

# Operations Research perspectives on patient flow and capacity management

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# Overview

- Ontario Waitlist Forecasting
- CHEO ED Wait Time Reduction
- Colonoscopy Capacity Planning
- Thoracic Surgery Location
- Health Human Resources Planning
- Toronto EMS Call takers



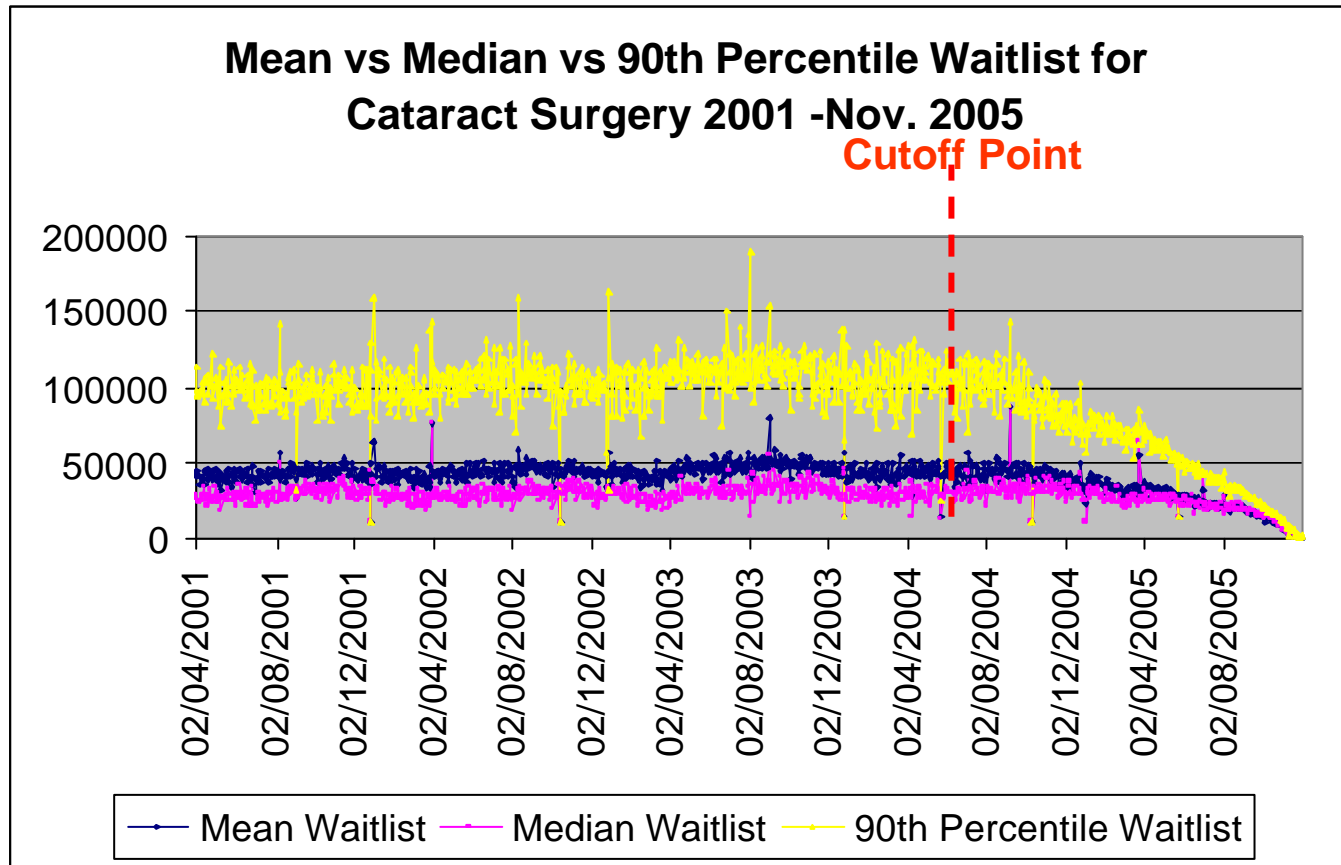
# Ontario Waitlist Initiative (Spring 2006)

- Target to reduce wait times to benchmarks for five priority areas:  
Cardiac, Cataract, Cancer, Hip & Knee Replacement, MRI/CT
- Problem: How many (cataracts) do we need to do to meet bench mark (90% wait less than 26 weeks) by March 2007?

