Improving Quality Outcomes with Hospital Information Systems: Can Canadians do it Better?

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Objectives

1. Illustrate examples of improved patient, clinician and financial outcomes possible when implementing advanced hospital information systems in a Canadian environment
2. Identify key success factors / lessons learned
3. Outline challenges and opportunities unique to Canada

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Environmental Scan: What Problems must we Solve?

- **Patients** deserve and demand better quality and safety of inpatient care:
  - 9,250 to 23,750 preventable deaths per year in Canadian hospitals

Baker GR, Norton PG. Canadian Adverse Events Study. CMAJ 2004 170(11): 1678-86

- **Government** must reduce healthcare costs, evidence-based care is expected, ⬆ requirements for hospitals to report detailed outcome/cost data for funding

Excellent Care for All Act, Legislative Assembly of Ontario 2010
Quality-Based Procedures, MOHLTC, Ontario 2012

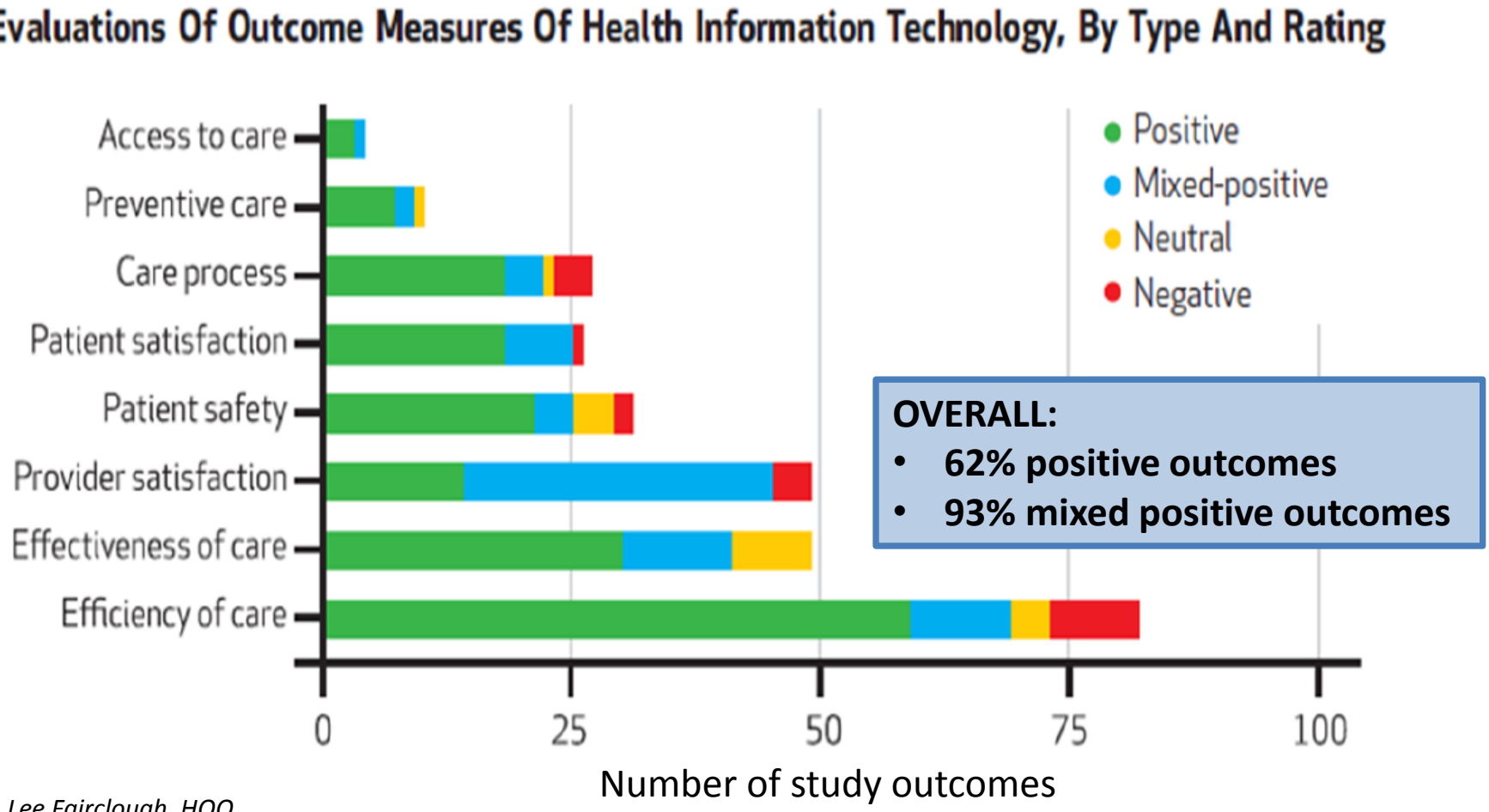
- **Healthcare providers** have too much information to process, and need assistance to synthesize data for **improved clinical decision-making** (traditionally: evidence takes 17 years from publication to bedside)

Kawamoto K et al. Systematic review of clinical decision support system success factors. BMJ 2005

- **Hospital workflows are often inefficient, and sometimes unsafe**

Could electronic systems help to **bend the cost/quality curve,** providing **higher quality and safety** at a **lower total cost?**

Surveying the Landscape: HIT Outcomes



OVERALL:

- **62% positive outcomes**
- **93% mixed positive outcomes**

Thanks to: Lee Fairclough, HQO

Source: The Benefits Of Health Information Technology: A Review Of The Recent Literature Shows Predominantly Positive Results
Melinda Beeuwkes Buntin, Matthew F. Burke, Michael C. Hoaglin, and David Blumenthal Health Aff March 2011 30:3464-471; doi:10.1377/hlthaff.2011.0178

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This Isn't Easy

- **Unexpected Increased Mortality**
  after Implementation of a Commercially Sold CPOE System
  - Mortality rate increased from 2.8% to 6.57% (OR 3.28)

Han Y et al Pediatrics 2005; 116: 1506-1512

- **Lessons Learned – Clinician/Informatics Leadership Lacking**
  - Insufficient analysis and redesign of clinical workflows
  - No CPOE Order Sets / **Clinical Standardization** before go-live
  - Insufficient real-world usability testing prior to go-live
  - *"One must avoid the temptation to blame the adverse effects on the particular system used. This would be equivalent to stating that a particular brand of tool from a hardware store was unsafe because an injury occurred while someone was misusing it."*

Sittig, D et al Pediatrics 2006; 118: 797-801

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How We Did It:
The North York Story


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Community academic hospital affiliated with the University of Toronto
Catchment area: > 400,000
Three Sites: General, Branson, Seniors' Health
Beds: 426 acute care
192 long-term care
Volumes per year:
• 124,000 ED visits
• 31,000 inpatient cases
• 214,000 outpatient cases
• 5,800 births
HIMSS Analytics
STAGE 6
2011
HIMSS
Davies Award
NICHOLAS E. DAVIES
2016
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What is eCare?

Advanced EMR with CPOE and electronic documentation

+

Standardization on Evidence-Based Care

+

Safe Prescribing and e-Medication Management

+

Clinical Decision Support (Static and Dynamic)

=

eCare

Kickoff: **2007**

Phased Implementation: **2008-2015**

Hospital-wide: **2015**

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Making a World of Difference

Goals of the eCare Project

- **Implement advanced EMR to *improve patient outcomes:***
  - → **Quality and safety of patient care**
  - → **Enable Clinical & Business Intelligence for better decisions**
- **Embrace culture of standardized, evidence-based care**
  - → **Build evidence and best practice into optimized workflows**
  - → **Make it "easy to do the right thing"**
- **SHARED VISION = *"by clinicians, for clinicians"***
  - → **100% clinician adoption via comprehensive engagement**
  - → **Team-based interprofessional approach/workflows**

The Importance of Clinician Review

Details for a Medical Imaging Order:

BEFORE:

Reason for exam (mandatory)

Is patient on oxygen? (mandatory)

Is patient pregnant? (mandatory)

Transport method? (mandatory)

Hospital site? (mandatory)

Order priority? (mandatory)

AFTER:

Reason for exam (mandatory)

Order priority (mandatory)

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The Importance of Clinician Review

BEFORE:

Antibacterial Agents: Inpatient, Suspected Pseudomonas Regimens

- Combination agent regimen: (Piperacillin-tazobactam, cefepime, imipenem-cilastatin, or meropenem) + (ciprofloxacin or levofloxacin)
- Combination agent regimen: (Piperacillin-tazobactam, cefepime, imipenem-cilastatin, or meropenem) + (gentamicin, tobramycin, or amikacin) + (azithromycin, levofloxacin, or moxifloxacin)

piperacillin-tazobactam
- 4.5 gram intravenously every 6 hours

cefepime
- 2 gram intravenously every 8 hours

imipenem-cilastatin
- 500 milligram intravenously every 6 hours

meropenem
- 1 gram intravenously every 8 hours

ciprofloxacin
- 400 milligram intravenously every 8 hours
- 750 milligram orally every 12 hours

levoFLOXacin
- 750 milligram intravenously every 24 hours
- 750 milligram orally every 24 hours

gentamicin
- 1.7 milligram/kilogram intravenously every 8 hours
- 7 milligram/kilogram intravenously every 24 hours

tobramycin
- 1.7 milligram/kilogram intravenously every 8 hours
- 7 milligram/kilogram intravenously every 24 hours

amikacin
- 7.5 milligram/kilogram intravenously every 12 hours
- 15 milligram/kilogram intravenously every 24 hours

azithromycin

AFTER – simpler, safer:

Suspected Pseudomonas

- First-line treatment for SUSPECTED/PROVEN P.AERUGINOSA: piperacillin-tazobactam +/- azithromycin (NYGH)
- For patient with true beta-lactam allergy: Meropenem +/- azithromycin. Meropenem is associated with low cross-reactivity among those with a beta-lactam allergy. However, if a true anaphylactic, Ig-E mediated reaction has been documented with beta-lactam exposure, consider Infectious Disease and/or Allergy consultation

Tazocin inj
- 4,500 mg Inj IV q8h NOW
- 3,375 mg Inj IV q8h NOW Instructions: Suggested dose for creatinine clearance 20-40 mL per min.
- 3,375 mg Inj IV q12h NOW Instructions: Suggested dose for creatinine clearance < 20 mL per min.

