MACHINE LEARNING & AI FOR HEALTHCARE
A HIMSS EVENT

FEBRUARY 11, 2019
ORLANDO, FL

How AI Enabled a Community Hospital to Tackle Clinical Variation

And Reduce Length-of-Stay

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  - Why use AI for Managing Clinical Variation

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  - Our Results

Why reducing Clinical Variation Is Important

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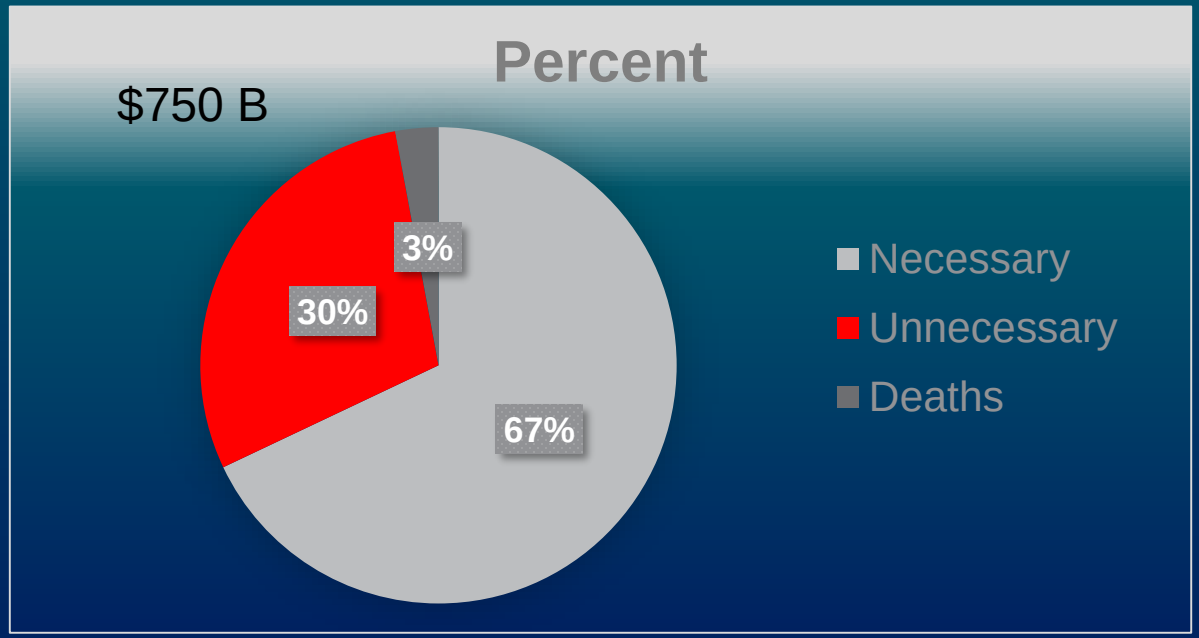
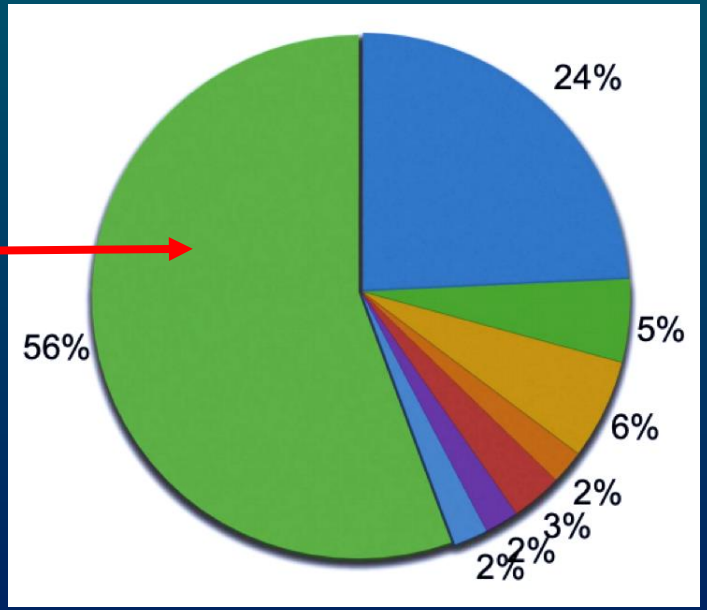
- Now the 3rd leading cause of death in Canada
- WHO reports 95,000 deaths in Europe due to Medical Errors (15th ?)

