NORTH YORK GENERAL

Making a World of Difference

eCare

Reduction in Inpatient Mortality from Evidence-Based CPOE, Culture Change toward Standardized Care

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Making a World of Difference

Community teaching hospital affiliated with the University of Toronto

Catchment area: > 400,000

Three Sites:
General, Branson, Seniors' Health

Beds: 418 acute care
192 long-term care

Volume per year:
121,000 ED visits
30,000 inpatient cases
5,800 births

HIMSS Stage 6 since 2011

Challenges in Inpatient Care

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

Aging population

LIMITED HEALTHCARE FUNDING

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

SEPSIS

C. difficile

VTE

What is eCare?

Multi-year hospital-wide clinical transformation project utilizing health information technology

Advanced Electronic Medical Record (EMR)

+

Standardization on Evidence-Based Care

+

Safe Prescribing and Medication Administration

+

Clinical Decision Support (Rules, Alerts)

=

A new era in patient care using EMR technology:

Multiple phases from 2010 to 2016

System Components

- Computerized Provider Order Entry (CPOE)
- Evidence-Based Order Sets & Clinical Workflows
- Closed-Loop Medication Administration
- eMAR, Medication Reconciliation, Depart Process
- Advanced Clinical Decision Support

Goals of the eCare Project

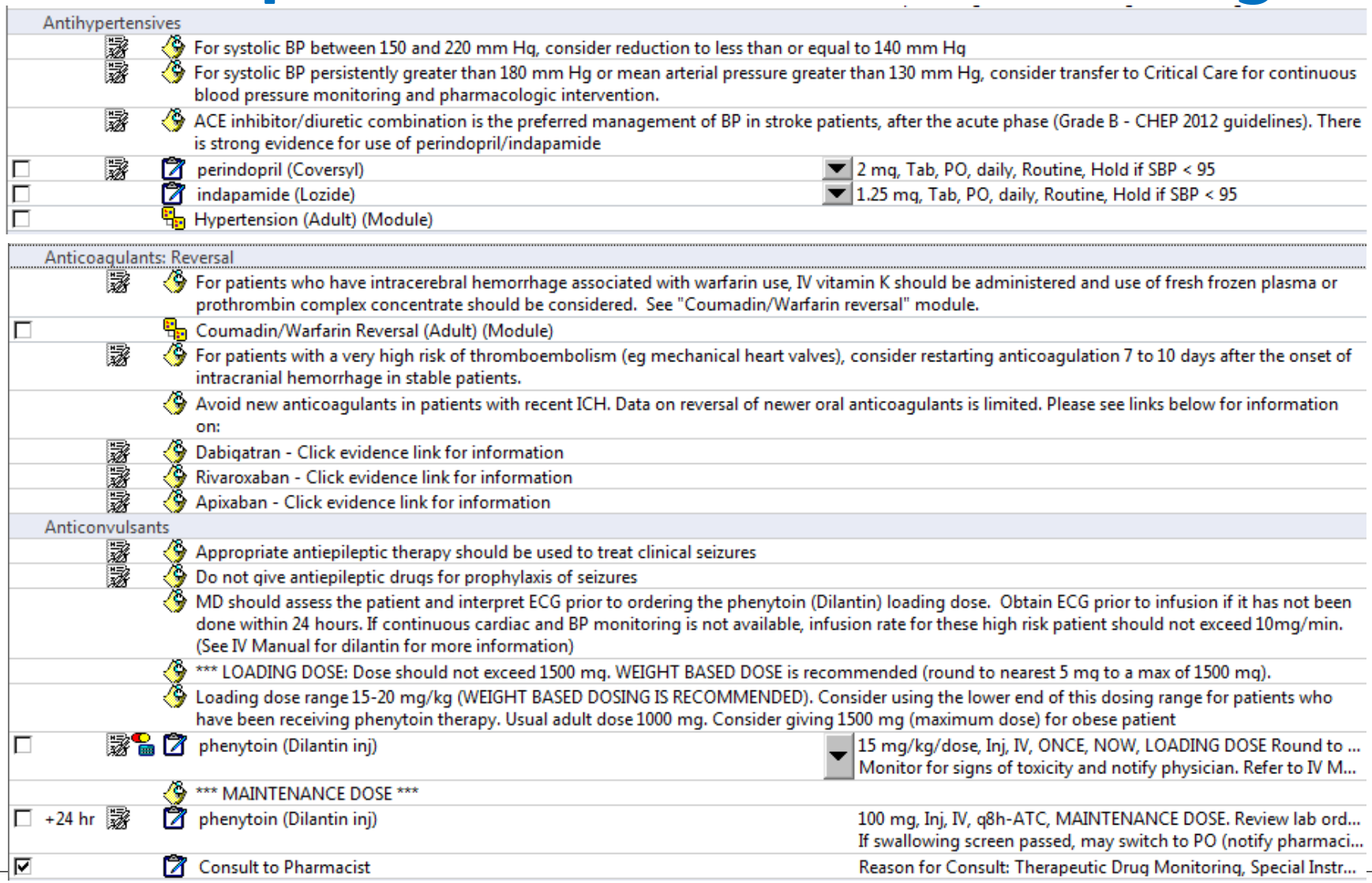
- Implement advanced electronic medical record technology to *improve patient outcomes:*
  - → Quality and safety of patient care
- Embrace culture of evidence-based care, best practices
  - → Make it "easy to do the right thing"
  - → Build evidence into clinical workflow: standardized order sets and clinical decision support
- SHARED VISION = *"by clinicians, for clinicians"*
  - → 100% clinician adoption
  - → Team-based interprofessional approach/workflows