Zithromax inj
- 500 mg Inj IV q24h-ATC Duration: 5 days NOW

Merrem inj
- 1000 mg Inj IV q8h NOW Instructions: RESTRICTED TO ID AND INTENSIVISTS
- 1000 mg Inj IV q12hr NOW Instructions: RESTRICTED TO ID AND INTENSIVISTS. Sugested dose for creatinine clearance 10-24 mL/min
- 1000 mg Inj IV q24h-ATC NOW Instructions: RESTRICTED TO ID AND INTENSIVISTS. Sugested dose for creatinine clearance < 10 mL/min

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EVIDENCE-BASED CARE: THE GAPS

1) **Belief Gap:** "I know everything already"

2) **Capacity Gap:**

200 MB capacity

GAP

6,000 articles/day
300,000 RCT's/year

- 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**

3) **Temporal Gap:**
   - Average of **17 years** for evidence to reach the bedside

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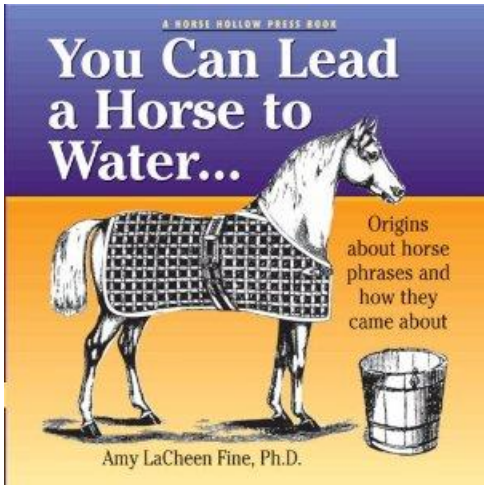
Evidence Utilization by Physicians



- "Pull model": almost 0% success rate
- "Push model": 75% success rate

Predictor of Success	Adjusted OR
Computer-based generation of decision support	6.3
Provision of recommendation rather than just an assessment	7.1
Provision of decision support at the time and location of decision-making	15.4
Automatic provision of decision support ***as part of workflow***	**112.1**

Kawamoto K et al. Systematic review of clinical decision support system success factors. BMJ 2005

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Evidence-Based Electronic Order Sets

The KEY catalyst to transform practice with CPOE!

- Standardization of care (e.g. condition-based)
- Current evidence and best practice can be built into clinician workflow
- Enables rapid content updates, real-time decision support
- Encourages an interprofessional approach:
  - Order sets with multi-disciplinary orders
  - Care pathways with key interventions and goals

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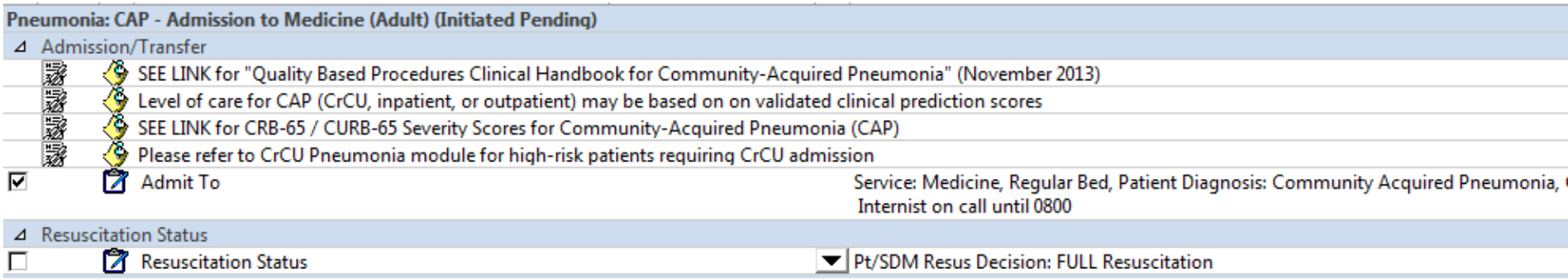
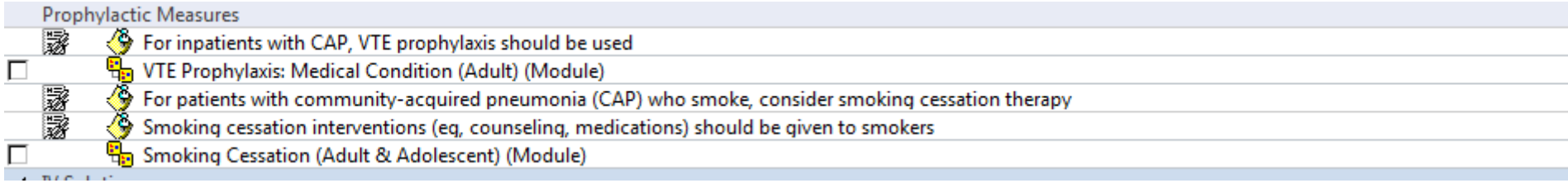
Pneumonia Admission Order Set: Integrated Evidence

Risk Stratification (home / ward / Critical Care):



Prophylaxis and Proactive Care:



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Pneumonia Admission Order Set:
Evidence-Based Empiric Antibiotic Treatment Selection

Reminders		
Please refer to NYGH Antimicrobial Guideline Handbook, and select appropriate empiric antimicrobial regimens during first 24 hours. Use oral option when possible unless NPO or vomiting		
Antibiotics should be administered as soon as possible (within 4-6 hours) after the diagnosis of CAP has been made in ER. If patient has taken an antibiotic within the last 3 months for any reason, select an antibiotic from an ALTERNATE class		
EARLY SWITCH FROM PARENTERAL TO ORAL ANTIMICROBIAL THERAPY: should be considered followed by discharge for eligible patients (e.g. hemodynamically stable, improving clinically, normal GI tract, and able to ingest medications)		
For suspected aspiration OR Healthcare Associated Pneumonia (HCAP): Use the following modules instead of the antimicrobial options below		
☐ Pneumonia With Suspected Aspiration (Adult) (Modul...		
☐ Pneumonia: Nosocomial/Health Care Associated Pne...		
Antibiotic Regimens		
First-line treatment: Beta-lactam (ceftriaxone, or if taking PO, amoxicillin-clavulanic acid). Addition of a macrolide is indicated for patients with severe illness, positive urine antigen, or suspected Legionellosis (See Atypical Coverage: Macrolide section below)		
In patients with a true beta-lactam allergy (eg. anaphylaxis, angioedema, or bronchospasm): Respiratory fluoroquinolone alone		
DURATION OF THERAPY: 5-7 days of therapy for hospitalized patients not in ICU		
First line Treatment: Beta-Lactam		
☐ cefTRIAXone (Rocephin inj)	1000 mg, Inj, IV, q24h-ATC, NOW	
☐ amoxicillin-clavulanate (Clavulin F 875-125)	875 mg, PO, q12h, NOW	
☐ amoxicillin-clavulanate (Clavulin F 500-125)	500 mg, Tab, PO, q12h, NOW, Suggested dose for creatinine clearance 10-30 ml ..	
Atypical Coverage: Macrolide		
A macrolide for atypical coverage is indicated in patients with severe illness, positive urine antigen, or suspected Legionellosis		
☐ azithromycin (Zithromax inj)	500 mg, Inj, IV, q24h-ATC, for 5 days, NOW	
☐ azithromycin (Zithromax)	500 mg, Tab, PO, q24h-ATC, NOW	
Beta-lactam Allergy: Quinolone		
A respiratory fluroquinolone is indicated in patients with a true beta-lactam allergy (eg. anaphylaxis, angioedema, or bronchospasm)		
Moxifloxacin (IV or PO) is indicated for low to intermediate risk patients		
☐ moxifloxacin (Avelox)	400 mg, Tab, PO, q24h-ATC, NOW	
☐ moxifloxacin (Avelox I.V.)	400 mg, Inj, IV, q24h-ATC, NOW	
For renally impaired patients, no dose adjustment is required with moxifloxacin		
Suspected Pseudomonas		
First-line treatment for SUSPECTED/PROVEN P.AERUGINOSA: piperacillin-tazobactam +/- azithromycin		
For patient with true beta-lactam allergy: Meropenem +/- azithromycin. Meropenem is associated with low cross-reactivity among those with a beta-lactam allergy.		

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Reminder

For patients who have atrial fibrillation and are at high or intermediate risk for stroke, use oral anticoagulation with apixaban, dabigatran, rivaroxaban, or warfarin.

For those who are unsuitable for warfarin therapy, use a direct thrombin inhibitor or factor Xa inhibitor.

For patients who have atrial fibrillation of ≥ 48 hours' duration or of unknown duration and who are undergoing cardioversion, use warfarin, an LMWH, apixaban, rivaroxaban, or dabigatran for at least 3 weeks prior to and 4 weeks after non–TEE-guide

For those who have atrial fibrillation of < 48 hours' duration and are undergoing cardioversion, use heparin (either IV UFH or an LMWH), a direct thrombin inhibitor, or factor Xa inhibitor if the patient is not already anticoagulated.

For patients with atrial fibrillation who have a creatinine clearance < 25 mL/minute, do not use apixaban.

For patients with atrial fibrillation who have a creatinine clearance < 15 mL/minute, do not use rivaroxaban.