2012 Institute of Medicine



Variation in Healthcare Expenditures 2011 AHA

Unexplained



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- Special Cause Variation

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- Not knowing the difference will create wasted time & effort

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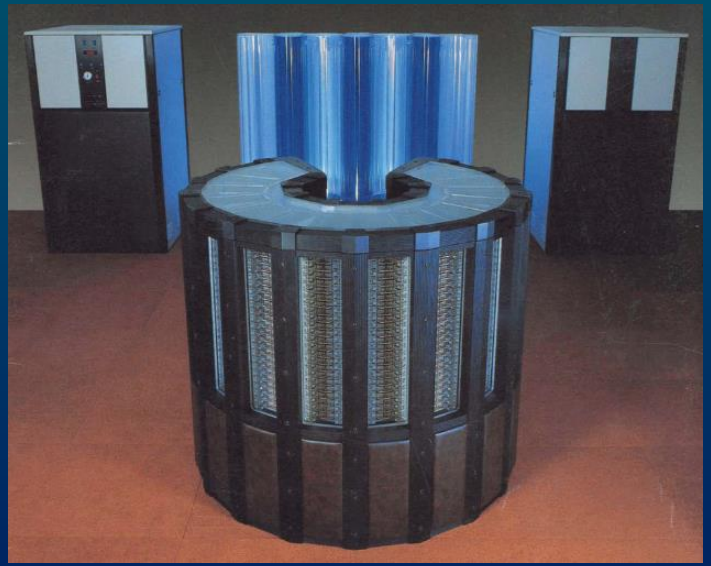
  - By the time we act, the data may have changed significantly

- Over the past several years, three things have changed
  - We now have massive computational power



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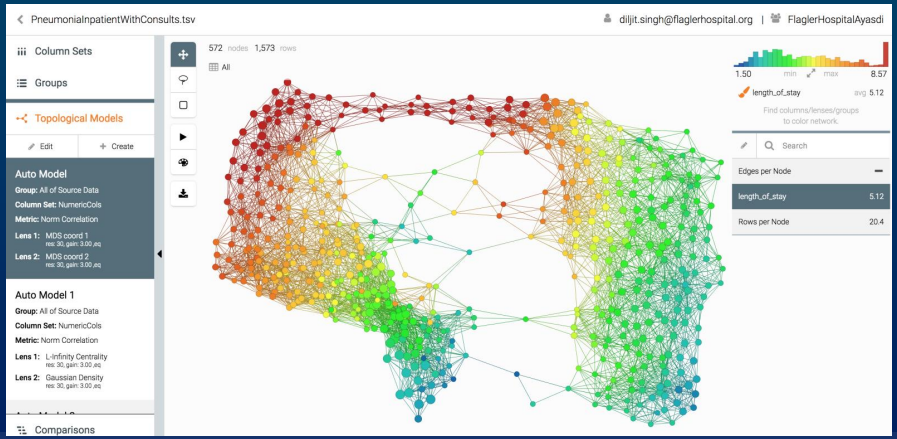
  - AI systems like Ayasdi can now look at all the data and answer questions we did not know to ask.