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 built into clinician decision-making workflow
- NYGH library: 650 standardized order sets reviewed interprofessionally by front-line clinicians
- Regular content updates:
  - 279 new/updated order sets in past year
    - New evidence, QBP's
    - Utilization analysis – order set, individual orderables
    - Rational use of resources: Choosing Wisely
    - Policy, procedure, formulary, drug recalls

Example: Intracranial Hemorrhage



Antihypertensives

For systolic BP between 150 and 220 mm Hg, consider reduction to less than or equal to 140 mm Hg

For systolic BP persistently greater than 180 mm Hg or mean arterial pressure greater than 130 mm Hg, consider transfer to Critical Care for continuous blood pressure monitoring and pharmacologic intervention.

ACE inhibitor/diuretic combination is the preferred management of BP in stroke patients, after the acute phase (Grade B - CHEP 2012 guidelines). There is strong evidence for use of perindopril/indapamide

☐ perindopril (Coversyl) — 2 mg, Tab, PO, daily, Routine, Hold if SBP < 95

☐ indapamide (Lozide) — 1.25 mg, Tab, PO, daily, Routine, Hold if SBP < 95

☐ Hypertension (Adult) (Module)

Anticoagulants: Reversal

For patients who have intracerebral hemorrhage associated with warfarin use, IV vitamin K should be administered and use of fresh frozen plasma or prothrombin complex concentrate should be considered. See "Coumadin/Warfarin reversal" module.

☐ Coumadin/Warfarin Reversal (Adult) (Module)

For patients with a very high risk of thromboembolism (eg mechanical heart valves), consider restarting anticoagulation 7 to 10 days after the onset of intracranial hemorrhage in stable patients.

Avoid new anticoagulants in patients with recent ICH. Data on reversal of newer oral anticoagulants is limited. Please see links below for information on:

Dabigatran - Click evidence link for information

Rivaroxaban - Click evidence link for information

Apixaban - Click evidence link for information

Anticonvulsants

Appropriate antiepileptic therapy should be used to treat clinical seizures

Do not give antiepileptic drugs for prophylaxis of seizures

MD should assess the patient and interpret ECG prior to ordering the phenytoin (Dilantin) loading dose. Obtain ECG prior to infusion if it has not been done within 24 hours. If continuous cardiac and BP monitoring is not available, infusion rate for these high risk patient should not exceed 10mg/min. (See IV Manual for dilantin for more information)

*** LOADING DOSE: Dose should not exceed 1500 mg. WEIGHT BASED DOSE is recommended (round to nearest 5 mg to a max of 1500 mg).

