Implementing Advanced Inpatient EMR Systems:
Hitting the Quality and Safety Bullseye

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eHealth Summit June 16, 2011
Defining the Target

• eHealth solutions are expensive:
  – 2007: $4.8B Canada-wide, $2.4B hospitals alone
    *Industry Canada, eHealth Market Environment for Canadian Firms, 2009*

• Without clear goals, failure is inevitable:
  – eHealth Ontario scandal 2009
  – $1B in taxpayer funds “wasted” due to “lack of strategic direction”
    *CBC News, Oct 7, 2009*
Automation

- Legibility
- Ubiquitous access
- Efficiency (cost, time)

**HOWEVER:**

<table>
<thead>
<tr>
<th>Venue</th>
<th>Annual Savings: Efficiency</th>
<th>Annual Savings: Evidence-Based Care, CDS</th>
<th>Total Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulatory</td>
<td>$1.6 B (15%)</td>
<td>$9 B (85%)</td>
<td>$10.6 B</td>
</tr>
<tr>
<td>Inpatient</td>
<td>$8.3 B (26%)</td>
<td>$22.9 B (74%)</td>
<td>$31.2 B</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$9.9 B (24%)</strong></td>
<td><strong>$31.9 B (76%)</strong></td>
<td><strong>$41.8 B</strong></td>
</tr>
</tbody>
</table>

*Reduced length of stay, improved utilization of investigations/drugs*

Hillestad et al, Health Affairs 2005
Evidence

- Finish medical school and residency knowing everything
- Read and retain 2 articles every single night
- At the end of 1 year: **1,225 years behind**

Standardizing care on evidence → positive patient outcomes:
- 40% rel. risk reduction in death from pneumonia
  (22,000 patient study)  

Hauck et al, Ann Epidemiol 2004; 14: 669-675
Evidence

- **“Pull model”**: almost 0% success rate
- **“Push model”**: 75% success rate

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

*Kawamoto K et al. Systematic review of clinical decision support system success factors. BMJ 2005*
Stages of Inpatient EMR Development are Relevant to Patient Outcomes

2006 HIMSS EMR Sophistication Correlates to Hospital Quality Data
Advanced clinical decision support: Saves lives, reduces complications and cost

- Single-hospital study – sepsis order set:
  - Length of stay reduced by 6.3 days (p=0.02)
  - **15.5% absolute mortality reduction (p<0.01)**


- 41-hospital study of Texas-based hospitals:
  - $538 saved per patient with clinical decision support
    ($132 saved per patient with CPOE alone)
  - **Significant 21% mortality reduction with clinical decision support (no sig. change with CPOE alone)**

“If You Build It…”
Adoption of Advanced EMR Systems

• “Up to 30% (of CPOE implementations) fail”
  National Health Information Network Co-ordinator David Brailer, Washington Post, 2005

• Why?
  – CPOE dramatically changes clinician workflows
  – CPOE magnifies existing workflow, policy and procedure issues

• 2002: Cedars Sinai Medical Center:
  – Physician dissatisfaction → proprietary $34 million CPOE system scrapped

• UK NHS NPfIT project:
  – £2.3B over 3 years → £12.4B over 10 years
  – “One size will not necessarily fit all… forcing a single solution (with no local tailoring) onto busy clinicians will not work…”
    Brennan, S. 2009
“If You Build It…”
Adoption of Advanced EMR Systems

• **New South Wales, Australia:**
  – Large scale public healthcare advanced EMR deployment failed
  – “**Poor clinician adoption**”:
    – System designed centrally, for decentralized deployment
    – Front-line clinicians had little input into project plan, system design
  – “**Poor fit with clinical workflows**”
  – **Lessons learned:**
    – Importance of **clinician champions** at each local site
    – Local customization of EMR solutions “*One size does not fit all***”
    – **Integration** of system design into local clinical workflows

*Southon FCG et al. JAMIA 1997; 4: 112-124*
Clinical Integration

CPOE: “Strapping a new solution onto an old broken process can spell disaster!”
Clinical Integration

_CPOE implementation_ is a _key chance_ to integrate best practice into new clinical workflows

- **A) Integration of Professions** ("the best care is provided by teams"):  
  - Interprofessional approach to system/content design

- **B) Integration of Evidence:**  
  - Order sets (don’t just “convert” what was on paper)  
  - Clinical decision support _built into clinician workflow_  
  - Organizational culture

- **C) Integration of the System into Workflows:**  
  - Usability testing and workflow mapping  
  - Policies, procedures and personnel
The Bullseye: Improving Patient Outcomes, Meeting Challenges

Canadian Adverse Events Study
7.5% of acute care admissions
9,250 – 23,750 preventable deaths/year

Time for newly published evidence to reach care at the bedside:
17 years

Aging population
LIMITED HEALTHCARE FUNDING

SEPSIS
VTE
Community teaching hospital affiliated with the University of Toronto

Catchment area: 400,000

Three Sites:
General, Branson, Seniors’ Health

Beds: 413 acute care
200 long-term care

Volume per year:
110,000 ED visits • 28,000 inpatients
What is eCare?