Methods of AI

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- Supervised Learning

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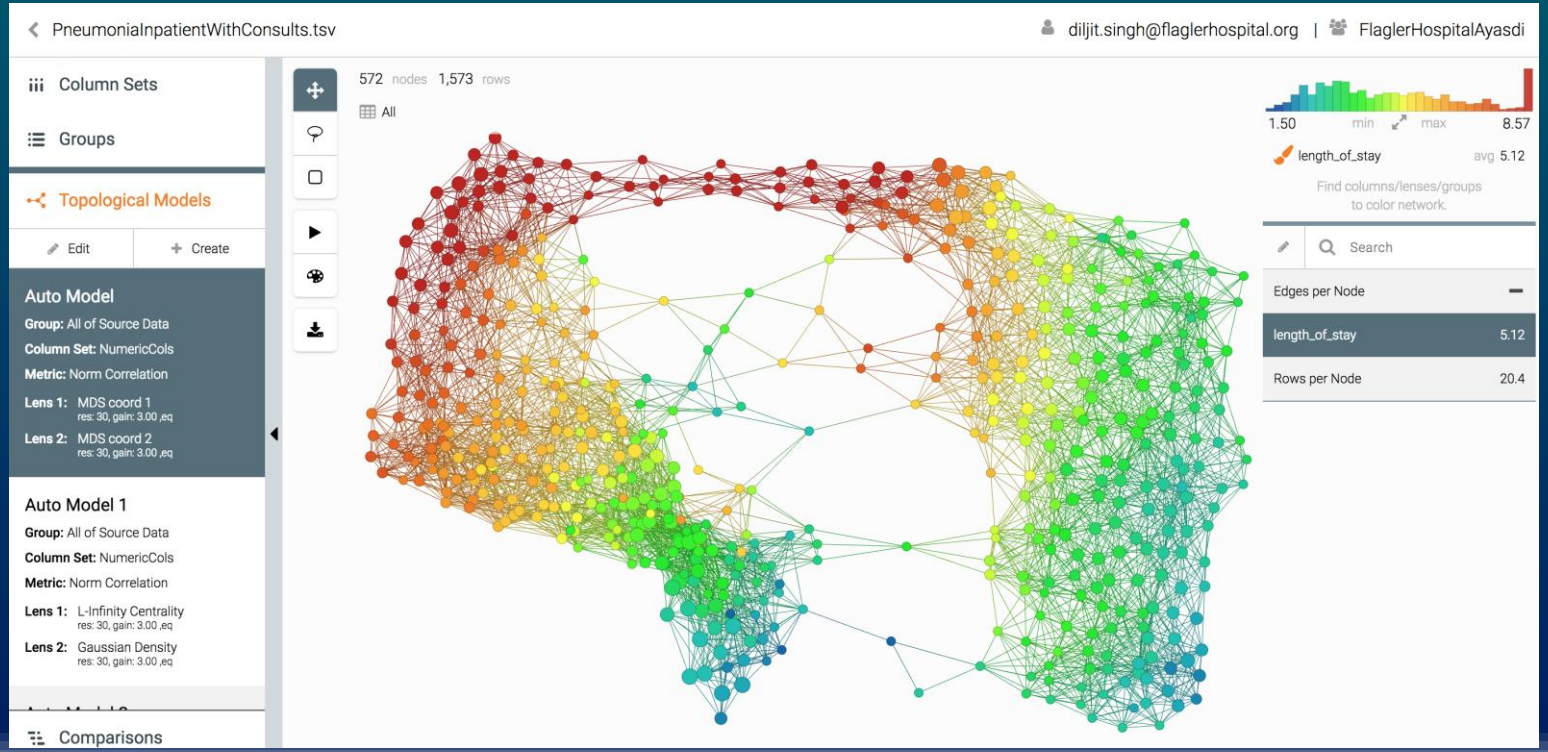
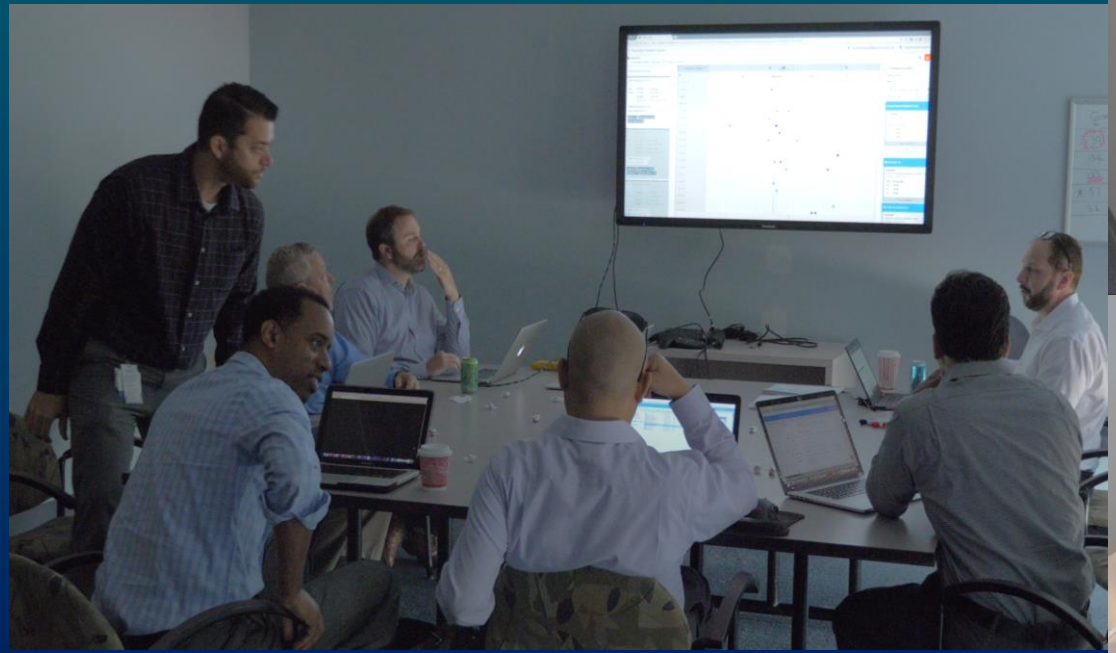
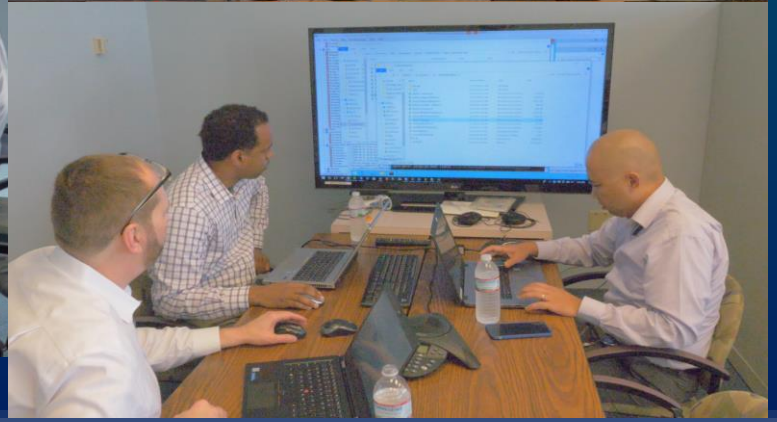
- Euler, in 1736 solution to the 7 bridges of Konigsberg

