</td>
<td>&gt; 10%</td>
<td>&gt; 10%</td>
</tr>
<tr>
<td>Mental status change</td>
<td>Acute Δ</td>
<td>Acute Δ</td>
<td>Acute Δ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OD</th>
<th>V1</th>
<th>V6</th>
<th>V13</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP</td>
<td>&lt; 90 mmHg</td>
<td>&lt; 90 mmHg</td>
<td>&lt; 90 mmHg</td>
</tr>
<tr>
<td>SBP decrease</td>
<td>Δ &gt; 40 mmHg</td>
<td>Δ &gt; 40 mmHg</td>
<td>Δ &gt; 40 mmHg</td>
</tr>
<tr>
<td>MAP</td>
<td>&lt; 65 mmHg</td>
<td>&lt; 65 mmHg</td>
<td>&lt; 65 mmHg</td>
</tr>
<tr>
<td>Lactate</td>
<td>&gt; 2.0 mmol/L</td>
<td>&gt; 2.0 mmol/L</td>
<td>&gt; 2.0 mmol/L</td>
</tr>
<tr>
<td>Creatinine</td>
<td>&gt; 2 mg/dL</td>
<td>&gt; 2 mg/dL</td>
<td>&gt; 2 mg/dL; Increase ≥ .5 mg/dL</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>&gt; 2 mg/dL</td>
<td>&gt; 2 mg/dL</td>
<td>&gt; 2 mg/dL and &lt; 10 mg/dL</td>
</tr>
<tr>
<td>Platelets</td>
<td>&lt; 100k</td>
<td>&lt; 100k</td>
<td>&lt; 100k</td>
</tr>
<tr>
<td>Mental status change</td>
<td>-</td>
<td>Acute Δ</td>
<td>Acute Δ</td>
</tr>
<tr>
<td>INR/PTT</td>
<td>&gt; 1.5 or &gt; 60 sec.</td>
<td>&gt; 1.5 or &gt; 60 sec.</td>
<td>&gt; 1.5 or &gt; 60 sec.</td>
</tr>
<tr>
<td>PaO2/FiO2</td>
<td>&lt; 300</td>
<td>&lt; 300</td>
<td>&lt; 300</td>
</tr>
</tbody>
</table>

Processing logic
- OD lookback period 48 hr. 48 hr. 12 hr. for lactate, 30 hr. all others

Alert Operating Characteristics
- Alert Rate 35% 25% 15%
- Sensitivity 84% 63% 70%
- Specificity 65% 71% 80%
St Johns sepsis agent

- 33% ↑ Sepsis case identification
- Sepsis mortality ↓15.8 to 13.3%
- Simple Sepsis to Septic Shock progression ↓12%
- Sepsis LOS ↓0.9 days (severe 1.4 days)

- 2010 – 2012 (Q2)
- Sepsis mortality dropped 15.8% to 12.9%
- Sepsis case identification 15.8 to 13.3%
- Simple Sepsis to Septic Shock progression dropped 12%
- Sepsis LOS 0.9 days (severe 1.4 days)

TRINITY HEALTH

186 Lives Saved
Population Health Management

Big Data

<table>
<thead>
<tr>
<th>Raw Data</th>
<th>Clinical</th>
<th>Wellness</th>
<th>Satisfaction</th>
</tr>
</thead>
</table>

Data Transformation

Structured Data

Longitudinal Record

Analytics

Programmes

- Evidence
- Learned Knowledge
- Algorithms

Identify
Attribute
Predict
Intervene
Measure
Analyse

Healthe Intent

Synapse

De-identified

Research
(HealthFacts)

Client Opt
In/Out

VP of Population

Health Coach

Primary Care Physician

Home Health Assistant

VP of Population

Person

Clinic

Hospital

Device

HIE

Payer

Pharmacy

HL7, CCD, EDI, PHR, Batch, Crawler

Org or Patient Consent

Claims

Health Coach

Primary Care Physician

Home Health Assistant

VP of Population

Person

Big Data

Healthe Intent

Synapse
Clinical performance improvement

- Adopting informatics standards for interoperability and clinical noting
- Embed best practice to improve quality
- Automating capture of core quality measures
- Establish local clinical performance improvement projects
  - Pressure ulcers, falls, VTE, sepsis...
  - Readmission prevention
- Extend to population health management

- ↓ falls by 30%
- 37.2% physicians modified Rx due to Allergy alerts
- 112 preop avoided CXR in 84 days
- ↓ hospital acquired VTEs by 63%
- Projected $600k savings
- ↓ pressure ulcers by 48%
- ↓ falls by 28%
- ↓ hospital acquired VTEs by 63%
- Projected $600k savings
- 48 hr readmission c-stat predictor up from 0.66 to 0.77
Justin.whatling@cerner.com