Loading dose range 15-20 mg/kg (WEIGHT BASED DOSING IS RECOMMENDED). Consider using the lower end of this dosing range for patients who have been receiving phenytoin therapy. Usual adult dose 1000 mg. Consider giving 1500 mg (maximum dose) for obese patient

☐ phenytoin (Dilantin inj) — 15 mg/kg/dose, Inj, IV, ONCE, NOW, LOADING DOSE Round to ... Monitor for signs of toxicity and notify physician. Refer to IV M...

*** MAINTENANCE DOSE ***

☐ +24 hr phenytoin (Dilantin inj) — 100 mg, Inj, IV, q8h-ATC, MAINTENANCE DOSE. Review lab ord... If swallowing screen passed, may switch to PO (notify pharmaci...

☑ Consult to Pharmacist — Reason for Consult: Therapeutic Drug Monitoring, Special Instr...

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Study: Use of CPOE and evidence-based order sets

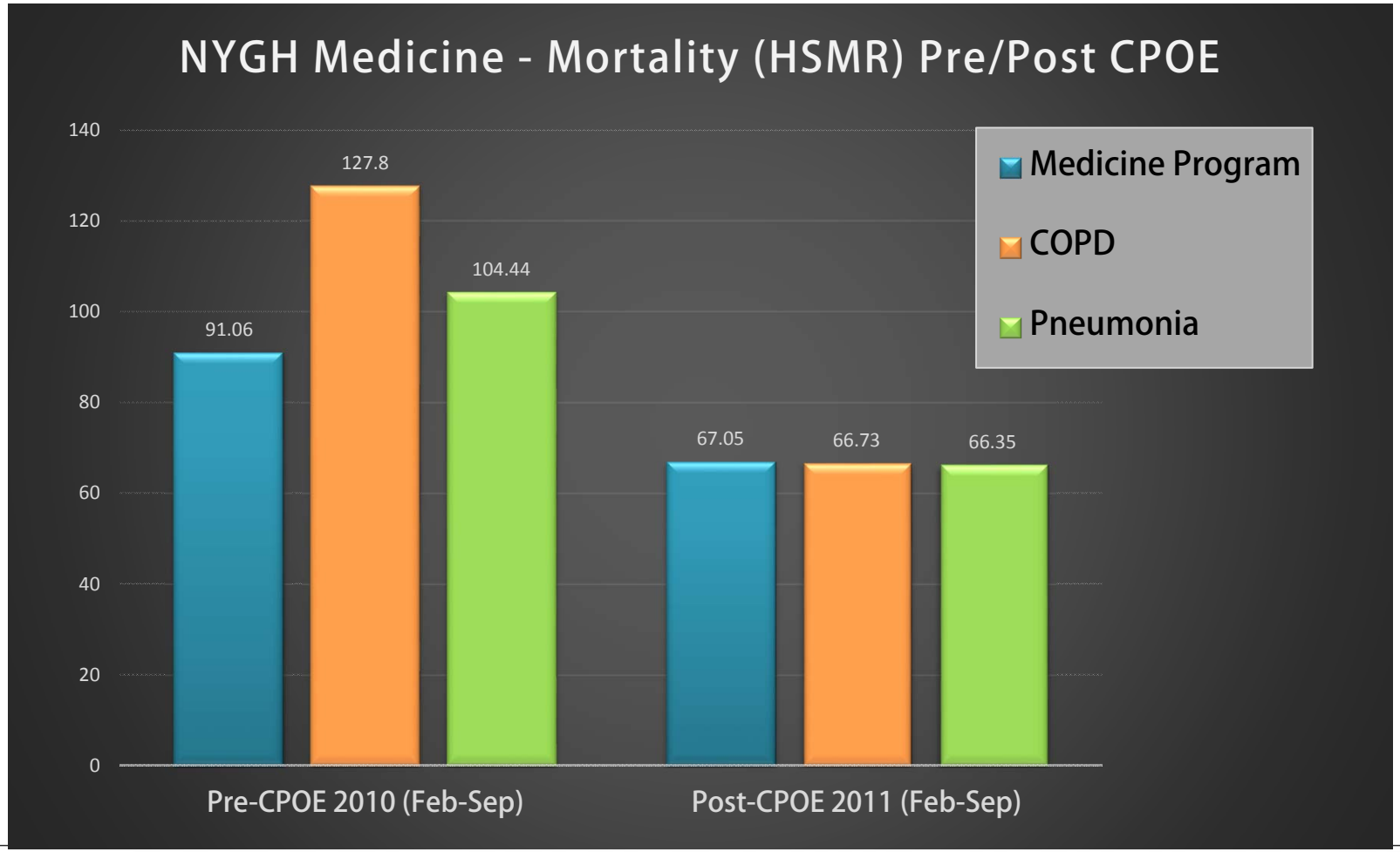
TORONTO STAR

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"

Pre-CPOE vs Post-CPOE: Hospital Standardized Mortality Ratio (HSMR)



Study – CPOE and Evidence-Based OS: Impact on Mortality, Readmission, LOS

Retrospective chart review

- All patients discharged with a most responsible diagnosis of Pneumonia or COPD
  - **Population #1**: Pre-CPOE (Jan-Sep 2010)
  - **Population #2:** Post-CPOE (Jan-Sep 2011)

    (CPOE go-live was October 26, 2010)

Why were Pneumonia and COPD selected?

- High-volume diagnoses for inpatient care
- Plenty of evidence to guide treatment
- Clear clinical decision support available
- Diagnosis often made on admission

Study – CPOE and Evidence-Based OS: Impact on Mortality, Readmission, LOS

Primary Hypothesis:

- Use of **CPOE with evidence-based order sets** is associated with a reduction in age and comorbidity-adjusted inpatient mortality, 30-day readmission and/or length of stay from pneumonia and COPD, compared with traditional paper-based processes

Study – CPOE and Evidence-Based OS: Impact on Mortality, Readmission, LOS

Secondary Hypothesis:

- The use of CPOE with an evidence-based **admission order set that matches or closely matches the final most responsible discharge diagnosis** is associated with a reduction in age and comorbidity-adjusted inpatient mortality, 30-day readmission and/or length of stay in patients hospitalized for pneumonia or COPD, compared with use of any order set

Study – CPOE and Evidence-Based OS: Impact on Mortality, Readmission, LOS

Order Set Example: Pneumonia

Diagnosis-Appropriate Order Set	"Closely matching" Order Set	Other Order Set
Pneumonia: Admission to Medicine Admission to Critical Care Antimicrobial Modules	Sepsis or Fever	Asthma
	COPD Antimicrobials	CHF
	Bronchitis	Thoracentesis
	Influenza Treatment	General Medical Care

Study – CPOE and Evidence-Based OS: Impact on Mortality, Readmission, LOS

Calculation of Probability of Death:

- Age in years
- Sex
- Length of Stay
- Comorbidities - Charlson Weight
- Admission type (emergent vs. elective)
- Transfer (whether pt was transferred from other institution)
- Diagnosis Group (coefficients applied to all above variables)

→ Critical Care Unit Admission not included in calculation

HSMR Technical Notes Feb 2012, Cdn Institute for Health Information (CIHI)

Statistical Analysis

- **Baseline population characteristics:**
  - Wilcoxon rank-sum test for continuous variables (e.g. probability of death, age, length of stay)
  - Chi-squared test for other variables

- **Odds of death and readmission:**
  - Logistic regression

- All statistical analyses performed using **Stata 12**

StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP.

Table 1 – Pre vs Post-CPOE Population

	Paper Orders	CPOE (eCare)	p-value
Number of Patients	520	511	NS
Gender	F=262, M=258	F=269, M=242	0.468
Age	Mean: 78.13 yrs Median: 81 yrs	Mean: 76.54 yrs Median: 80 yrs	0.152
CrCU Admission	Total: 61 (Pneumonia: 16 COPD: 45)	Total: 62 (Pneumonia: 32 COPD: 30)	0.351
Length of Stay (days)	Mean: 9.85 Median: 6	Mean: 10.00 Median: 6	0.936
30 day Readmission	68	57	0.344
Diagnosis	Pneumonia = 248 COPD = 272	Pneumonia = 285 COPD = 226	**0.009**
Probability of Death - Pneumonia - COPD	Mean / Median 0.128 / 0.103 0.155 / 0.130 0.104 / 0.087	Mean / Median 0.123 / 0.098 0.142 / 0.122 0.099 / 0.080	0.199 0.114 0.294
Death (unadjusted)	78	47	**0.004**