Abbreviations | Guidelines

Rationale

The following table summarizes meta-analyses related to this topic:

Study	Comparison	
Giugliano et al (ENGAGE AF-TIMI 48, 2014)	High-dose (60 mg once daily) edoxaban vs Low-dose (30 mg once daily) edoxaban vs Warfarin	In patients with atrial fibrillation who have moderate-high stroke risk: • High-dose edoxaban decreases stroke (ischemic or hemorrhagic) during tr • There is no significant between-group difference in stroke during treatment • There is no significant between-group difference in a combined outcome o • Low-dose edoxaban increases the frequency of a combined outcome of is • Both high-dose and low-dose edoxaban decrease hemorrhagic stroke and
Halperin et al (ROCKET AF, 2014)	Rivaroxaban vs Warfarin	In patients with nonvalvular atrial fibrillation at moderate to high risk of stroke: • In patients ≥ 75 years of age: ◦ Rivaroxaban increases the combined outcome of major or clinically ◦ There is no significant between-group difference in a combined outc • In patients < 75 years of age: ◦ There is no significant between-group difference in a combined outc ◦ There is no significant between-group difference in a combined outc
Lip et al (2014)	Apixaban vs Aspirin	Based on data from the AVERROES study and at a mean follow-up of 1.1 years, • In all patients, apixaban decreases ischemic stroke. • In female patients, apixaban decreases ischemic stroke. • In male patients, apixaban decreases ischemic stroke. • In all patients, there is no significant between-group difference in intracrani • In female patients, there is no significant between-group difference in intra • In male patients, there is no significant between-group difference in intracr
Hylek et al (2014)	Apixaban vs Warfarin	Based on data from the ARISTOTLE trial, in patients with atrial fibrillation, apixab
Artang et al (2013)	Warfarin vs Alternative anticoagulant (eg, direct thrombin inhibitors, factor Xa inhibitors, aspirin, clopidogrel)	In patients with atrial fibrillation, there is no significant between-group difference i
Bruins Slot and Berge (CD008980, 2013)	Factor Xa inhibitors vs Vitamin K antagonists	In patients with atrial fibrillation or atrial flutter, factor Xa inhibitors reduce the com strokes, major bleedings, intracranial hemorrhages, and all-cause deaths.

Integrating New Evidence

- [ ] 6.25 mg Tab PO q12h Instructions: Give with food to minimize risk of orthostatic hypotension. Hold if HR < 55 bpm, Hold if SBP < 95 mmHg,
- [ ] 12.5 mg Tab PO q12h Instructions: Give with food to minimize risk of orthostatic hypotension. Hold if HR < 55 bpm, Hold if SBP < 95 mmHg,
- [ ] 25 mg Tab PO q12h Instructions: (target dose FOR WEIGHT </= 85 KG) Give with food to minimize risk of orthostatic hypotension. Hold if HR < 55 bpm, Hold if SBP < 95 mmHg,
- [ ] 50 mg Tab PO q12h Instructions: (target dose FOR WEIGHT > 85 KG) Give with food to minimize risk of orthostatic hypotension. Hold if HR < 55 bpm, Hold if SBP < 95 mmHg,

ARBs (Angiotensin Receptor Blockers)

- REDUCED EF (HF-REF): Angiotensin-II receptor blockers (ARBs) are recommended in ACEI-intolerant patients, to reduce morbidity and mortality. Routine combination of ACE-I, ARB, and aldosterone antagonist therapy is potentially harmfu NEW
- PRESERVED EF (HF-PEF): ARBs may be considered in patients with hypertension, or to decrease hospitalization for patients with heart failure and PEF NEW

Atacand C

- [ ] 4 mg Tab PO daily Hold if SBP < 95 mmHg,
- [ ] 8 mg Tab PO daily Hold if SBP < 95 mmHg,
- [ ] 16 mg Tab PO daily Hold if SBP < 95 mmHg,
- [ ] 32 mg Tab PO daily Instructions: (target dose) Hold if SBP < 95 mmHg,

Diovan C

- [ ] 40 mg Tab PO q12h Hold if SBP < 95 mmHg,
- [ ] 80 mg Tab PO q12h Hold if SBP < 95 mmHg,
- [ ] 160 mg Tab PO q12h Instructions: (target dose) Hold if SBP < 95 mmHg,

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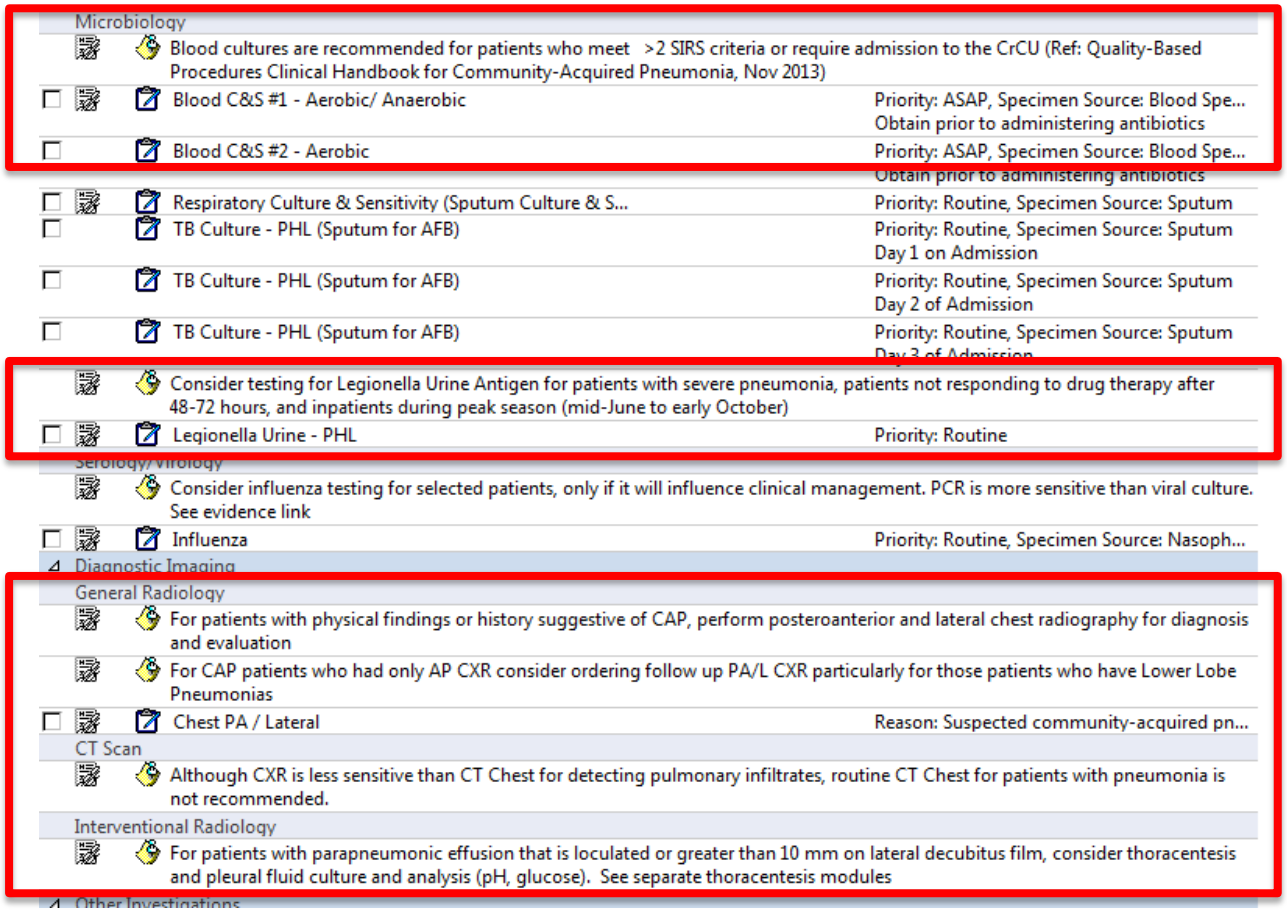
Pneumonia Admission Order Set:
"Choosing Wisely": ordering investigations



Microbiology

Blood cultures are recommended for patients who meet >2 SIRS criteria or require admission to the CrCU (Ref: Quality-Based Procedures Clinical Handbook for Community-Acquired Pneumonia, Nov 2013)

Blood C&S #1 - Aerobic/ Anaerobic	Priority: ASAP, Specimen Source: Blood Spe... Obtain prior to administering antibiotics
Blood C&S #2 - Aerobic	Priority: ASAP, Specimen Source: Blood Spe... Obtain prior to administering antibiotics
Respiratory Culture & Sensitivity (Sputum Culture & S...	Priority: Routine, Specimen Source: Sputum
TB Culture - PHL (Sputum for AFB)	Priority: Routine, Specimen Source: Sputum Day 1 on Admission
TB Culture - PHL (Sputum for AFB)	Priority: Routine, Specimen Source: Sputum Day 2 of Admission
TB Culture - PHL (Sputum for AFB)	Priority: Routine, Specimen Source: Sputum Day 3 of Admission

Consider testing for Legionella Urine Antigen for patients with severe pneumonia, patients not responding to drug therapy after 48-72 hours, and inpatients during peak season (mid-June to early October)

Legionella Urine - PHL	Priority: Routine

Serology/Virology

Consider influenza testing for selected patients, only if it will influence clinical management. PCR is more sensitive than viral culture. See evidence link

Influenza	Priority: Routine, Specimen Source: Nasoph...

Diagnostic Imaging

General Radiology

For patients with physical findings or history suggestive of CAP, perform posteroanterior and lateral chest radiography for diagnosis and evaluation

For CAP patients who had only AP CXR consider ordering follow up PA/L CXR particularly for those patients who have Lower Lobe Pneumonias

Chest PA / Lateral	Reason: Suspected community-acquired pn...

CT Scan

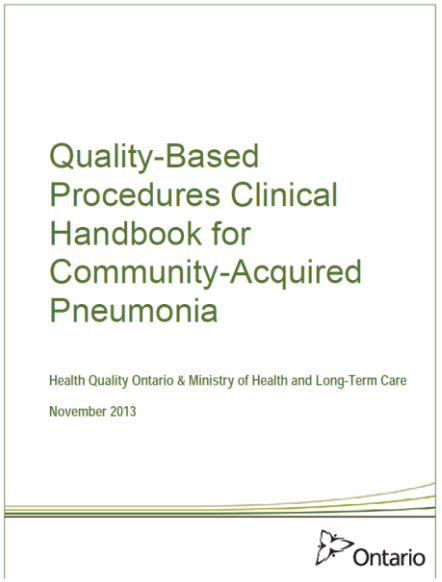
Although CXR is less sensitive than CT Chest for detecting pulmonary infiltrates, routine CT Chest for patients with pneumonia is not recommended.