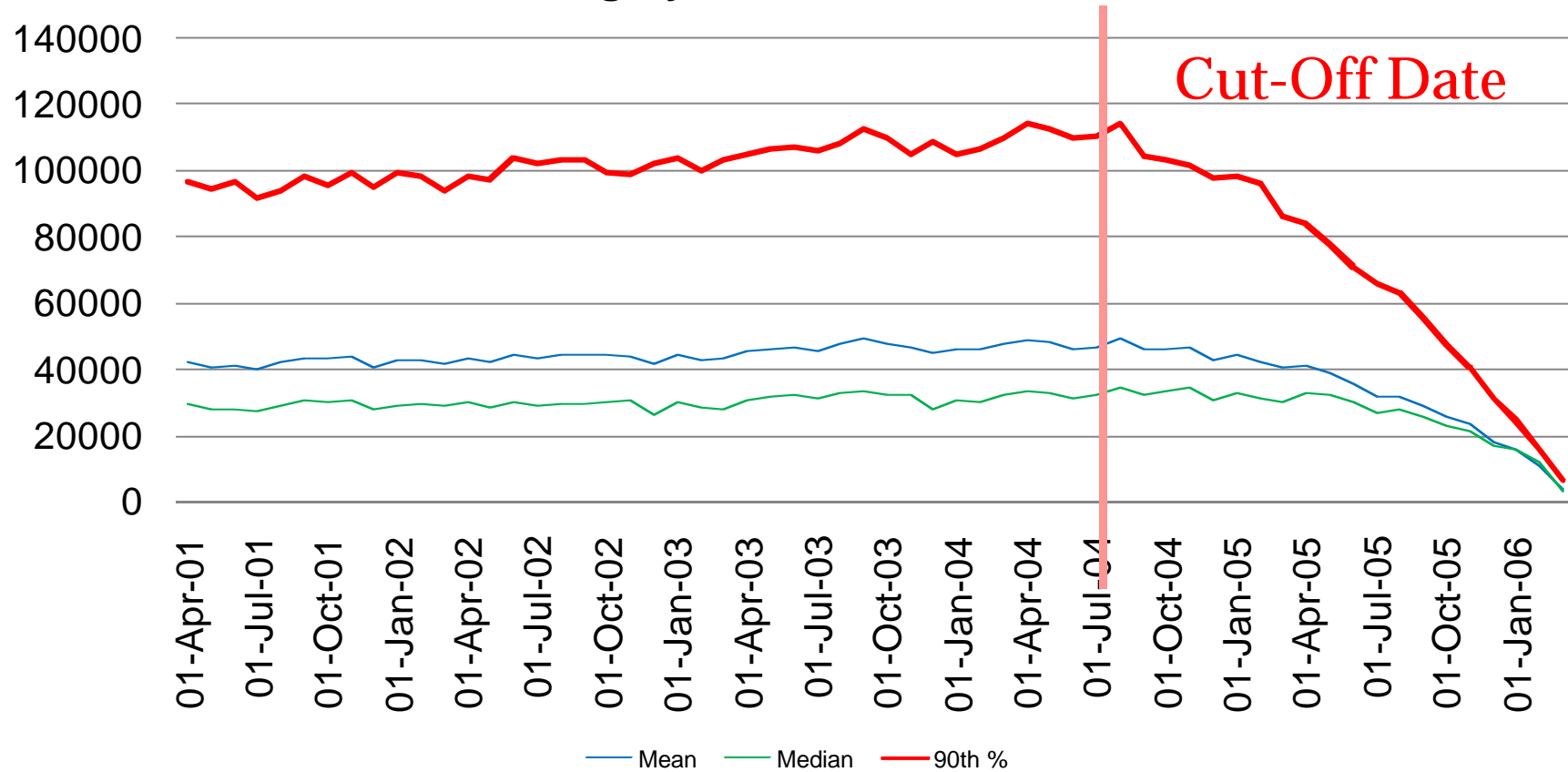
# Data Requirements for Prediction

- Current Patient Arrival Rate
- Projected Future Arrival Rate
- Current Waitlist
- Distribution of Patients on Waitlist (by Priority)
- Surgical Volumes (Service Rates)
- Future Funded Surgical Volumes

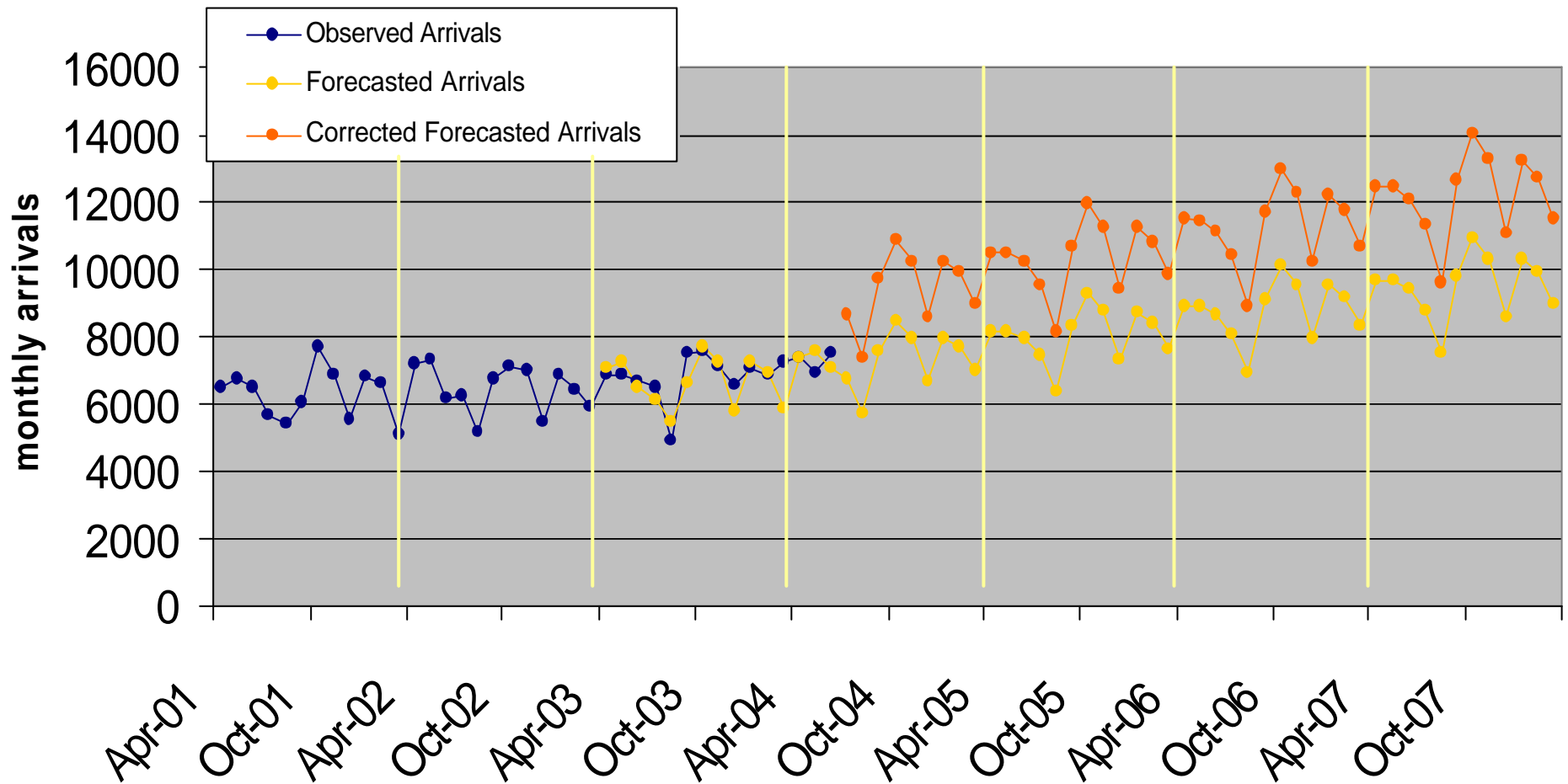
# Observed Waitlist Approximations



## Mean vs Median vs 90th Percentile Waitlist for Cataract Surgery (April 2001 to March 2006)



## Cataract Arrivals in Ontario fy2001-fy2006



## Current Ontario Performance

- Nov/Dec/Jan 2009 (all priorities)
  - Hips – 24.5 weeks (target 90%: 26 weeks)
  - Knees – 28 weeks (target 26)
  - Cataracts – 15 weeks (target 26)
  - Breast cancer – 5.5 weeks (target 12)
  - Colorectal cancer – 6 weeks (target 12)
  - Cardiac Bypass – 7 weeks (target 26)
  - MRI – 14 weeks (target 4)
  - CT – 5 weeks (target 4)

[www.health.gov.on.ca/transformation/wait\\_times/](http://www.health.gov.on.ca/transformation/wait_times/)



