Hôpital général juif
Jewish General Hospital

A Prescriptive Analytics Project For Maximizing Healthcare Value Generation At The Sir Mortimer B. Davis Jewish General Hospital

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RIVERLOGIC

Agenda

- **Project Motivation**
- The Model
- Data Needed For The Model
- Model Limitations
- Evaluated scenarios
- Future Potential

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Project Motivation

- The Sir Mortimer B. Davis Jewish General Hospital:
  - Is a full service university affiliated medical center
  - Operates 537 beds
  - Provides a broad range of inpatient and outpatient services
  - Has major tertiary & quaternary cardiovascular, neurosciences, oncology(including robotic surgery) and colo-rectal programmes
  - Performs 12,000 - 13,000 operative procedures per year
  - More than 23,000 admissions per year
  - More than 67,000 ED visits per year (in old ED)

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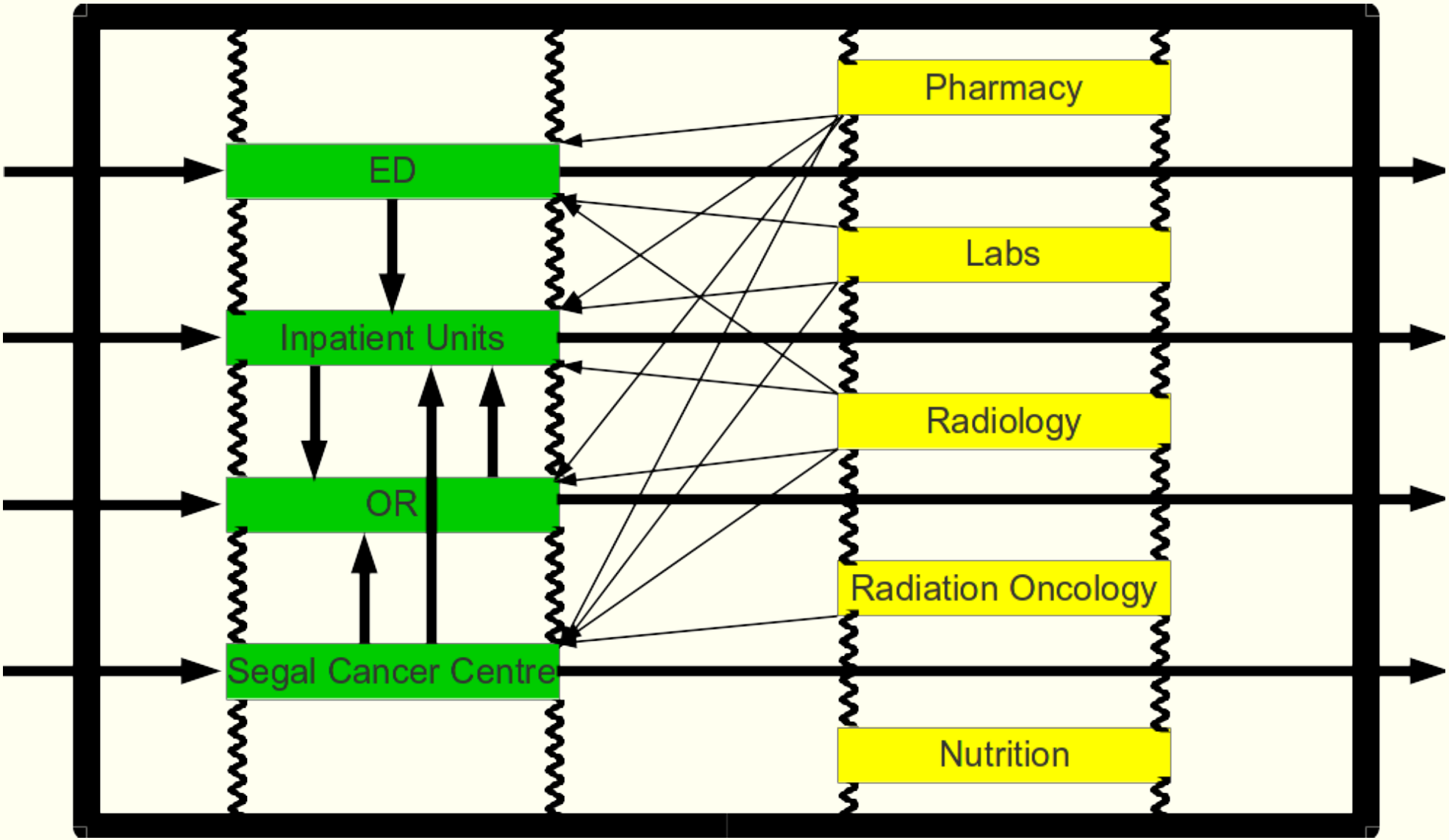
Project Motivation – Hospital With Interconnected Constraints/Patient Flows