Interventional Radiology

For patients with parapneumonic effusion that is loculated or greater than 10 mm on lateral decubitus film, consider thoracentesis and pleural fluid culture and analysis (pH, glucose). See separate thoracentesis modules

Other Investigations

Choosing Wisely Canada



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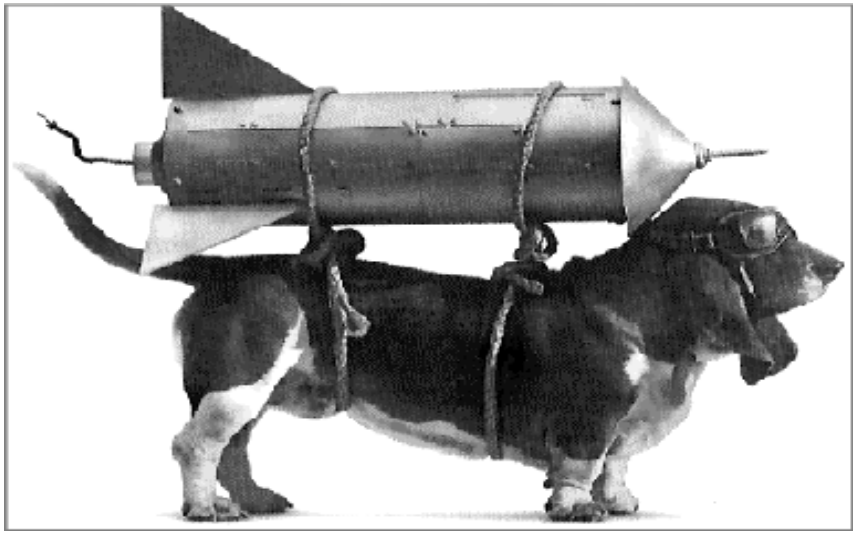
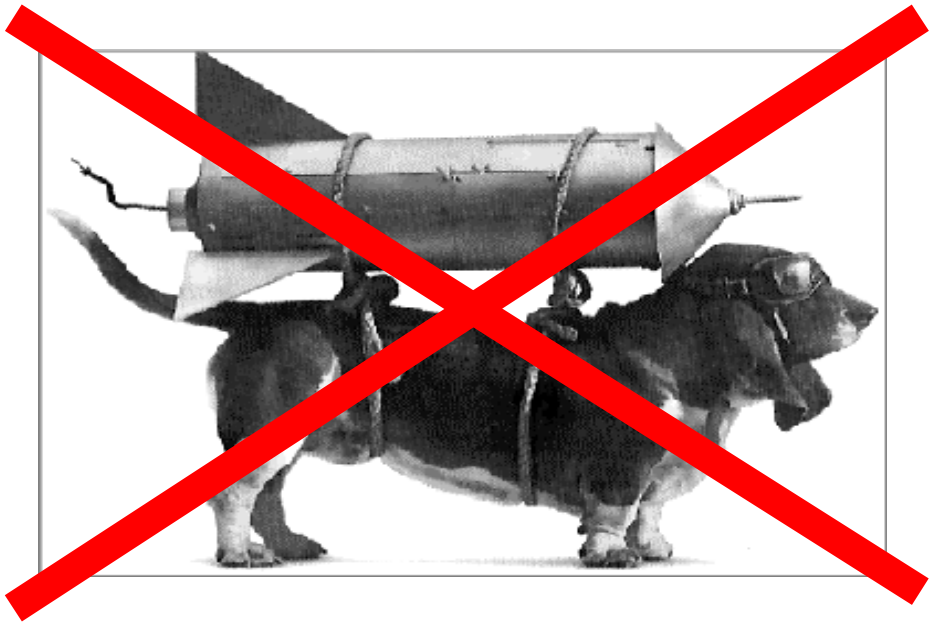
“Launching CPOE will magnify existing workflow and policy problems in your organization”



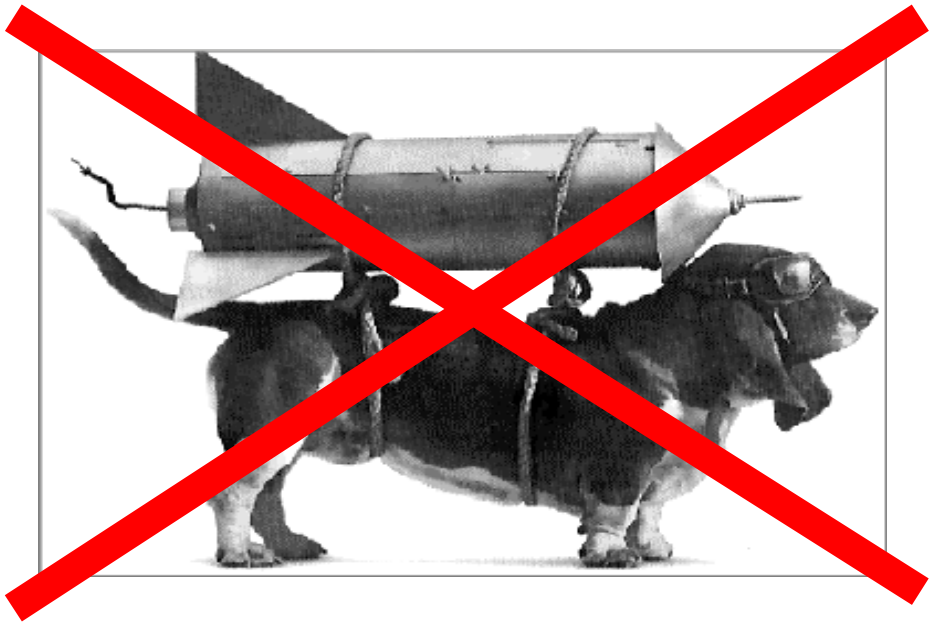
Workflow Integration for CPOE

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



Workflow Integration for CPOE

CPOE implementation is a **key opportunity** to integrate evidence and best practices into new clinical workflows



Workflow Integration for CPOE

Integrating Workflows:

Mobilizing Evidence with People and Technology

Re-engineer care processes to mobilize evidence:

- Stroke:
  - Bedside swallowing assessment
  - SCD's
- Prevention of VTE
- Prevention of IV contrast-induced nephropathy/renal failure
- Therapeutic drug monitoring (digoxin, aminoglycosides)

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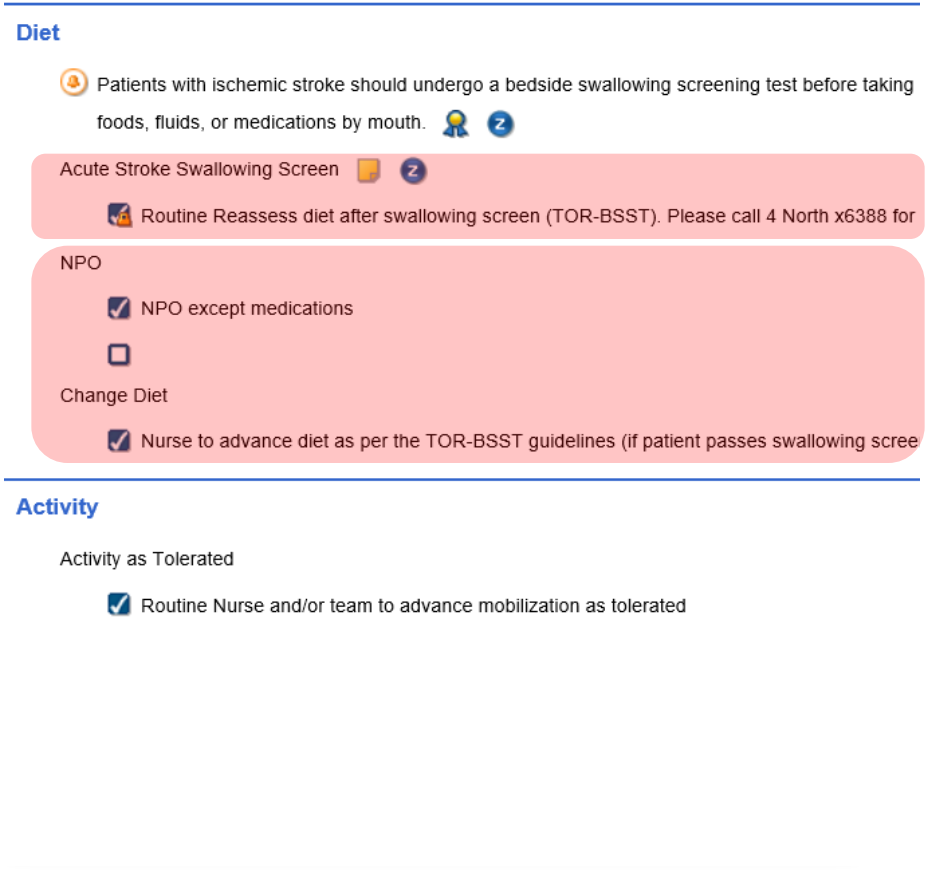
Order Set Design: Strong Influence on Evidence-Based Care (example: Stroke)

- **Original Order Set:**
  - NPO diet order not mandatory
  - Swallowing screen separate from diet, not mandatory
- **Revised Design:**
  - Swallowing screen mandatory
  - Diet orders streamlined, integrated with swallowing
- **Audit:** 10-week period before and after revision:
  - Number of patients referred for screening **doubled**
  - Patients screened within 24hr increased from **81%** to **96%**



What Were the Results?
Selected Outcomes from NYGH eCare

TORONTO STAR

Metro Edition Thursday Dec 13, 2012

In-Hospital Death Rates Down Across Greater Toronto Area

- Annual CIHI Report demonstrated that preventable in-hospital deaths were reduced
- NYGH – top performer in Greater Toronto and second best in all of Canada
- CEO Tim Rutledge: “health information technology has hard-wired quality and safety into the hospital”

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HSMR:

- Reported from hospitals to CIHI annually
- Reported to public by CIHI annually
- GOAL: Reduce preventable inpatient deaths

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Study: CPOE and Evidence-Based Order Sets

Retrospective chart review:

- All patients discharged with a main diagnosis of Pneumonia or COPD
  - **Population #1:** Pre-CPOE (Jan-Sep 2010) n = 520
  - **Population #2:** Post-CPOE (Jan-Sep 2011) n = 511
  - Groups similar in age, gender distribution
  - Corrections: "Probability of Death", critical care admission

Primary Hypothesis:

- Use of CPOE is associated with reduction in adjusted mortality vs traditional paper processes

Secondary Hypothesis:

- Use of CPOE with a matching evidence-based admission order set is associated with reduction in adjusted mortality vs use of any order set

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Results: CPOE vs Paper

Outcome	Odds Ratio	Confidence Interval	p-value
Death	**0.574**	0.391 – 0.843	**0.005**
Death adj for Probability of Death	**0.571**	0.383 – 0.852	**0.006**
Death adj for Probability of Death and CrCU Admission	**0.547**	0.360 – 0.830	**0.005**
30-Day Readmission	0.835	0.573 – 1.210	0.345
30-Day Readmission adj for Probability of Death and CrCU Admission	0.837	0.562 – 1.250	0.380

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Results: Evidence-Based Order Set Selection

Order Set	Outcome	Odds Ratio	Confidence Interval	p-value
Diagnosis-appropriate	Death	**0.48**	0.26 – 0.90	**0.022**
Diagnosis-appropriate	Death adj for Probability of Death and CrCU Admission	**0.44**	0.21 – 0.90	**0.024**
Diagnosis-appropriate	30-Day Readmission	1.35	0.75 – 2.38	0.30
Close to diagnosis	Death	1.47	0.71 – 3.01	0.30
Close to diagnosis	Death adj for Probability of Death and CrCU Admission	1.82	0.78 – 4.23	0.16
Any order set	Death	0.55	0.12 – 2.54	0.44
Any order set	30-Day Readmission	1.53	0.19 – 11.92	0.69

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Results: Adoption and Culture Change

	Paper Orders		CPOE (eCare)	
Percentage of patients for whom a **diagnosis-appropriate** order set was used	Pneumonia	26.05%	Pneumonia	**60.43%**
	COPD	0.0%	COPD	**45.1%**
Percentage of patients for whom **any** admission order set was used	Pneumonia	37.90%	Pneumonia	**97.54%**
	COPD	35.11%	COPD	**97.35%**

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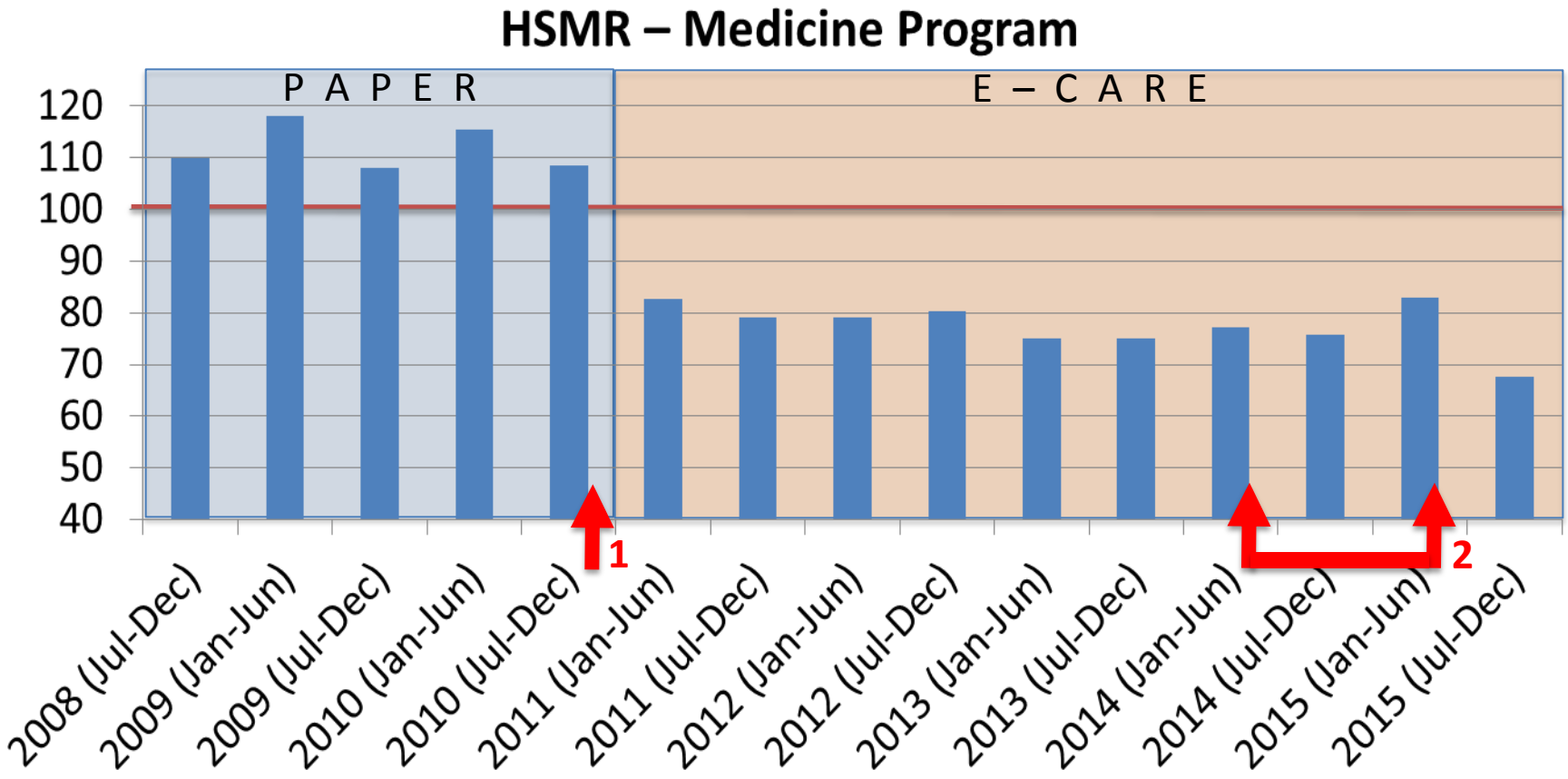
Inpatient Preventable Mortality: Trended Format



1 – eCare Phase 2 Implementation (CPOE, order sets, electronic med management)