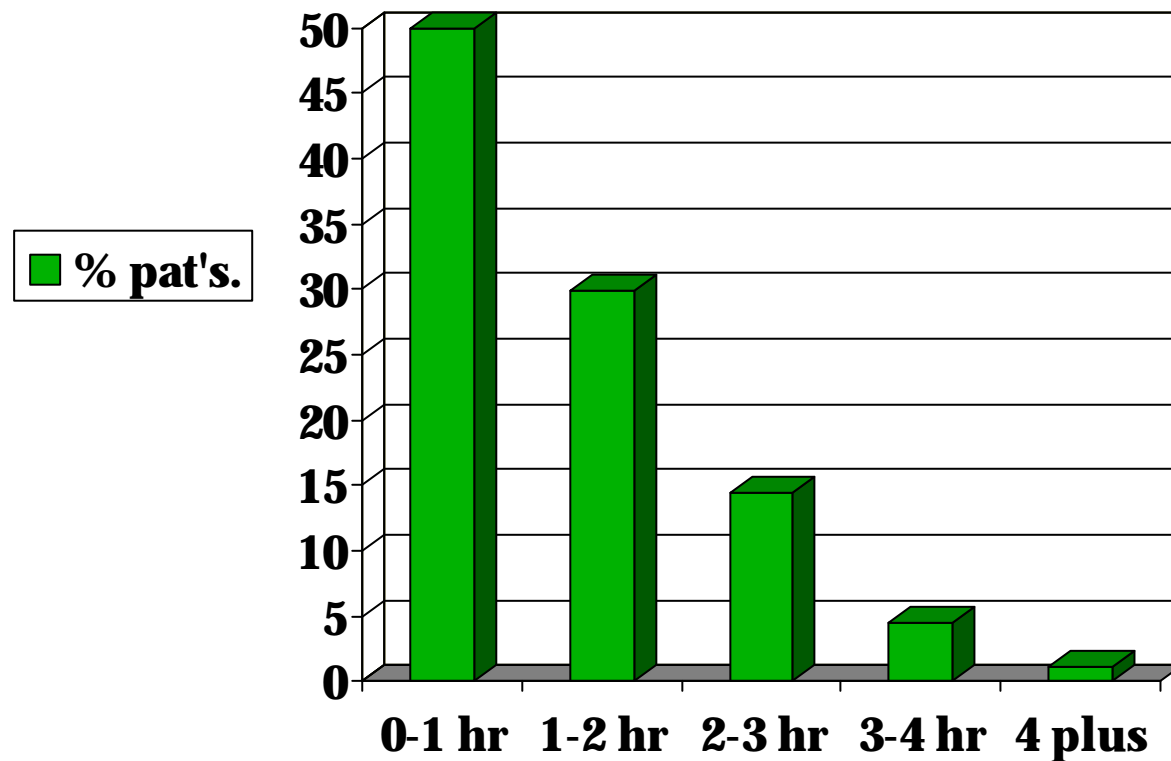
# Future Directions

- Now getting much better wait time data
- Federal Government pushing for wait time ***guarantees***
- Need to know what wait times will be in 6-12 months
- Current “wait times” based on last month ***procedures; not the wait list.***

# CHEO: Emergency Room

- Children's Hospital of Eastern Ontario: Ottawa 1993
- Paediatric Teaching Hospital
- 50,000 patient visits per year in the ER

# CHEO: Waiting Times (1993)



# CHEO: Emergency Room

- 20 % of patients wait over two hours
- Eleven suggestions by staff
- Simulation used to evaluate scenarios
- Fast track clinic
- New Casualty Officer
- Staggered start times

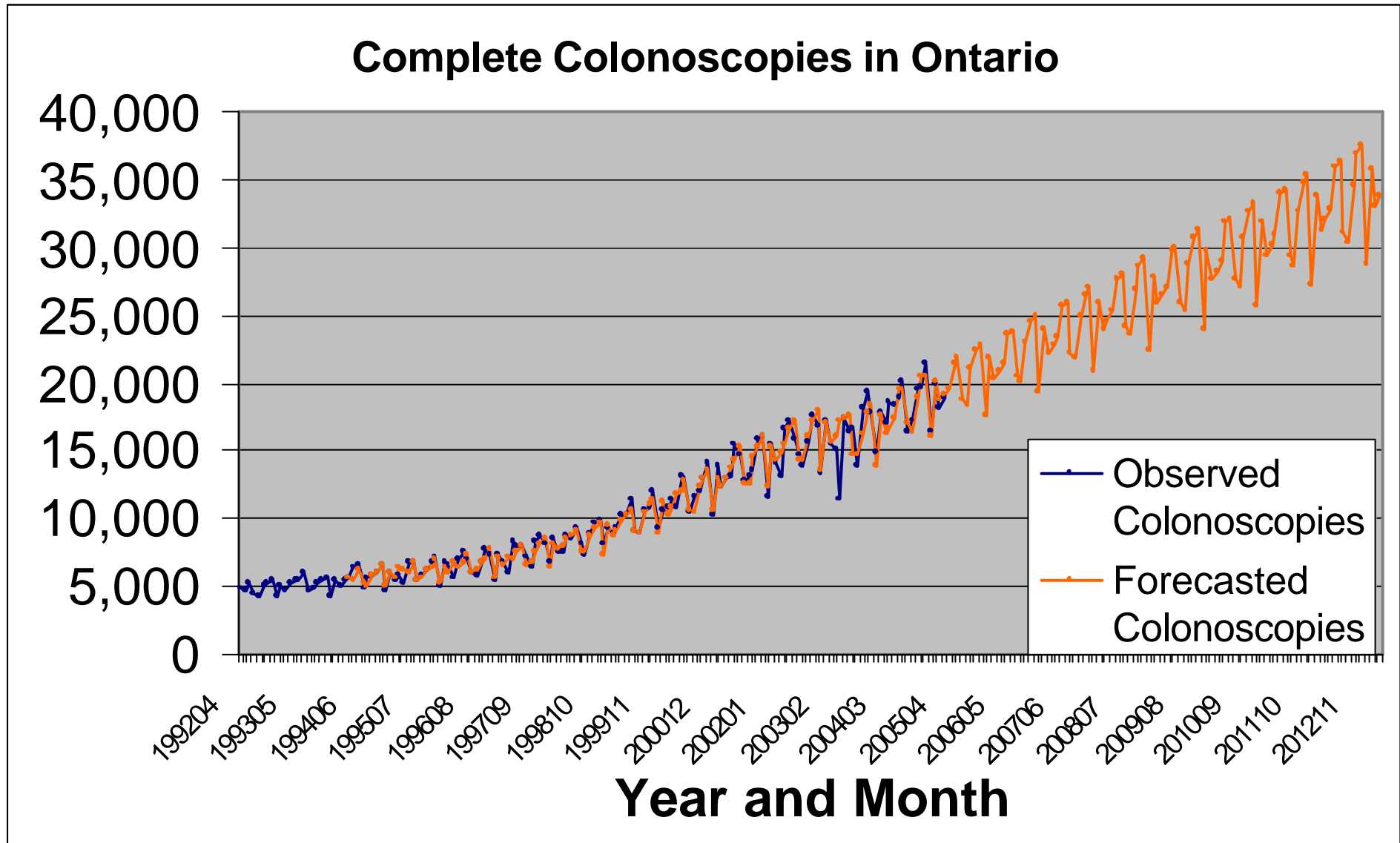
# Planning Tools with Cancer Care Ontario