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Project Motivation

- Interactions between different areas of the hospital:
  - Patient flows
  - Constrained resources
- Little understanding of how resource consumption in one area affects patient flow in other areas
- No measure of healthcare value
- No ability to evaluate proposed solutions
- Major budget deficit
- Few attempts to maximize:
  - Healthcare value: Output / Costs
  - Healthcare output subject to cost constraints

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Project Motivation

- The hospital is currently doing an analysis/evaluation of all of the programmes in the hospital with respect to:
  - Value to community
  - Efficiency
  - Patient orientation
  - Strategic fit

- While very valuable, just picking the “best” programs may cause major problems for the hospital if those programs don't fit well together

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Modeling Needs

- The hospital needed a model that could:
  - Handle patient flows into ED, inpatient units, ODS, Segal Centre
  - Relate flows between different parts of the hospital
  - Relate flows to resource consumption
  - Relate flows to healthcare output
  - Relate flows to strategic plan
  - Optimize the hospital's performance
- This lead to proof of concept project with CGI and River Logic

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The Model

- Linear Programming
- Equations relating incoming patient flows to resource consumption
- Equations relating patient flows to patient flows in other parts of the hospital
- Cost constraints (potentially)
- Objective function

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The Model

- Is implemented using River Logic's EO (Enterpise Optimization) engine
- Modelers do not enter equations
- Modelers do input tables of:
  - Processes
  - Resources used by processes
  - Mapping between processes and resources
  - Presentation quantities for each process
- EO's rule based capabilities generate equations from input tables and model diagram

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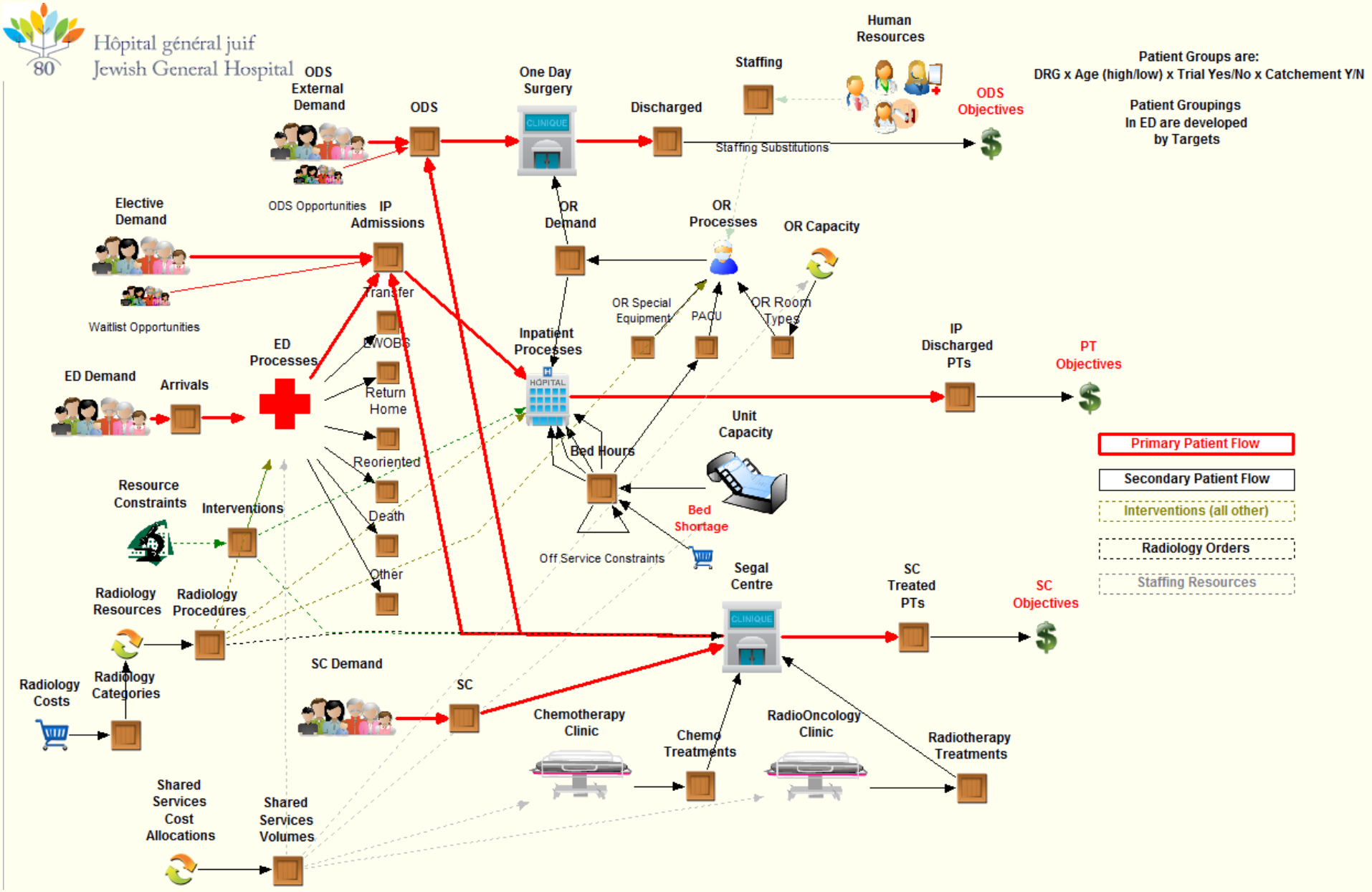
The Model