Topological Map of our Pneumonia Pilot



Or Team





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  - Begin monitoring our providers

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Pneumonia20180810 | Population Explorer

michael.sanders@flaglerhospital.org | FlaglerHospitalAyasdi

BASE

All Patients in Cohort | 1605 patients | encounter_UD_CarePathVersion has BASE

All Patients in Cohort

125 Patients at $3384

125 Patients	$3,384 Avg. DVC	4.54 days Avg. Length of Stay
	$3,197 Median DVC	4.00 days Median Length of Stay

Flagler Hospital (Mode: 125)

Patel, Jignesh (Mode: 12)

copd (36.0%) hypertension (77.6%) readmitted (0.8%) diabetes (67.2%) heart_failure (27.2%)

122 Patients at $2618

122 Patients	$2,618 Avg. DVC	3.24 days Avg. Length of Stay
	$2,344 Median DVC	3.00 days Median Length of Stay

Flagler Hospital (Mode: 122)

Soto, Jocelyn (Mode: 17)

copd (24.6%) hypertension (71.3%) heart_failure (29.5%) diabetes (27.0%)

106 Patients at $2273

106 Patients	$2,273 Avg. DVC	3.01 days Avg. Length of Stay
	$2,141 Median DVC	3.00 days Median Length of Stay

Flagler Hospital (Mode: 106)

Zeljko, Tomislav (Mode: 13)

copd (32.1%) hypertension (57.5%) readmitted (0.9%) diabetes (15.1%) heart_failure (20.8%)

TREATMENT GROUPS

Choose a treatment group to see their common carepath here.

d -12hr Index Point 12hr

ID: 1120612

Cost: $0.00

Stay: 3.00

dia htn readm

sodium chloride 0.9% Bolus

OVERVIEW

nutritional products (medication_administration:nut

Pre-Index | 3 hrs 39 mins

COST

DVC $0.00

DFC $0.00

TDC $0.00

sodium chloride 0.9% Bolus

OVERVIEW

nutritional products (medication_order:nutritional -C

Pre-Index | 3 hrs 39 mins

COST

DVC $0.00

DFC $0.00

TDC $0.00

CBC with Auto Differential

OVERVIEW

Hematology (diagnostic_order:HM) | ONE-TIME

Pre-Index | 3 hrs 39 mins

COST

DVC $0.00

DFC $0.00

TDC $0.00

Comprehensive Metabolic Panel

OVERVIEW

Chemistry (diagnostic_order:CH) | ONE-TIME

Pre-Index | 3 hrs 39 mins

COST

DVC $0.00

DFC $0.00

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TREATMENT GROUPS

Choose a treatment group to see their

d -12hr

Ayasdi Care

Secure | https://platform.ayasdi.com/care/procedures/6073842865699935 08/cohorts/compare/5404882639496797 63

PneumoniaInpatientWithOrderSetInfoAndSurgCat | Population Explorer

michael.sanders@flaglerhospital.org | FlaglerHospitalAyasdi

All Patients | COMPARED TO | All Patients

248 Patients at $2541 | 212 Patients at $3354

Search columns.