Collaborations with Graham Woodward at CCO

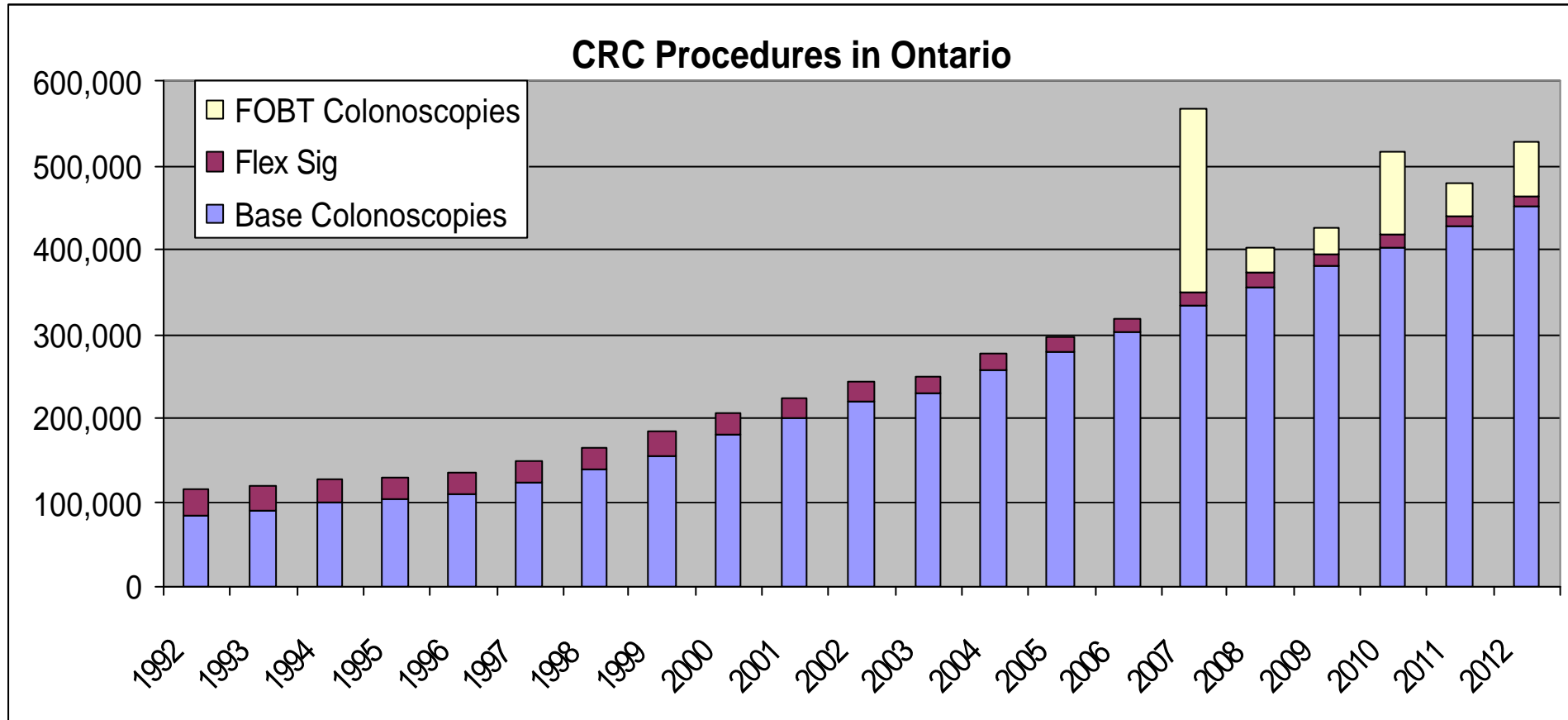
## Colorectal Cancer Screening: (Sept 2007)

- 2nd leading cause of death from cancer
- One of the most preventable cancers
- In 2006: est. 7,500 Ontarians diagnosed with C.R. and 3,100 died
- Only 20% over 50 have been screened
- Fecal Occult Blood Test (FOBT)
  - High false positive rate!