2 – Quality Based Procedure (QBP) implementation – phased, over 1 year

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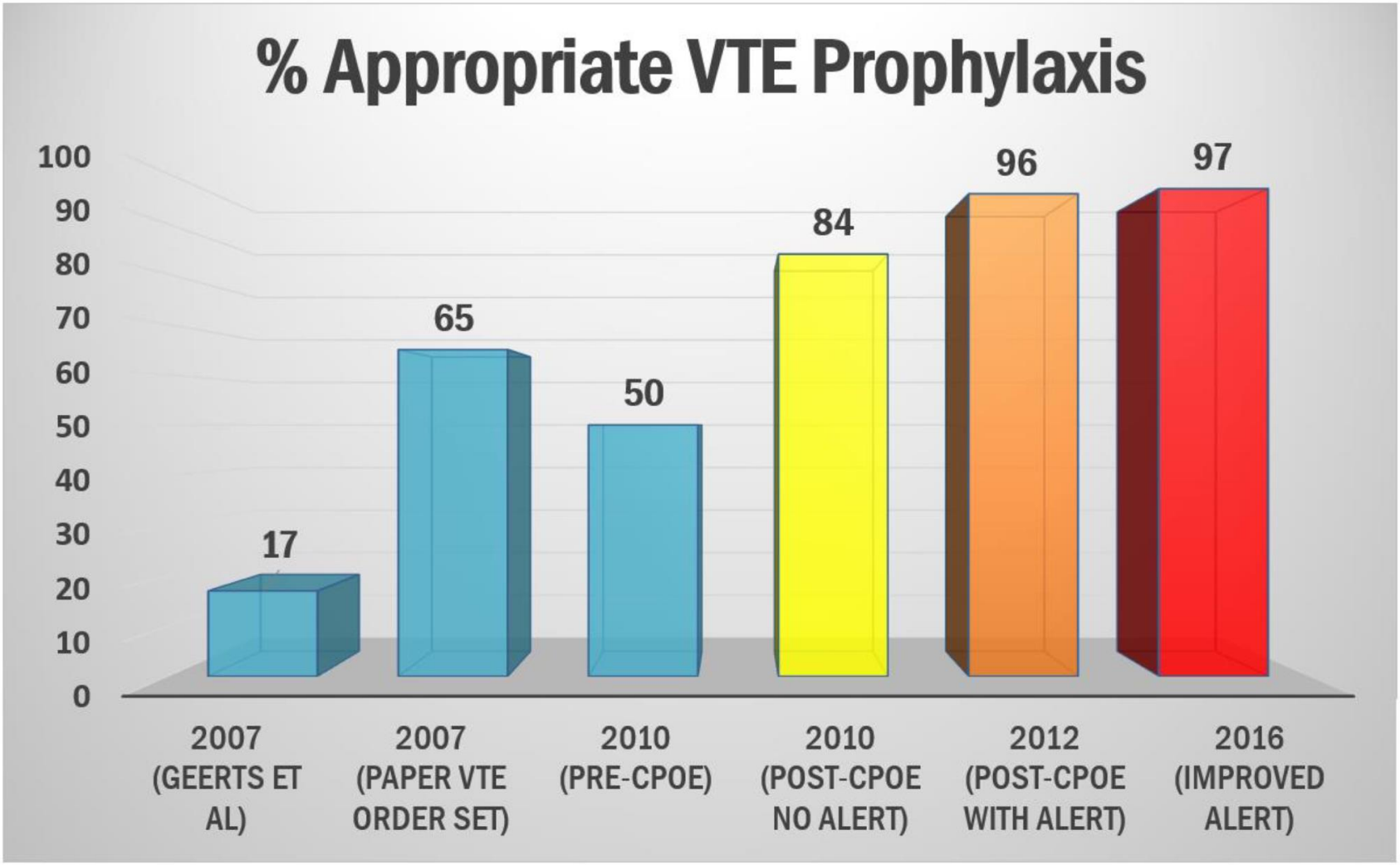
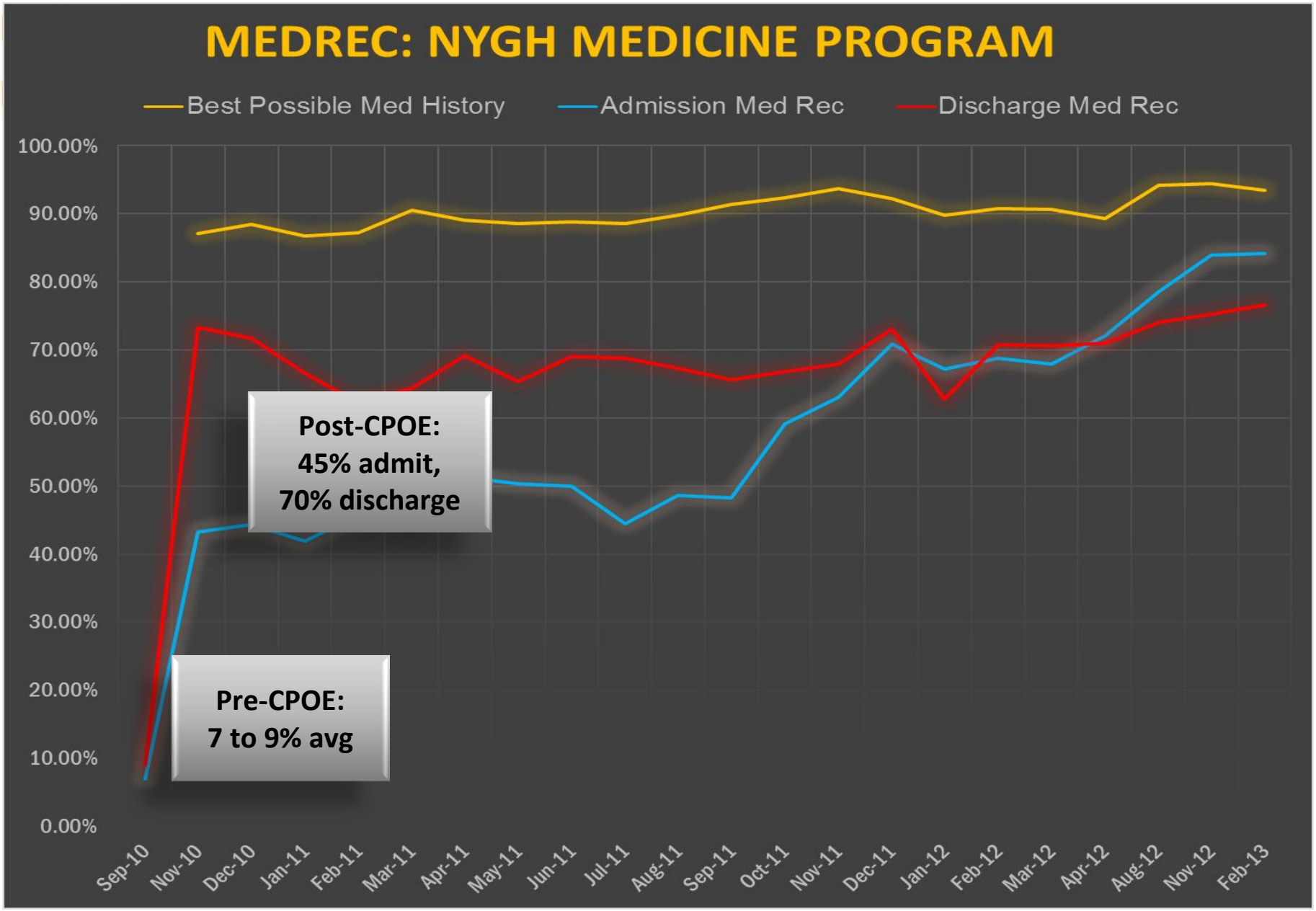
Making Quality Stick: VTE Prophylaxis




MEDREC: NYGH MEDICINE PROGRAM
Best Possible Med History
Admission Med Rec
Discharge Med Rec
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Sep-10
Nov-10
Dec-10
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
Jan-12
Feb-12
Mar-12
Apr-12
Aug-12
Nov-12
Feb-13
Post-CPOE:
45% admit,
70% discharge
Pre-CPOE:
7 to 9% avg

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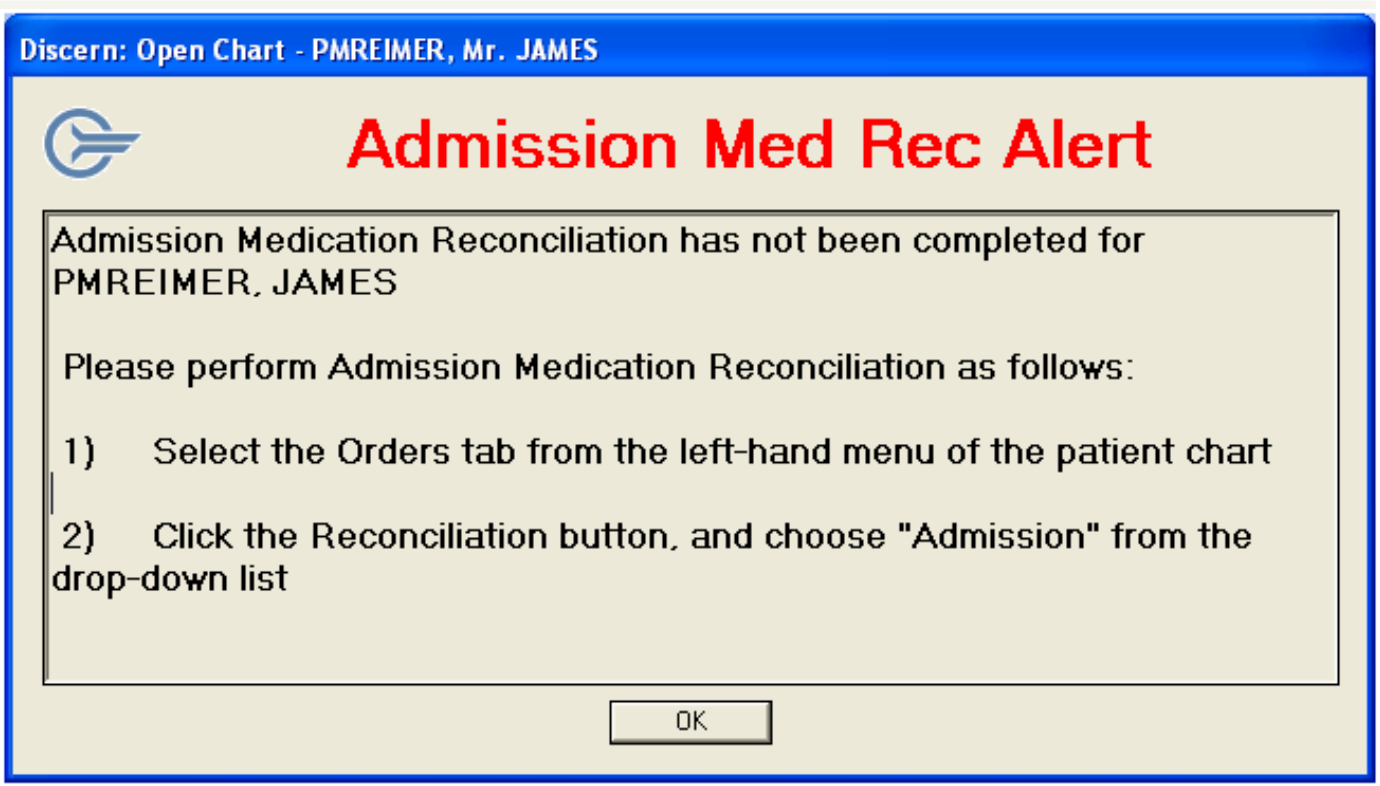
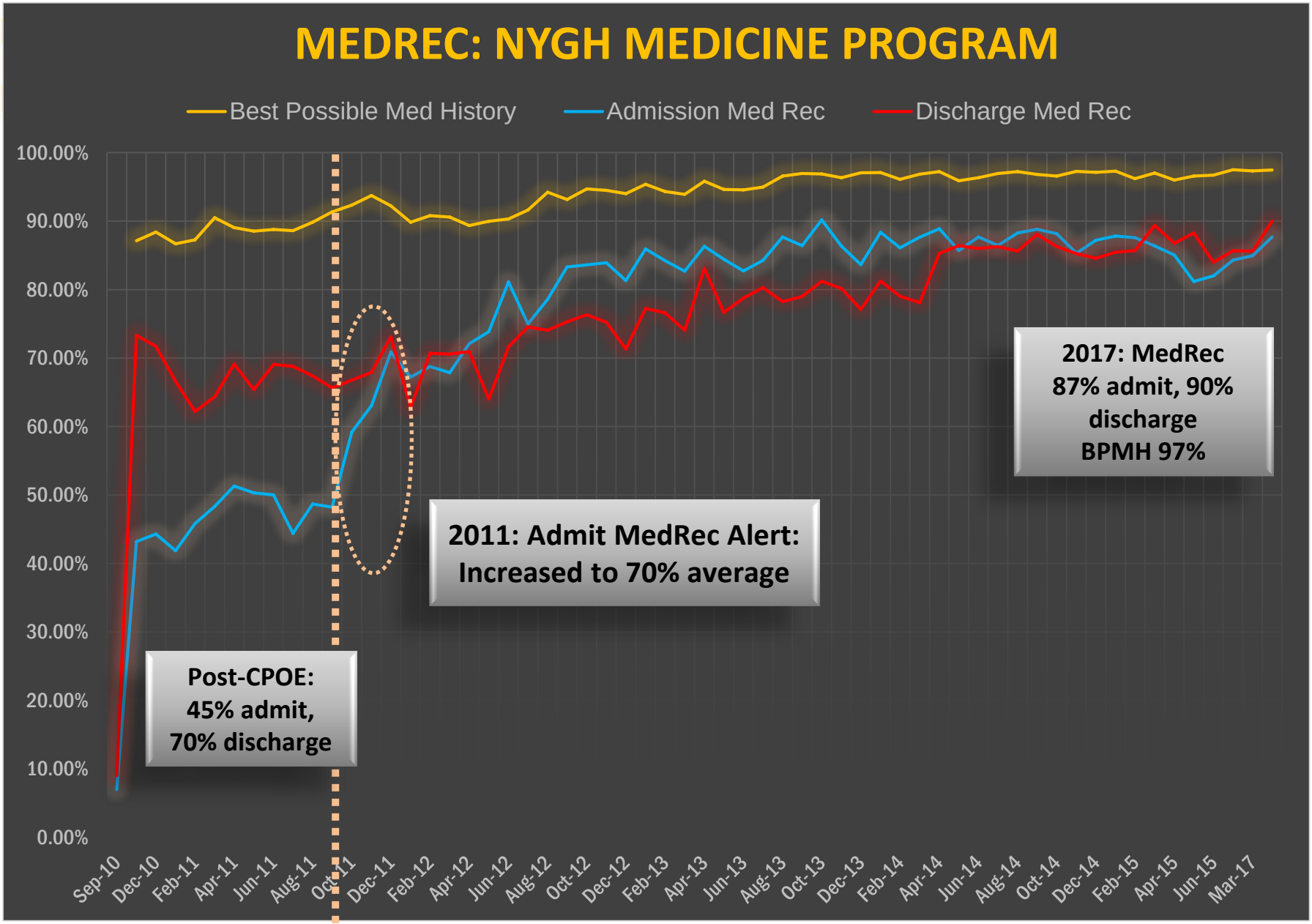
Clinical Decision Support to improve Admission Medication Reconciliation