Continuous | Categorical

248 PATIENTS AT $2541
212 PATIENTS AT $3354

COLUMN NAME	KS SCORE	P-VALUE	DISTRIBUTION		
num_events	0.620	5.37e-13	44	90 / 137	259
fixed_direct_cost	0.281	2.70e-8	0	798.25 / 1037.62	3066.39
total_direct_cost	0.264	2.21e-7	0	3231.96 / 4137.37	11444.39
variable_direct_cost	0.252	9.31e-7	0	2409.62 / 3080.32	8892.44
encounter.length.value	0.246	1.96e-6	1	3 / 4	13
length_of_stay	0.246	1.96e-6	1	3 / 4	13
encounter.UD_InitialLactate	0.212	0.0164	0.3	0.96 / 1.6	13.29
encounter.UD_BMI	0.179	1.36e-3	12.6	25 / 27.5	114
encounter.UD_Age	0.170	2.65e-3	19	71 / 74	101
procedure.performer.name	0.120	0.0717	139	6659 / 5497	19432
encounter.UD_spO2	0.114	0.327	4	96 / 96	100
encounter.UD_InitialWBC	0.0732	0.560	2.8	11.6 / 11.5	92.4
encounter.UD_InitialAlbumin	0.0523	0.923	2.2	3.9 / 3.8	4.9
procedure.cost.directVariableCost	0.00	0.00	0	0 / 0	
procedure.cost.directFixedCost	0.00	0.00	0	0	

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Pneumonia20180810

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DUPLICATE OF Pneumonia CarePath from 216 Patients at $3166

DRAFT | ADHERENCE VIEW ON | Gap Analysis

Find an event.

- Diagnostic Order — 14 instances
- Diagnostic Report — 9 instances
- Medication Administration — 3 instances
- Medication Order — 3 instances
- Nutrition Order — 2 instances
- Procedure — 8 instances

ED - Pre-Admission	Admission - Index Point	Hospital Day 1st	Hospital Day 2nd	Hospital Day 3rd
2 hrs 49 mins	0	1 min	1 day	2 days
ED. PULM Pneumonia	PNU-AdmitDateTime	Start Next Meal	CR Chest 2 Views	CBC with Auto Differential
	MED. Pneumonia, Comm.Acquired (CAP)		CR Chest 2 Views	CBC with Auto Differential
Electrocardiogram		HSCans per meal 1	Comprehensive Metabolic Panel	
8 mins				
CKMB Profile		heparin flush 100 units/mL Injectable		
4 mins		enoxaparin Injectable		
Comprehensive Metabolic Panel		5 mins		
CR CHEST AP		Vital Signs		
7 mins		3 mins		
Urinalysis and Microscopic		cefTRIAXone IVPB		
2 mins		1 min		
Procalcitonin		cefTRIAXone IVPB		
1 min		18 mins		
Vital Signs		Oxygen Therapy		

ADHERENCE ON

Event Time: 0 Days 0 Hrs 0 Mins

Equivalent event

Specify an event that also qualifies as adherence to this event.

any MED

Find an event.

PULM. Nosocomial Pneumonia

Adherence Range

Adherence is achieved if the event happens.

FROM 60 mins before

TO 60 mins after

Admission - Index Point

Cancel | Save

Ayasdi Care

Secure | https://platform.ayasdi.com/care/procedures/2008749222915688309/carepaths/-2329974824014717173

PneumoniaInpatient

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Carepath from 80 Patients at $2309