Advanced Electronic Medical Record (EMR) + Standardization on Evidence-Based Care + Safe Prescribing and Medication Administration + Clinical Decision Support (Rules, Alerts)
Phase 2 System Components:

• Computerized Provider Order Entry (CPOE)
• Evidence-Based Order Sets & Clinical Workflows
• Closed-Loop Medication Administration
• Medication Reconciliation
• Clinical Decision Support
The NYGH eCare Project is unique in Canada:

- First Canadian deployment of CPOE with regularly-updated evidence-based order set content integrated into the physician decision-making workflow.
- First Canadian medium to large size hospital with closed-loop barcode medication administration.
- First HIMSS Stage 6 community teaching hospital in Canada (only 3 hospitals in Canada overall).
Goals and Success Factors

GOALS:
• 100% clinician adoption
• Embrace culture of evidence-based care, best practices
• Improved patient outcomes: quality and safety of care

SUCCESS FACTORS:
1. Vision – improve quality and safety of patient care
2. Engagement of front-line clinicians
3. Clinical Integration: Professions, Evidence, Workflows
Vision - Senior Leadership Team

- Nurtured organizational culture that welcomes change
- Focused organization on goal of improved quality and safety of patient care using technology
- Clinical champions identified and hired to core roles Positioned the project: “by clinicians, for clinicians”
- Prioritized eCare project and allocated adequate financial resources, despite funding challenges
- Visible and supportive during implementation, go-live
Be an eCare Super Hero

and help reduce the rate of medication admin errors by 40%*

North York General Hospital

Be an eCare Super Hero

and help save 21% of inpatients lives at risk from pneumonia*

Dr. David Benoit, NYGH Physician

NYGH EHR users have seen decreases in medication errors and improved patient care.

North York General Hospital

zyxhealth
3 main project foci:
- Medication Integration
- CPOE/Order Sets and Physicians
- Interprofessional Integration

Each focus led by:
- Clinician Champion
- Executive Sponsor

Foci integrated by:
- Steering Committee
- Core Committee
Integrating Professions: Interprofessional Order Set Development

1. Order Set Prototyping (central build team)
2. Order Set Interprofessional Review: Nursing, Allied Health, Lab, Radiology, Medical Imaging
3. Order Set MD Review: online, one-on-one, group sessions
4. Comment review and consolidation, evidence updates, consensus meetings
5. Order Set Final Approval (MAC - monthly)
Integrating Evidence: Pneumonia Evidence-Based Order Set
Integrating Workflows:
Mobilizing Evidence with Systems, Policy and Personnel

• Re-engineer care processes to integrate evidence from order sets:
  • Stroke: bedside swallowing assessment
  • Prevention of VTE
  • Prevention of IV contrast-induced nephropathy/renal failure
  • Acute and chronic pain management
  • Therapeutic drug monitoring (aminoglycosides, digoxin)
  • Health promotion (smoking cessation, vaccinations)

• **Clinician portal**: repository for evidence-based resources
Integrating Evidence into Workflow: Clinical Decision Support

<table>
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<th>Intervention</th>
<th>Compliance</th>
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<tr>
<td>No intervention – no VTE protocol</td>
<td>10-40%</td>
</tr>
<tr>
<td>Simple-to-follow VTE protocol, paper (3-level risk stratification, not score-based)</td>
<td>50%</td>
</tr>
<tr>
<td>Standardized, evidence-based VTE order module, embedded into CPOE order sets</td>
<td>65-85%</td>
</tr>
</tbody>
</table>
| Real-time electronic clinical decision support                              | 95%+       

*Dr. Greg Maynard, Director, Center for Improvement Science, UCSD*
VTE Prophylaxis for Hip Fracture at NYGH

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Percentage of patients with appropriate VTE prophylaxis</th>
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<tr>
<td>2007 (Geerts et al)</td>
<td>70%</td>
</tr>
<tr>
<td>2010 (pre-CPOE)</td>
<td>83%</td>
</tr>
<tr>
<td>2011 (post-CPOE)</td>
<td>95%</td>
</tr>
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</table>

↑ 36%  *p=0.0259

Percentage of patients with appropriate VTE prophylaxis for hip fracture at NYGH shows an increase from 2007 (70%) to 2011 (95%) with a statistically significant improvement (*p=0.0259) following CPOE implementation.
Outcomes to Date: Since “Go-Live” October, 2010

• User adoption of the system – **100%**
• Percentage of physician orders entered by MD’s – **95%**
• Number of orders entered by physicians - > **872,000**
• Evidence-based PowerPlans activated - > **42,000**
• Percentage orders from evidence-based PowerPlans: **39%**
• Medication-patient mismatch errors averted - > **715**
• Medication reconciliation on discharge – ↑**425%**
• Measurement of other outcomes underway
Outcomes: Hospital Standardized Mortality Ratio (HSMR)

\[
\text{HSMR} = \frac{\text{Actual # of inpatient deaths}}{\text{Average expected # of deaths}}
\]

(adjusted for age, sex, diagnosis and comorbidities)

• Tracked over time, HSMR can be a **motivator for change** by indicating how successful hospitals have been in reducing inpatient deaths, and improved patient care

• **Canadian Institute for Health Information** (CIHI) compiles HSMR results for eligible facilities and health regions in all provinces outside Quebec

• HSMR data are published in local and national media for public review
Dr. Jeremy Theal | eHealth Summit 2011 | Hitting the Quality and Safety Bullseye

Preliminary Outcomes: Hospital Standardized Mortality Ratio (HSMR)

Prelim. analysis of monthly data pre and post-CPOE:

Cancer care: $P = 0.155$ (95% CI -20.27 to 106.97)

Surgery: $P = 0.103$ (95% CI -10.14 to 90.18)

Medicine: $P = 0.029$ (95% CI 2.69 to 38.85)
AUTOMATION
EVIDENCE
ADVANCED SYSTEMS
ADOPTION
INTEGRATION
PATIENT OUTCOMES
Thank You