# Forecast

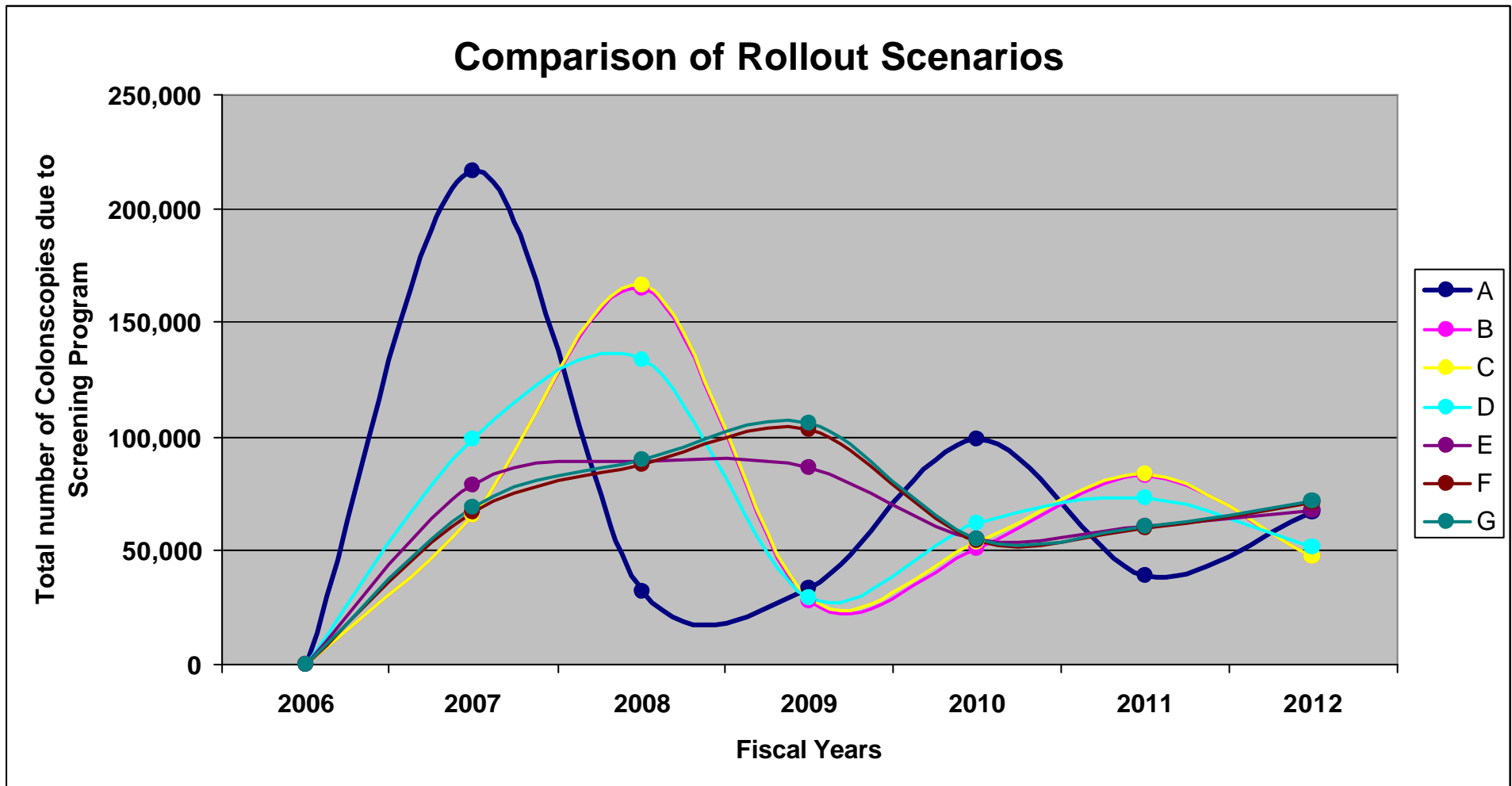


# The Model Results





# Comparing Scenarios

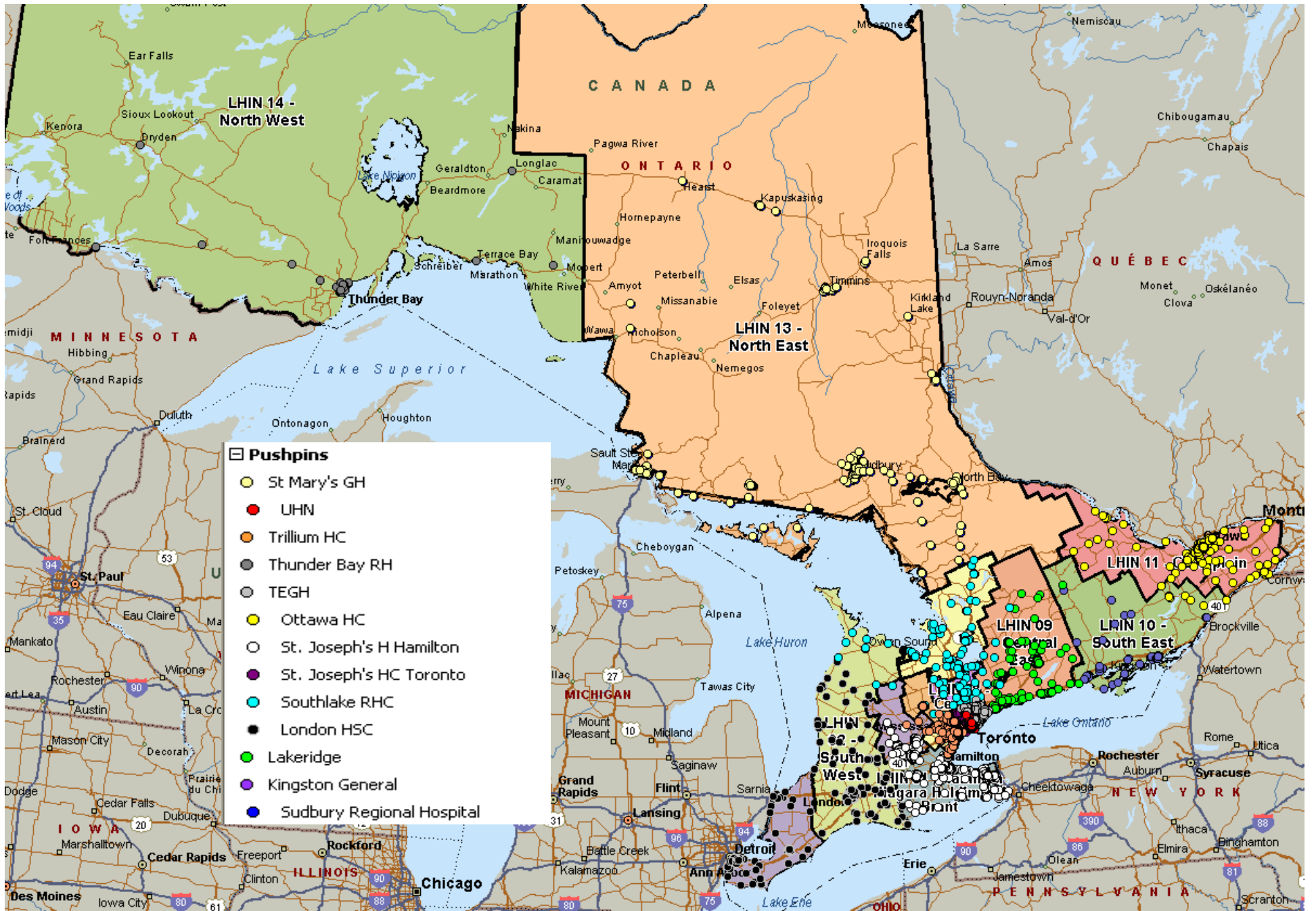


## Thoracic Surgery Centres (2008)

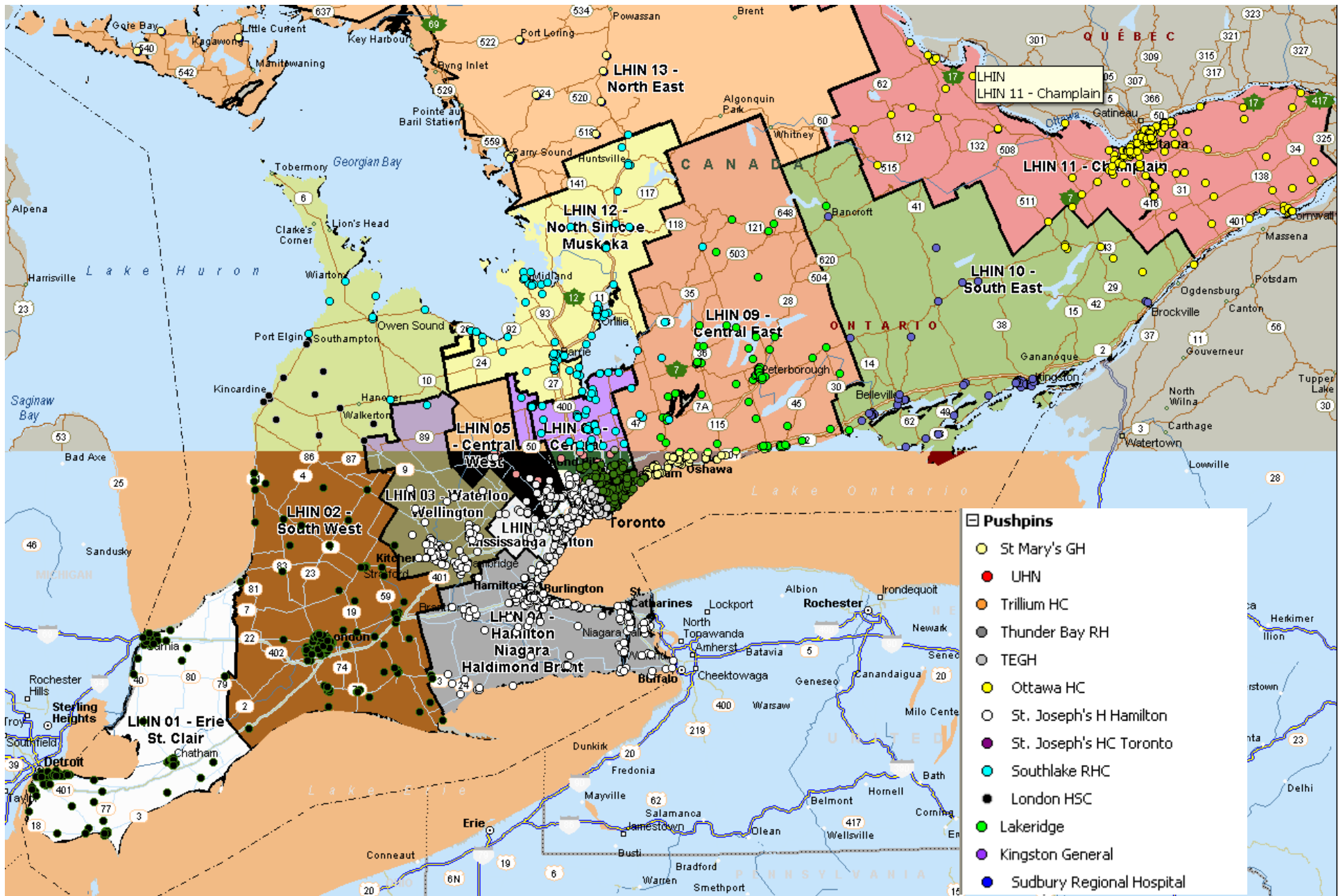
- Patient Travel Model determines where future patients will travel to receive treatment
- Two patient referral scenarios:
  - A - Closest facility to Patient's residence
  - B - Closest facility to Patient's original treatment facility

# Historical Volumes

Facility Level	LHIN	Avg. 2004 & 2005 Volume
Hopital regional de Sudbury Regional Hos	13	123.5
Hotel-Dieu Grace Hospital Windsor	1	47.5
Kingston General Hospital	10	46
Lakeridge Health Corporation	9	44.5
London Health Sciences Centre	2	167.5
Niagara Health System	4	42.5
North York General Hospital	8	28.5
Peterborough Regional Health Centre	9	60
Rouge Valley Health System	9	32.5
Sault Area Hospital	13	28.5
Southlake Regional Health Centre	8	81
St. Joseph's Health Centre Toronto	7	87.5
St. Joseph's Healthcare Hamilton	4	207.5
St. Mary's General Hospital	3	43
Sunnybrook & Women's College Health Sciences	7	22
The Credit Valley Hospital	6	21
The Ottawa Hospital Corporation	11	171.5
The Scarborough Hospital	9	35
The Toronto East General Hospital	7	39.5
Thunder Bay Regional Health Sciences Cen	14	36
Trillium Health Centre	6	57
University Health Network	7	289.5
William Osler Health Centre	5	47



FIOW



March 26, 2009