Results: Primary Hypothesis (CPOE vs Paper)

Outcome	Odds Ratio	Confidence Interval	p-value
Death	**0.57**	0.39 – 0.84	**0.005**
Death adj for Probability of Death	**0.57**	0.38 – 0.85	**0.006**
Death adj for Probability of Death and CrCU Admission	**0.55**	0.36 – 0.83	**0.005**

Results: Secondary Hypothesis (evidence-based CPOE 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**
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

Culture Change is Key

Results: Subgroup Analysis – Order Set Use

	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%**

Summary of *eCare* Adoption/Benefits

Culture Change:

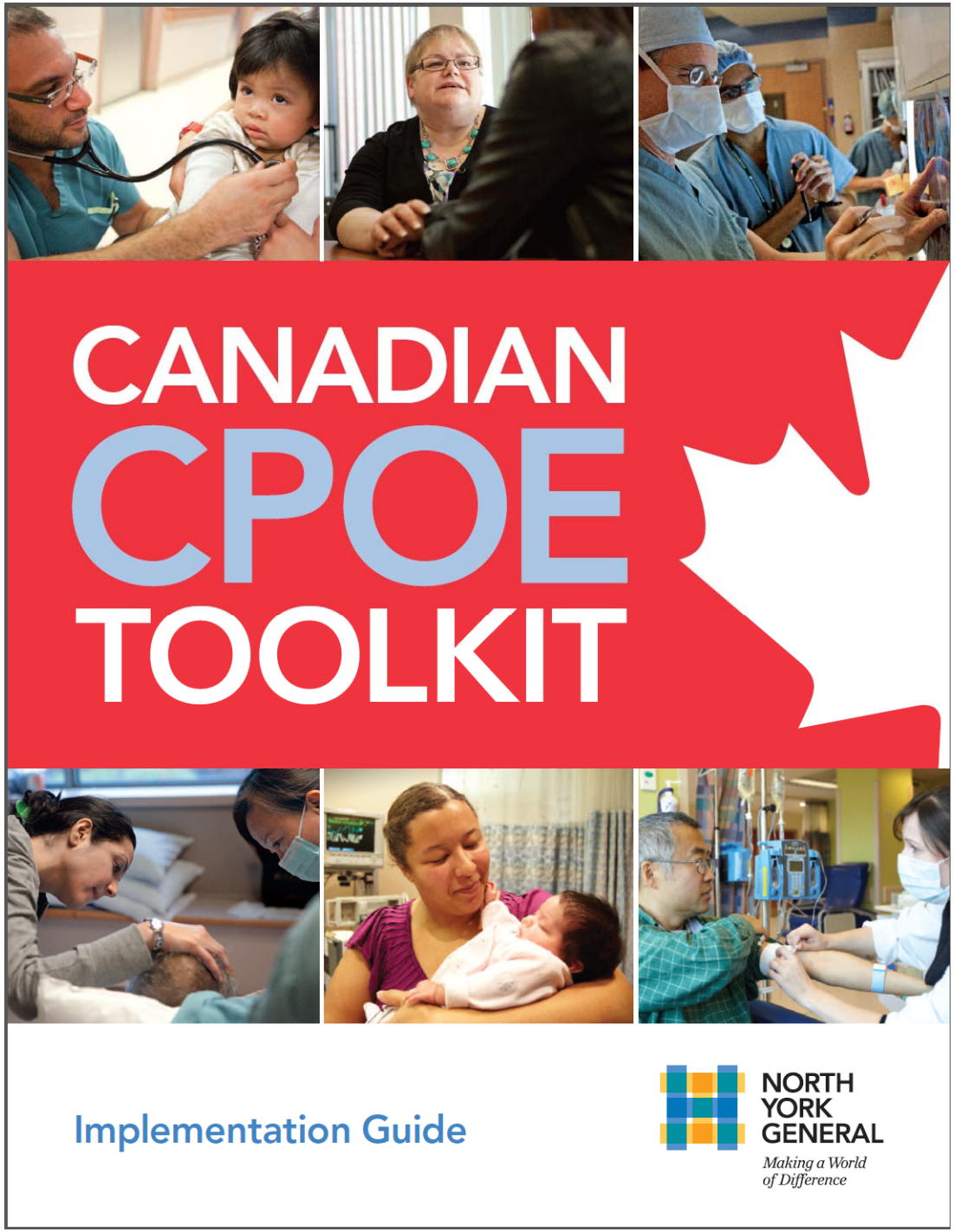
- **100%** clinician adoption
- **>92%** of orders entered directly by MD's
- **>49%** of all physician orders entered using standardized order sets