Alert to remind Most Responsible Physician (MRP)

– Best Possible Medication History is available

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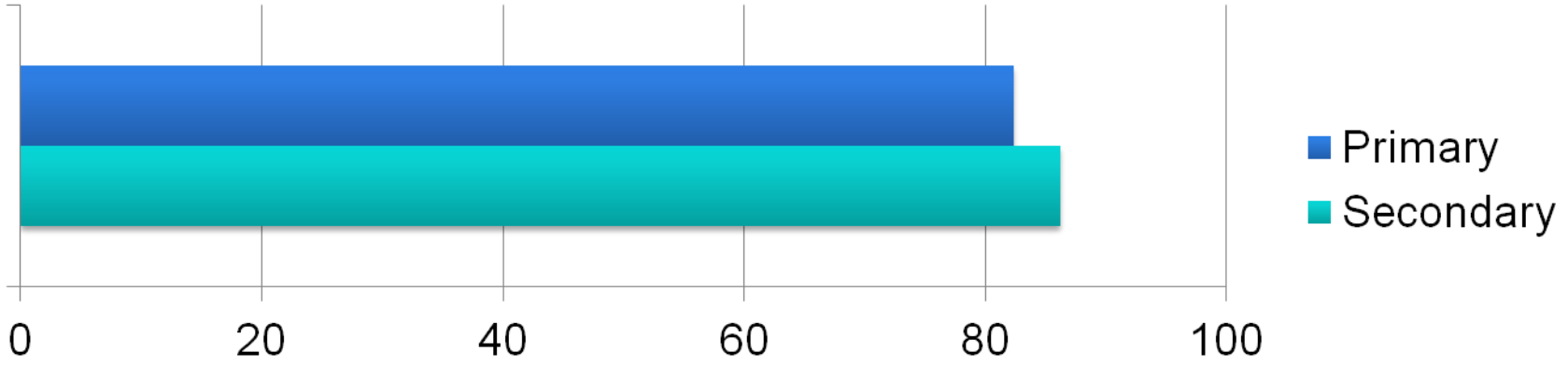
Dec-14
Feb-15
Apr-15
Jun-15
Mar-17
Post-CPOE: 45% admit, 70% discharge
2011: Admit MedRec Alert: Increased to 70% average
2017: MedRec 87% admit, 90% discharge BPMH 97%

Overall Clinician Satisfaction

	Primary	Secondary	*p*	OR (95% CI)
In general, how satisfied are you overall with the CPOE system you are currently working with? (Satisfied + Very Satisfied responses)	28/34 (82%)	25/29 (86%)	.677	.75 (.19 – 2.95)



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Ontario Shores Foundation for Mental Health

Ontario

HIS Adoption and Benefits Team

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Summary of *eCare* Clinical Benefits

- **100%** clinician adoption
- MedRec improved from **8%** to **90%**, with significant reduction in pharmacist interventions for duplicate meds and omitted medications
- Medication turnaround time improved by **83%** (291→50 mins), with prevention of **11,000** patient mismatch errors and reduction in reported medication adverse events
- Appropriate prophylaxis against VTE increased from **50%** of inpatients to **>97%** of inpatients (with help of alerts), with a corresponding **39%** reduction in VTE
- Order set usage for patient admission to hospital increased from **36.5%** (paper) to **>97%** (CPOE), even though use not mandatory
- Mortality from pneumonia and COPD exacerbation was reduced by **45%** using CPOE vs paper orders, and by **56%** using CPOE with a correctly-matched evidence-based order set

eCare ROI Calculation

Canadian cost of adverse nosocomial events:

- Cost per medication error: $402 to $632 (median **$517 CDN**)
- Cost per nosocomial adverse drug event: **$4,028 CDN**
- Cost per case of nosocomial VTE: **$24,41[illegible] $36,047 CDN**
- Cost per case [illegible] nosocomial [illegible] **[illegible]9 CDN**

[illegible]hells [illegible] *In Acute Care* – CPSI July 2012

Cost of 31 lives saved per year from pneumonia and COPD exacerbation alone:

PRICELESS

Nosocomi[illegible]	[illegible]ngs ($CDN) [illegible]Dec 2015
Medicati[illegible]	[illegible]0,428
Adverse Drug Eve[illegible] Discrepancy c[illegible]	$31,062,1[illegible]9
VTE prevention	$1,029,169
Prevented recurrences of *C.difficile*	$293,376
TOTAL COST AVERTED	**$38,115,113**

→ Net savings over 5 years: $1.2 million

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What is the "Secret Sauce"?
Local Clinicians and Informaticians

Positive **OR** negative outcomes are possible using the same vendor software:

- Children's Hospital of Pittsburgh 2005: **increased mortality**
- North York General Hospital 2010-2015: **decreased mortality**

To obtain clinical and financial benefits from implementing advanced HIS, we need:

- **Engagement of clinicians**, in partnership with **informaticians**
- Careful review and **redesign** of clinical workflows and content for clinical transformation – *"Make it easy to do the right thing"*
- System adoption → ownership → **stewardship**

EHR the Canadian Way: Challenges and Advantages

Are we making progress?

United States **EMR Adoption Model**[SM]

STAGE	2017 Q1	2017 Q2
7	5.0%	5.3%
6	31.9%	32.4%
5	34.3%	34.1%
4	10.0%	9.8%
3	13.3%	13.1%
2	1.9%	1.9%
1	1.6%	1.6%
0	1.9%	1.8%
	N:5,479	N:5,478

Canada **EMR Adoption Model**[SM]

STAGE	2017 Q1	2017 Q2
7	0.2%	0.3%
6	1.2%	1.1%
5	3.9%	3.9%
4	1.4%	1.6%
3	30.6%	30.6%
2	29.6%	29.5%
1	15.6%	15.5%
0	17.6%	17.5%
	N:643	N:644

- Progression to HIMSS EMRAM Stage 4 and above is associated with improved care: quality, safety and value

- Amarasingham R et al. Arch Intern Med 2009 169(2):108-14

- 2006 HIMSS EMR Sophistication Correlates to Hospital Quality Data
- 2012 HIMSS Analytics Report: Quality and Safety

- US has **12x** the proportion of sites at HIMSS Stage 4 and above vs Canada (81.6% vs 6.9%)

Canadian Challenges

- Funding
- No central program of financial bonuses/penalties
- No clinically-focused maturity models in use
- Insufficient regulatory enforcement of terminology standards
- American Hospital Information System vendors:
  - Architected to meet American regulatory requirements, clinical workflows
  - Vendor clinical content focused on American standards, units of measure
  - Custom work required to accommodate / integrate Canadian provincial standards, systems, regulatory requirements, reporting
- Disparate constellation of primary care / long-term care systems, certification requirements differ from hospital sector
- Many healthcare organizations independently managed/operated (only some co-ordinated regional health systems, developing cross-sector “ACO’s”)

Canadian Advantages

- Healthcare System Integration:
  - Regional Health Authorities, Cross-Continuum Management / Care
  - Centralized Health Information Systems are developing
- Publicly Funded Healthcare System:
  - Organizations co-operate rather than compete

→ **Open for Sharing**

CLINICAL + SYSTEMS TRANSFORMATION
Our path to smarter, seamless care

IHealth

PharmaNet

ConnectingOntario

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CPOE TOOLKIT: BY THE NUMBERS

www.cpoe-toolkit.ca

57
member organizations

6
contributing organizations

7
Canadian provinces

525
active users

1,544
evidence-based order sets

Ontario HIS Benefits and Adoption Team (HISBAT)

- Led by North York General Hospital (HIMSS 6) and Ontario Shores Centre for Mental Health Sciences (HIMSS 7), both Davies Enterprise Award winners
- Peer-to-peer knowledge sharing, mentorship of HIS project teams through on-site visits
- Provided at no cost to Ontario hospitals
- First 9 months – 50+ hospitals assisted