Operations Research & Patient Flow

# Sample Results

Facility Level	LHIN	Average	Volume - C			
		2004 & 2005 Volume	2006	2007	2008	2009
Hopital regional de Sudbury Regional Hos	13	123.5	165	167	169	177
Kingston General Hospital	10	46	59	58	58	59
Lakeridge Health Corporation	9	44.5	143	153	162	167
London Health Sciences Centre	2	167.5	222	229	236	237
Southlake Regional Health Centre	8	81	192	196	177	190
St. Joseph's Health Centre Toronto	7	87.5	122	125	108	139
St. Joseph's Healthcare Hamilton	4	207.5	314	317	328	329
The Ottawa Hospital Corporation	11	171.5	170	175	177	180
The Toronto East General Hospital	7	39.5	253	239	257	257
Thunder Bay Regional Health Sciences Cen	14	36	37	38	38	38
Trillium Health Centre	6	57	164	174	179	187
University Health Network	7	289.5	70	74	91	72
<b>TOTAL</b>			1911	1945	1980	2015

# Some Other CCO Projects

- Projecting demand for Systemic Therapy
- Improve colonoscopy capacity by designing an ideal colonoscopy suite
- Chemo therapy patient scheduling

# Health Human Resources Modelling



# Predicting Cardiac Surgeon HHR

- Cardiac Care Network of Ontario (2006)
- Cardiac Surgery rates in decline
- PCI (angiography) increasing
- Takes 11+ years to train a cardiac surgeon
- How many will we need in 2020?
- Built Systems Dynamics model

# The Systems Dynamics Model: Cause & Effect

## Legend

A  $\xrightarrow{+}$  B  
If A increases, then B increases above what it would have been