Benefits:

- Medication turnaround time improved by **83%** (291→50 mins)
- Appropriate prophylaxis against VTE increased from **50%** of inpatients to **>96%** of inpatients (with help of alerts)
- Medication reconciliation improved avg **8%** to **85%** (using alerts)
- Mortality from pneumonia and COPD exacerbation was reduced by **45%** using CPOE vs paper orders
- Mortality from pneumonia and COPD exacerbation was reduced by **56%** in patients admitted using CPOE with a correctly-matched evidence-based order set

Leverages the **non-competitive structure** of Canadian healthcare to create a **no-cost sharing platform** for Canadian CPOE development resources

- Saves significant implementation time and cost
- Searchable library of evidence-based order sets
  - Medicine, Surgery, Critical Care, Paeds, Obstetrics, LTC, Mental Health
  - Coming soon: NICU, Emergency
- Multi-publisher sharing model
  - Each contributing organization shares content at no cost, retains full ownership of all contributions



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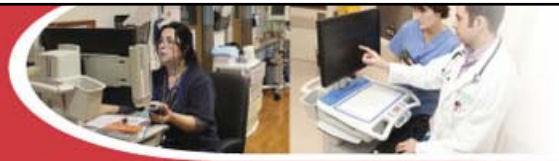

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Canadian CPOE Toolkit

The **Canadian CPOE Toolkit** is a national collaborative to freely share knowledge and electronic order sets for the implementation of Computerized Provider Order Entry (CPOE). North York General Hospital, the host organization, is providing the Toolkit at no cost to Canadian public healthcare institutions. Our belief is that by sharing resources, we can all work together to develop high quality CPOE systems across the country, at less total cost to our healthcare system, and with better outcomes for patients!

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The Toolkit is comprised of two parts:

1. A CPOE Implementation Guide, containing comprehensive information to help your organization with the design, build, deployment, support and maintenance of its CPOE system.
2. A searchable electronic order set library containing hundreds of evidence-based order sets that have been reviewed by Canadian clinicians and are in use at Canadian hospitals. The order set library is a sharing platform. Each member organization can contribute order sets to the library, so that everyone can benefit.

Toolkit News:

November 27, 2012 - the site is live! There are over 160 order sets available, covering the specialties of Medicine, Surgery and Critical Care.

December, 2012 - additional 200 order set links were added.

June, 2013 - The full library of North York General Paediatrics order sets is now available

April, 2014 - Maternal/Newborn and Peri-Op order sets from North York General are now available

May, 2014 - Mental Health order sets from Ontario Shores have been added. The CPOE Toolkit library now contains **over 600 order sets**!

October, 2014 - New Long Term Care order sets (48 in total) have been contributed to the Toolkit library by Ontario Long Term Care Association.

December, 2014 - Mental Health order sets from North York General have been added.

January, 2015 - London Health Sciences Centre order sets have been added. There are now more than **900 order sets** available!

February, 2015 - More London Health Sciences Centre order sets have been added. There are now more than **1,100** order sets available!

CPOE TOOLKIT: BY THE NUMBERS

46
member organizations

5
contributing organizations

6
Canadian provinces

389
active users

1,267
evidence-based order sets

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CANADIAN CPOE TOOLKIT

http://www.cpoe-toolkit.ca

THANK YOU!

For more information please contact:

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