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Model Decision Variables

- Categorized patient flow quantities into:
  - The emergency department
  - Inpatient units (for deliveries and elective surgical procedures)
  - One Day Surgeries
  - Segal Center

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Model Objective Functions

- Maximize weighted sum of outputs from programme committee
- Maximize sum of healthcare outcomes
- Minimize total cost (subject to minimum production levels)

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Data Needed For The Model

- For each process need:
  - Patient groupings (corresponding to decision variables) with arrival rates
  - Process for each patient grouping
  - Resources/Interventions needed/performed for each process
  - Disposition for each group
  - Mappings between:
    - Patient groupings and processes (if not 1:1)
    - Resources/interventions and processes

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Data Needed For The Model – ED Processes

- **ED Patient Visit Groupings:**
  - Divertable Non Admitted Nursing Home Patient (DNANHP)
  - Divertable Medical Admission Nursing Home Patient (DMANHP)
  - Divertable Segal Centre Patient (DSCP)
  - Fast Track Visit (FT)
  - Frequent Flyer (FF)
  - Other Visit (O)

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Data Needed For The Model (ED Processes – Groupings & Arrival Rates)

DNANHP Divertable Non Admitted Nursing Home Patient Visit	DMANHP Divertable Medical Admission Nursing Home Patient Visit	DSCP Divertable Segal Centre Patient Visit	FT Fast Track Visit	FF Frequent Flyer Visit	O Other Visit	Annual Volume
					X	31239
				X		2642
						36303
				X		1176
						152
				X		31
						30
		X	X	X		5
	X					460
	X			X		51
	X		X			3
	X	X				1
X						989
X				X		164
X			X			81
X			X	X		14

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Data Needed For The Model (ED Processes)

DNANHP Divertable Non Admitted Nursing Home Patient Visit					
DMANHP Divertable Medical Admission Nursing Home Patient Visit					
DSCP Divertable Segal Centre Patient Visit	X	X	X	X	X
FT Fast Track Visit					X
FF Frequent Flyer Visit				X	
O Other Visit					
Area	POD	RAZ	Resuscitation	POD	FastTrack
Yield	95.0%	1.5%	3.5%	100.0%	100.0%
Mean LOS	18.7	3.8	27.2	18.8	4.6
Mean Nursing Hours Per Patient	4.7	0.8	13.6	4.7	0.2
Mean Lab Cost In Dollars	$0.48	$0.00	$0.00	$0.00	$0.33
Mean Medication Cost	$12.96	$0.00	$76.94	$2.87	$0.00
Admitted	22.1%	0.0%	71.4%	13.9%	0.0%
Deceased	0.0%	0.0%	0.0%	0.0%	0.0%
LWBS	0.0%	0.0%	0.0%	0.0%	0.0%
Reoriented	0.0%	0.0%	0.0%	0.0%	0.0%
Returned Home	77.9%	100.0%	28.6%	86.1%	100.0%
Transferred	0.0%	0.0%	0.0%	0.0%	0.0%

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Data Needed For The Model (ED Processes - Interventions)

Intervention	Cost
CONSULT Asthma Nurse	?
CONSULT Diabetes Nurse	?
CONSULT Discharge Planning Nurse	?
CONSULT Nutrition Support	?
CONSULT Occupational Therapy	?
EXAM Abdominal Series (A/S)	?
EXAM Angio:	?
EXAM Ankle (Stress View)	?
EXAM Barium Swallow	?
EXAM Bladder scan	?
EXAM C.Spine (Cervical) Spine	?
EXAM C/SC	?
EXAM CARDIO (Cardiac Echo) Transthoracic Echocardiogram (TTE)	?
EXAM CARDIO Exercise Stress Test (EST)	?