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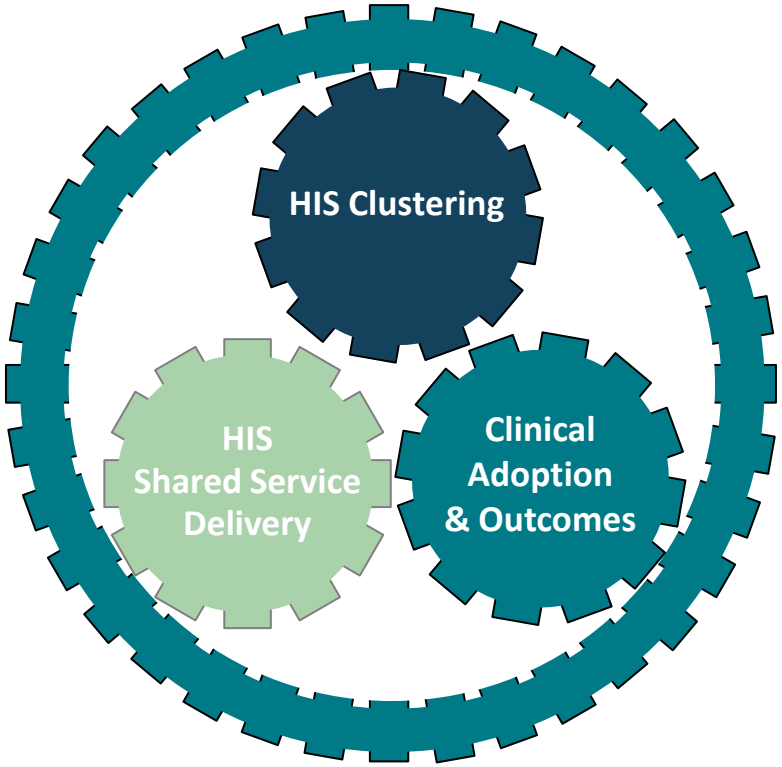
Ontario Shores Centre for Mental Health Sciences

Ontario

HIS Adoption and Benefits Team

Ontario HIS Renewal Strategy



Ontario's approach to HIS renewal focuses on accelerating maturity in three key areas that are all critical to success:

- **HIS Clustering**
- **HIS Service Delivery**
- **Clinical Adoption & Outcomes**

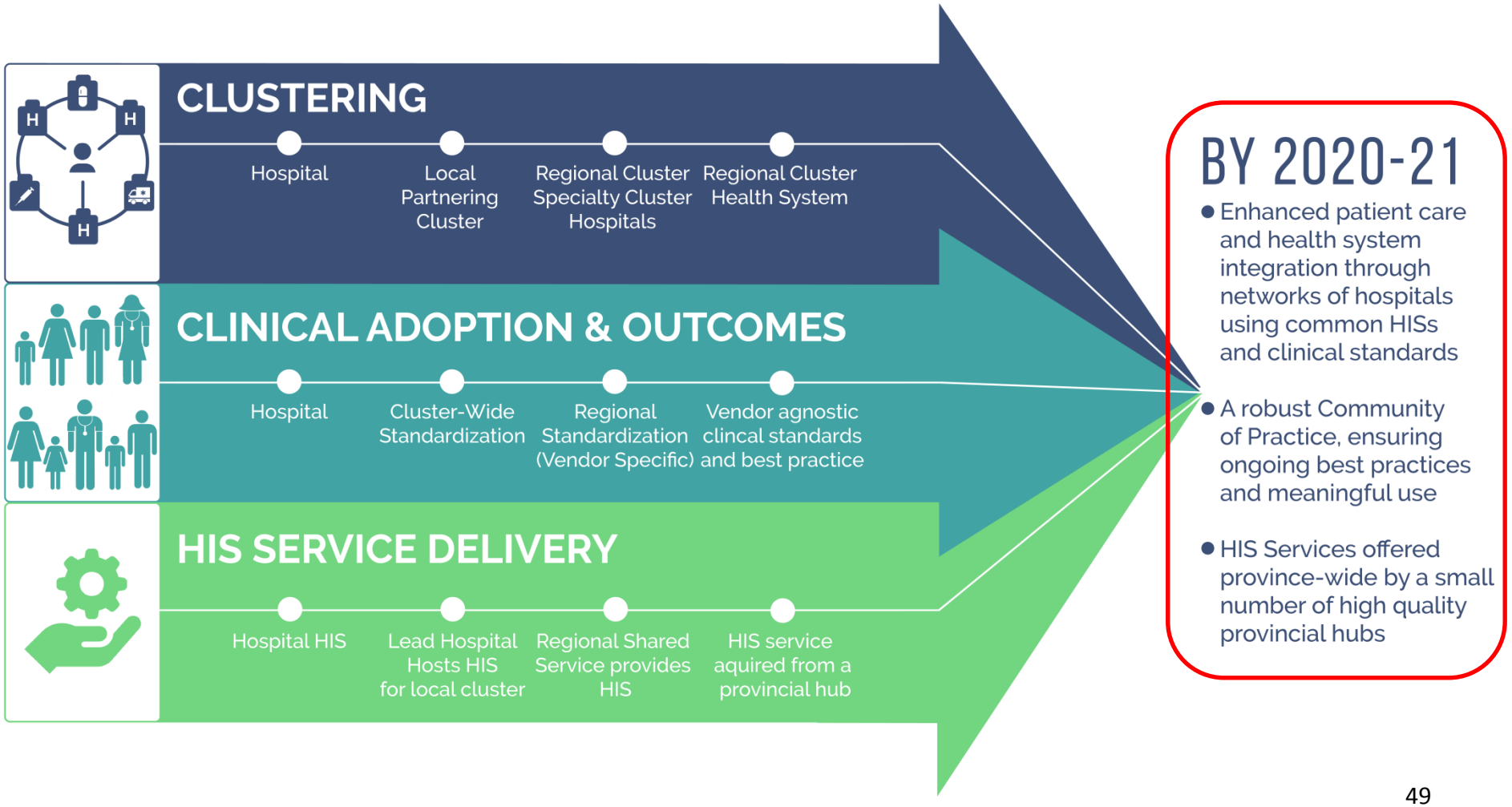
Implementation will be supported by key policy enablers:

- **Funding**
- **Procurement**

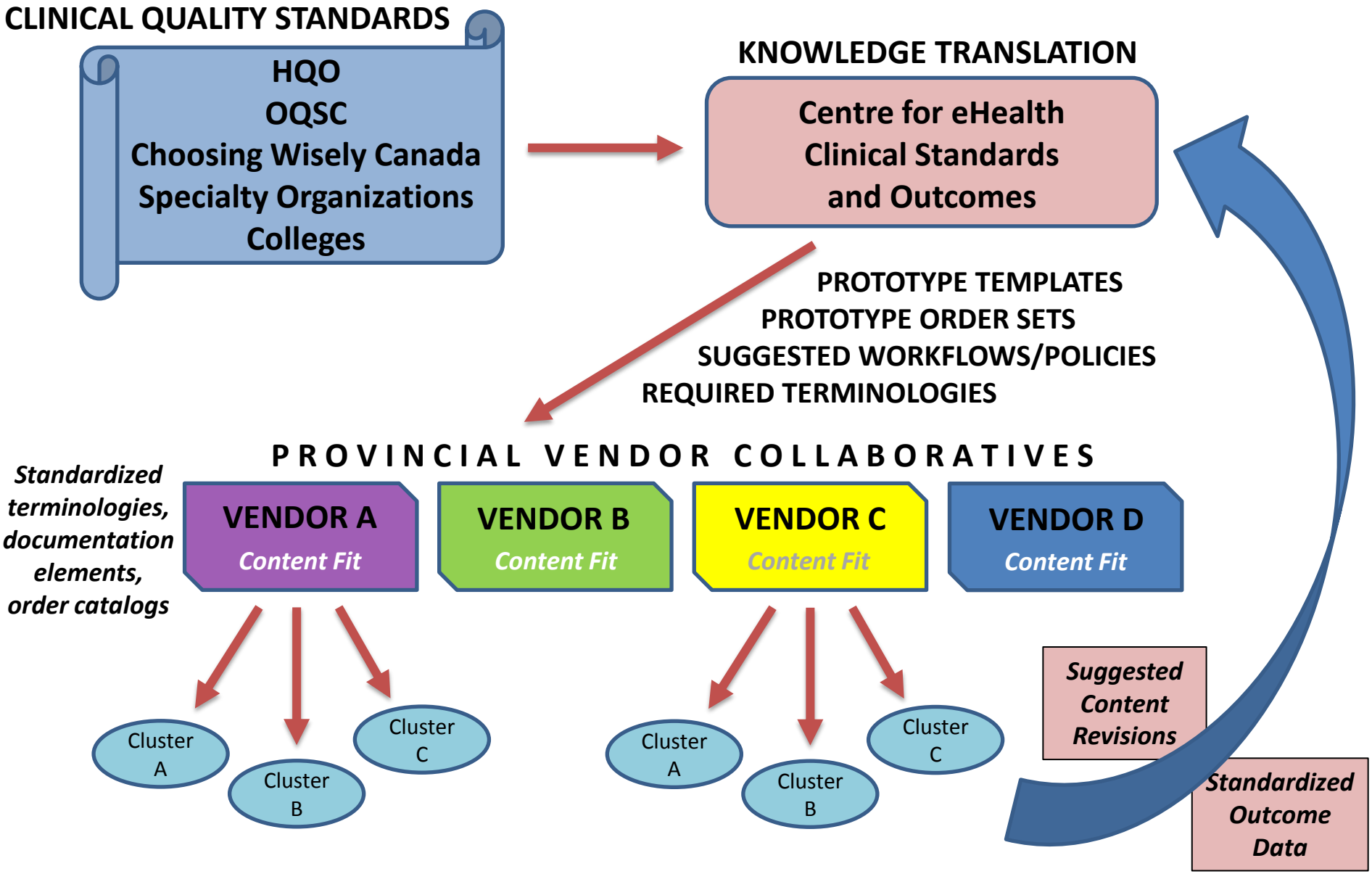
HIS Renewal Panel Recommendations:
Significantly changing the landscape of HIS procurement, funding, and partnerships

HIS Renewal Maturity Path

- Optimizing the benefits from HIS investments will depend on advancing maturity in the three key areas in tandem.



Provincial Schematic – Clinical Standardization



Success: the Canadian Way

Share globally:

- Lessons learned
- Best Practices
- Clinical Content
- Standards
- Patient data (cross-continuum)

Act locally:

Clinicians

+

Informaticians

+

Vendors

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THANK YOU!

For more information please contact:

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Jeremy.Theal@nygh.on.ca

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