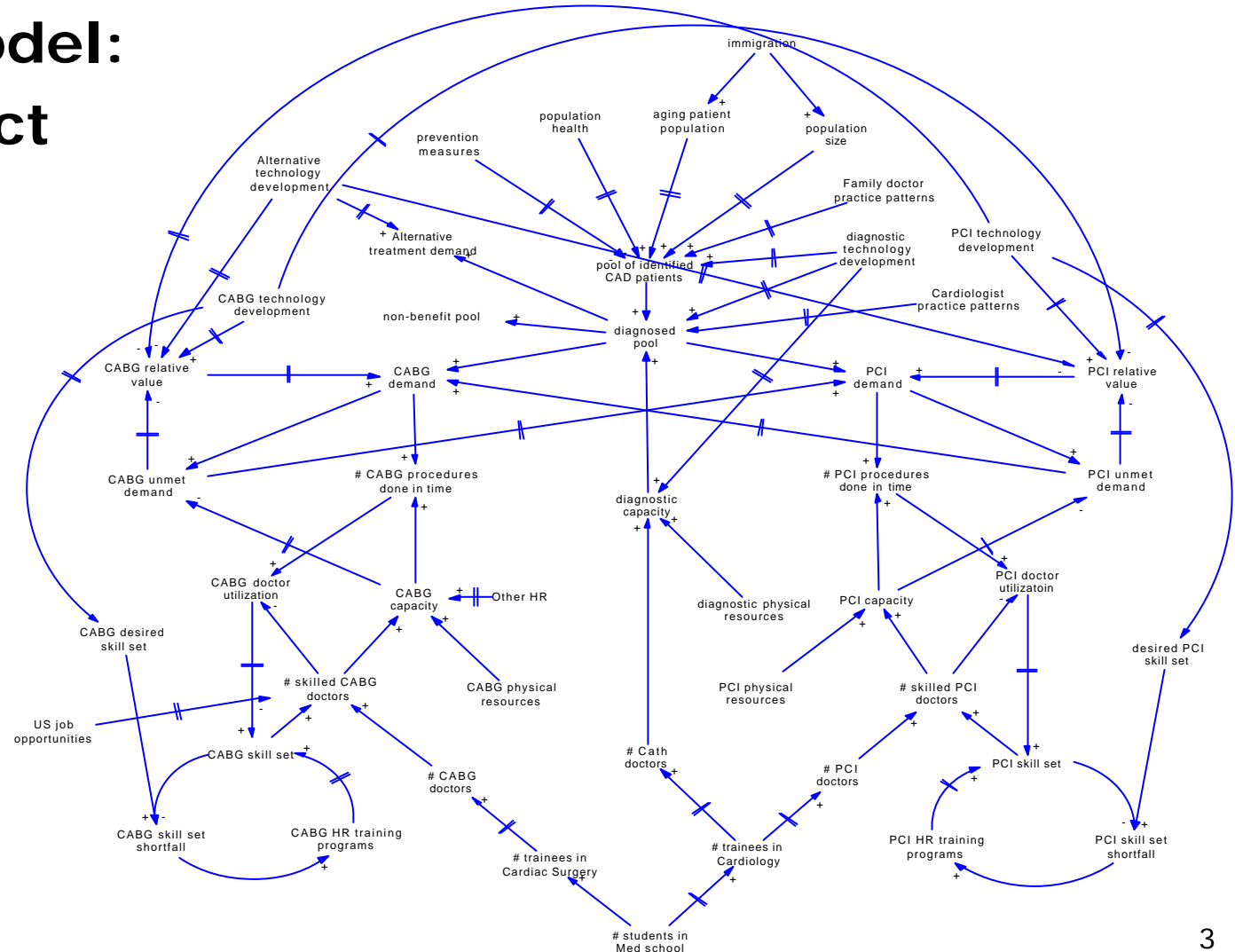
C  $\xrightarrow{-}$  D  
If C increases, then D decreases below what it would have been