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Data Needed For The Model (ED Processes Map To Interventions)

DNANHP	DMANHP	DSCP	FT	FF	O	Area	Intervention	Mean/Visit
	x			x		Resuscitation	EXAM CXR (PORTABLE)	1.0
	x					Resuscitation	EXAM CXR (PORTABLE)	0.9
x				x		Resuscitation	EXAM CXR (PORTABLE)	0.7
				x		Resuscitation	EXAM CXR (PORTABLE)	0.6
		x				Resuscitation	EXAM CXR (PORTABLE)	0.6
					x	Resuscitation	EXAM CXR (PORTABLE)	0.5
x		x				POD	CONSULT Physiotherapy	0.5
x						Resuscitation	EXAM CXR (PORTABLE)	0.5
	x					RAZ	CONSULT Physiotherapy	0.3

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Limitations

- Not a discrete event simulation – thus effects of variability in supply, demand and resource consumption are not reflected in model
- Hard to determine/relate outcomes to numbers on a single scale that can be maximized
- Data issues
  - Existence:
    - Episode ID
    - Cost data
  - Finding it
  - Getting it
  - Need for cleaning

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Model Scenarios

Program Scenario	What If Impact on Access, Quality and Cost
Discharge improvement programs	• Will LOS be reduced for a specific cohort of patients? • Will making beds available reduce blocking in the ED?
Bed Turnover Process Improvement	• Will reducing bed turn over time result in increased bed availability? • Will beds become available sooner in the day? • Will there be a reduction in ED, PACU, OR blocking?
Geriatric Outreach to Nursing Facilities	• Can we reduce admissions in the ED and hospital and keep patients healthier? • Will beds become available and reduce blocking of other services?
Directed Outreach for ED "Frequent Fliers"	• If we keep FF out of the ED can we reduce hospital admits and keep patients healthier? • Will ED load be reduced? • Will there be a reduction in blocking?

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Model Scenarios

Program Scenario	What If Impact on **Access**, **Quality** and **Cost**
Weekend Oncology Clinic	· Will existing patients be treated more timely · Will there be a reduction in volume of patients being treated in ED · Will there be a reduction in Friday/Monday Oncology Clinic volumes
Oncology Partnership with Local Hospitals	· What is the impact on Oncology Casemix (towards harder cases) · Will consults that lead back to community hospitals improve ED patient flow · Will there be a reduction in off service beds
Reducing Oncology Volumes	• If we move standard chemotherapy or radiology to the community will sicker patients have better access • What is the impact on Oncology case mix (more complex oncology cases)
Appropriate Oncology Orders in ED	· Will appropriate orders by ED physicians reduce unnecessary tests and improve quality of care · Will movement of care management to Oncology improve ED patient flow; reduce level of effort, costs and time in ED; and improve quality of care

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Scenario Results

Program Scenario	Access to Care	Quality of Care	Estimated Savings	Data	Ability to Achieve	Program Impact
Discharge Program - FSA	7 Beds	-40% FSA Bed Days	$1M			
Discharge Planning System	84 Beds	-16% Bed Days	$13M			
Appropriate Oncology Orders	0 Beds	-200 CTScans	$10K			
ED Frequent Flyers	14 Beds	-2000 ED Visits	$3M			
Cancer: Catchment & Studies	20 Beds	Treatment nearer home	$18M			
Cancer: Increase Study Patients	4 Beds	Increased study patients	($0.4M)			
Weekend Drop-Iin Clinic	0 Beds	-100 ED Visits	$0.2M			
Divertable Nursing Home Patients	26 Beds	-500 admissions, -1800 ED visits	$5M			
Earlier PICC Lines	3 Beds	-1100 Bed Days	$0.4M			
FSA & Elective Procedures	1000 Procedures	Earlier surgery	$0			

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Future Potential

- Link objective function to work being done by program evaluation committee
- Evaluate effect of long emergency department stays causing longer inpatient stays
- Add newly available cost per case data

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Future Potential

- Extend to CISSS where objective function could be:
  - Minimize cost of satisfying all healthcare needs for CISS
  - Maximize health improvement of residents of CISSS subject to budget constraints
- Likely (hypothesized) results - Realignment of services to those institutions that can provide them best at least cost

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Future Potential

- For profit oriented healthcare systems:
  - Maximize revenue
  - Maximize healthcare improvement
  - Maximize weighted sum of the above

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Questions

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Contact Information

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