DRAFT

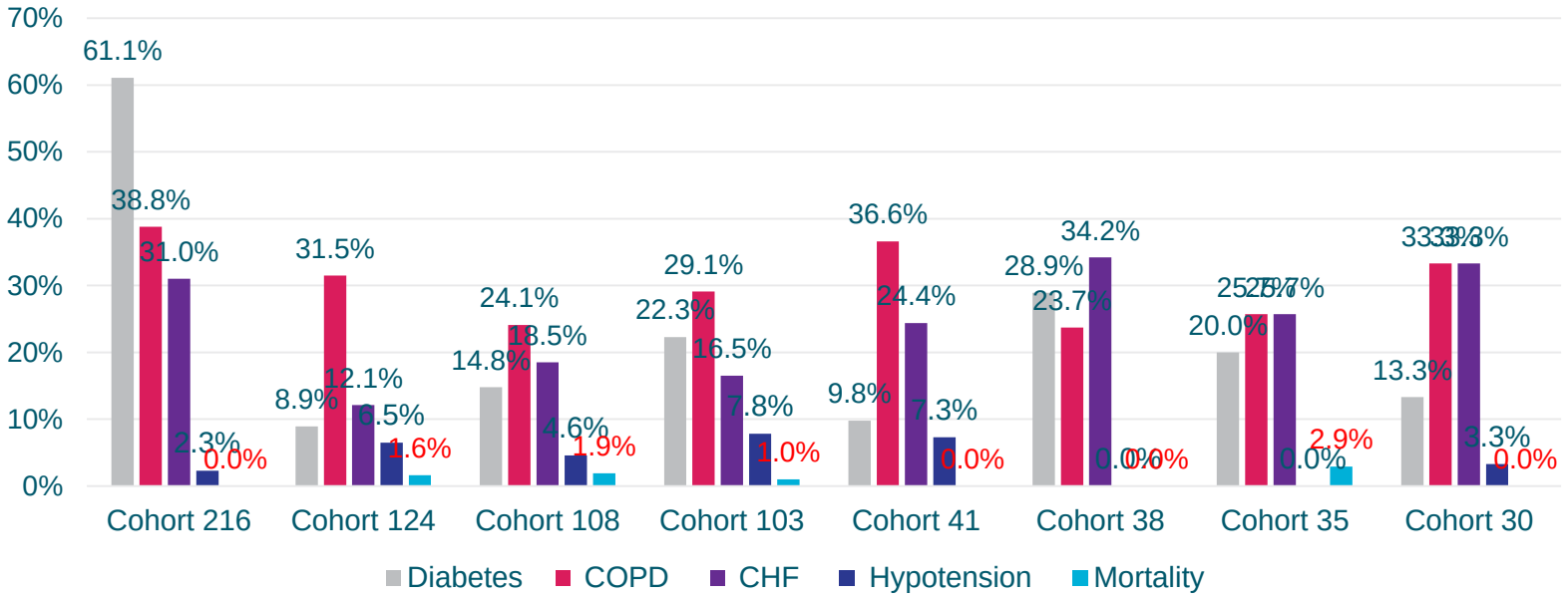
Close Gap Analysis

Gap Analysis

physician summary for All Patients

PHYSICIAN	NUM	ADH	DVC	STAY	READM	COPD
	127	No events	$3,878.69 $943.61 - $16,239.23	4.61 days 1.00 day - 23.00 days	0.8%	0.8%
	102	No events	$4,534.75 $633.76 - $26,022.60	5.84 days 1.00 day - 20.00 days	1.0%	2.0%
	83	No events	$4,507.50 $1,174.90 - $26,228.60	4.76 days 1.00 day - 16.00 days	0.0%	2.4%
	82	No events	$3,952.50 $0.00 - $23,742.55	4.82 days 1.00 day - 27.00 days	3.7%	4.9%
	75	No events	$4,461.70 $487.15 - $72,335.20	5.07 days 1.00 day - 39.00 days	2.7%	1.3%
	75	No events	$4,095.26 $1,052.30 - $15,375.72	4.79 days 1.00 day - 16.00 days	5.3%	4.0%
	72	No events	$4,893.87 $0.00 - $25,582.53	6.24 days 1.00 day - 32.00 days	2.8%	4.2%
	65	No events	$5,035.43 $138.98 - $17,237.41	5.09 days 1.00 day - 20.00 days	4.6%	7.7%
	61	No events	$4,599.11 $967.91 - $27,863.52	4.79 days 1.00 day - 27.00 days	6.6%	1.6%
	59	No events	$4,765.00 $1,765.38 - $14,321.16	5.25 days 1.00 day - 19.00 days	3.4%	3.4%
	51	No events	$3,900.94 $568.50 - $40,767.09	4.22 days 1.00 day - 21.00 days	3.9%	2.0%
	46	No events	$2,897.01 $711.77 - $12,779.78	3.30 days 1.00 day - 13.00 days	4.3%	2.2%
	45	No events	$5,799.50 $1,168.37 - $37,761.48	5.87 days 1.00 day - 35.00 days	4.4%	2.2%
	45	No events	$5,561.42 $1,047.25 - $20,731.06	6.56 days 1.00 day - 21.00 days	2.2%	0.0%
	40	No events	$4,787.79 $1,434.92 - $21,492.47	5.97 days 2.00 days - 14.00 days	0.0%	10.0%
	37	No events	$6,361.61 $615.65 - $20,257.51	7.51 days 1.00 day - 25.00 days	5.4%	5.4%
	30	No events	$5,428.86 $1,831.95 - $27,103.65	5.77 days 2.00 days - 27.00 days	3.3%	6.7%
	30	No events	$5,246.05 $1,850.34 - $14,439.94	6.03 days 1.00 day - 21.00 days	3.3%	3.3%
			$6,209.68	6.53 days		