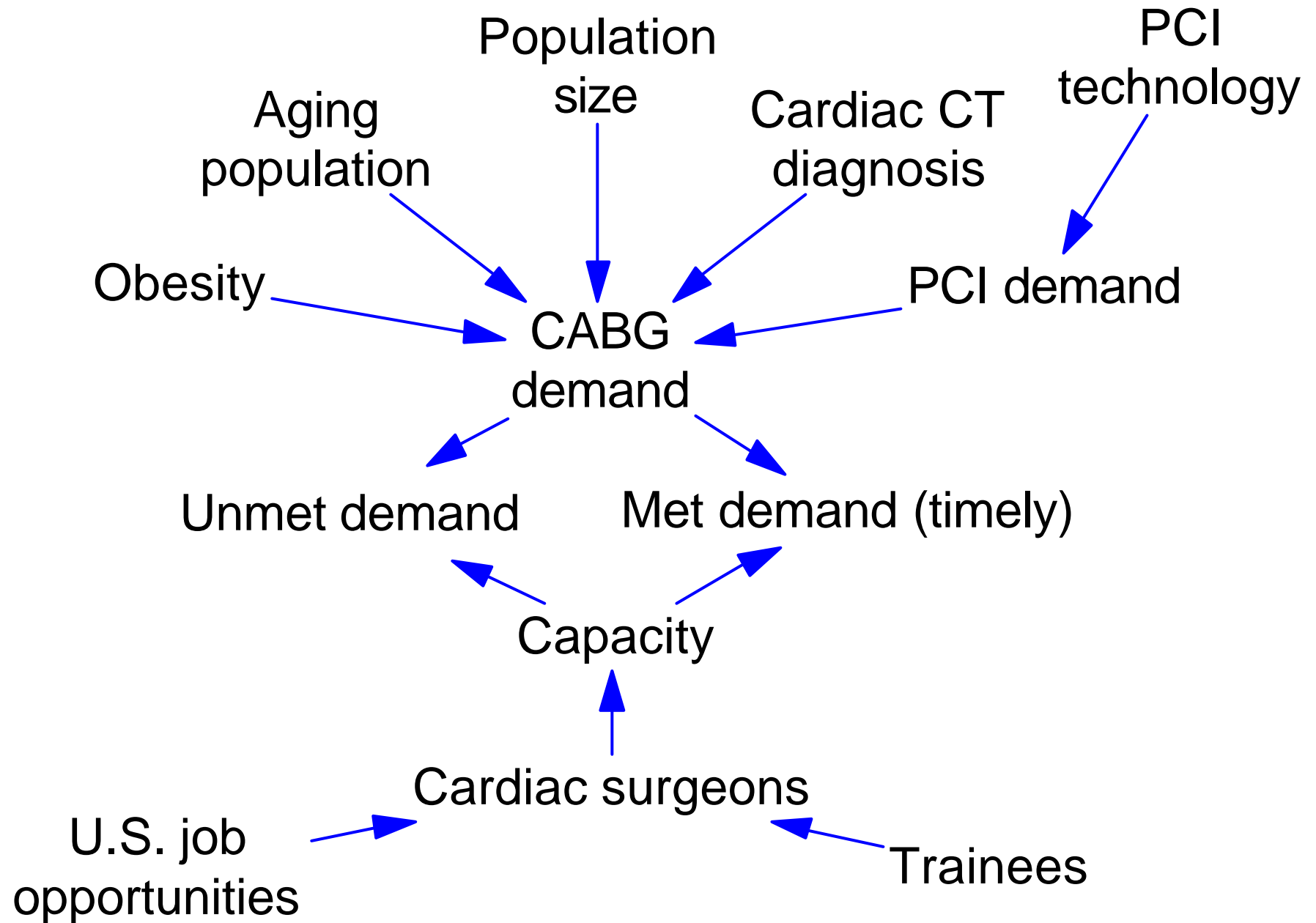
E  $\parallel$  F

Latency between a change in E and the resulting change in F

**1**

Number of the key relations. Explanations below refer to these numbers.





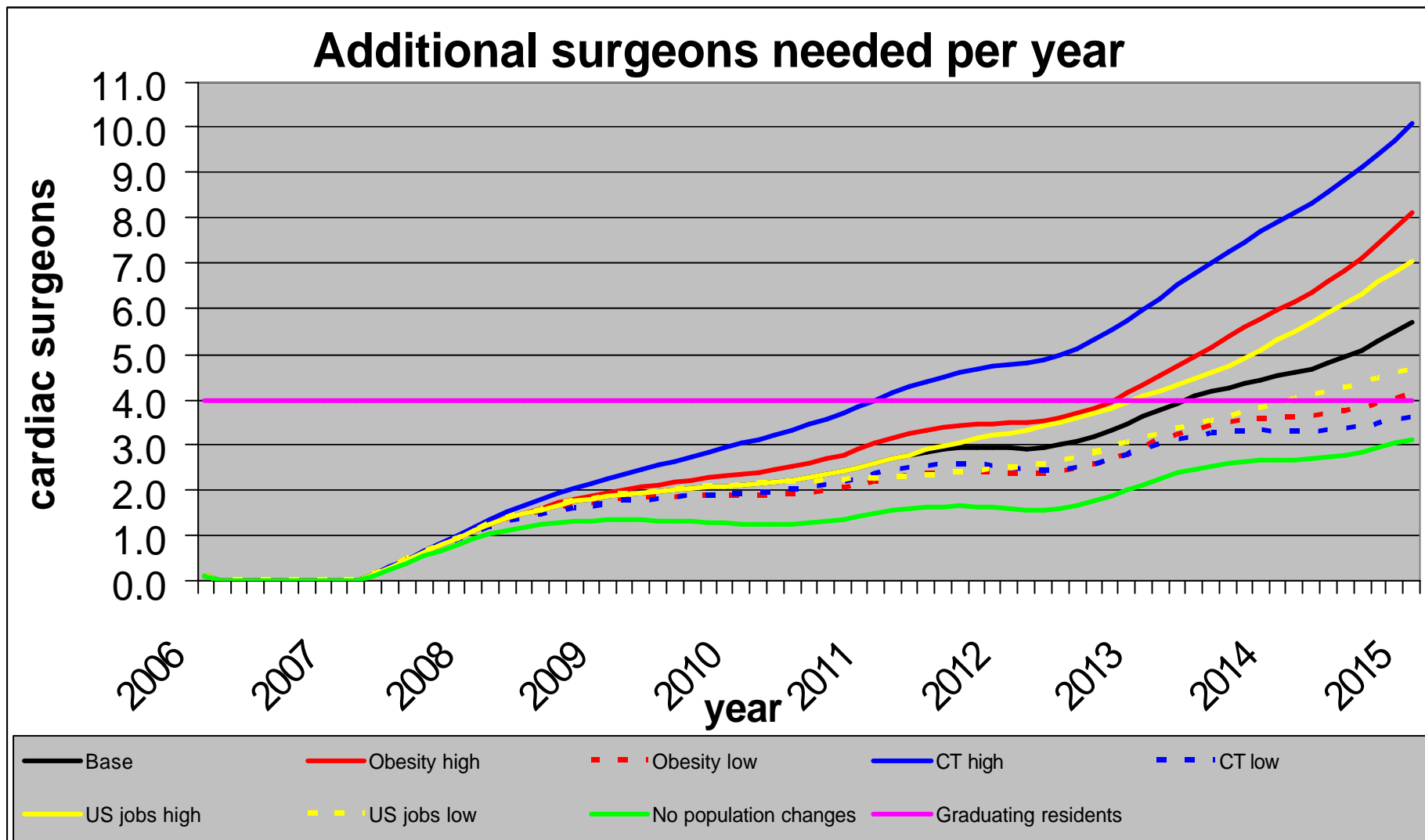
## Key change drivers analyzed

- The aging population
- Cardiac CT diagnosis
- Obesity
- U.S. job opportunities for cardiac surgeons from Ontario

# Key assumptions till 2015

1. Cardiac population mirrors general population
2. Aside from developments in biodegradable stents and cardiac CT diagnosis, the PCI/CABG ratio has equilibrated at 2.54.
3. A cardiac surgeon does 140 CABG procedures a year.
4. Four cardiac surgeons graduate each year.
5. One retirement each year.
6. If no job in Ontario: grads will leave the Province.
7. All grads are considered to be equal quality.

# Need for HR planning



# Cardiac surgeon age distribution

<i>Age group</i>	<i>Number of cardiac surgeons</i>
< 40	10
40 – 49	25
50 – 59	12
60 – 65	5
> 65	2
<b>Total</b>	<b>54</b>

# Other HHR Projects

- Canadian Society of Cardiac Surgeons
  - Develop a model for Canada (current)
- Alberta Health & Wellness
  - Model for ***demand*** for GPs, Nurses and Med Techs for next ten years
  - Partners: Praxia and Hay Group



# Toronto EMS 911 Calls

Jason Coke, Gillian Chin (U of T) and David Lyons (EMS)

- Analyze 911 call-taker shift schedules
- Require response on second ring
- Impact of staff breaks
- Impact of future demand (+15%)



# CE LHIN: Ageing at Home

- Developing a GIS model for quantifying the demand gap for Ageing at Home services: meal delivery, transportation, respite, adult day programs and supportive housing.
- Estimates demand and the relative gap in supply by geographical region