Comorbid Conditions
Pneumonia



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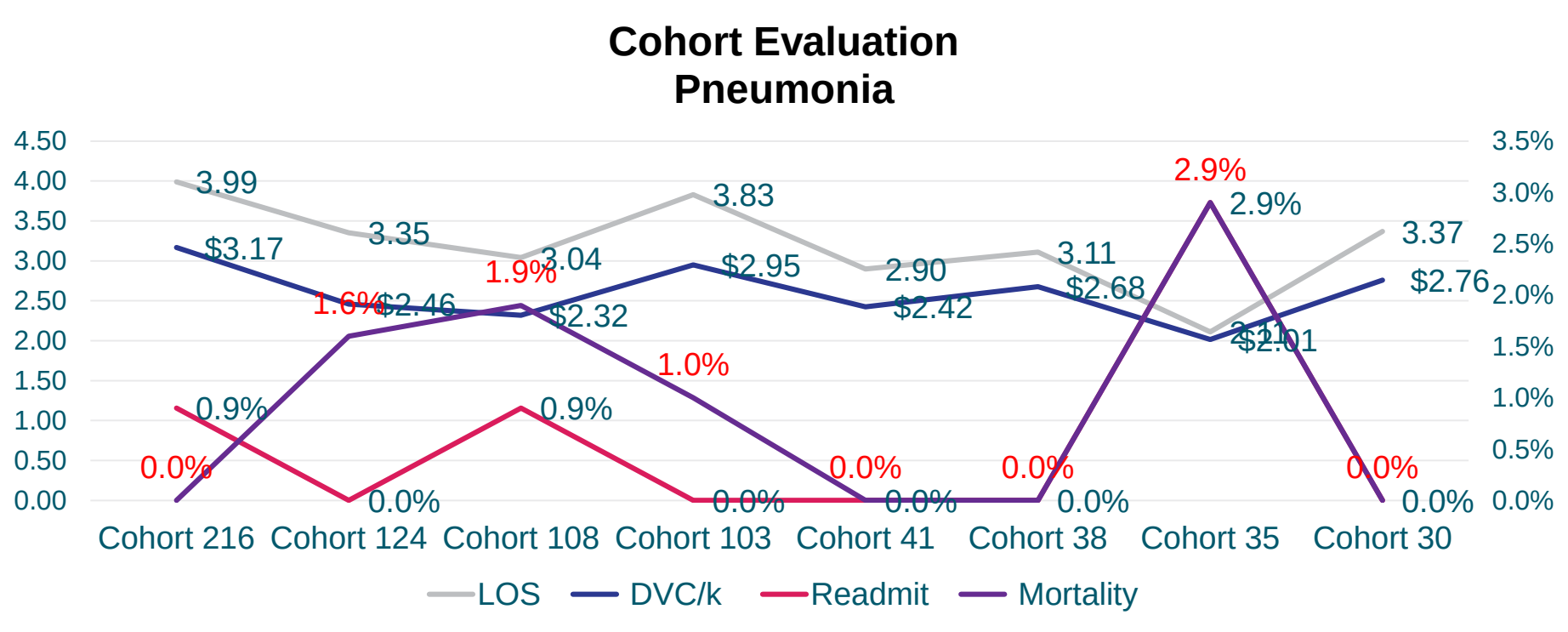

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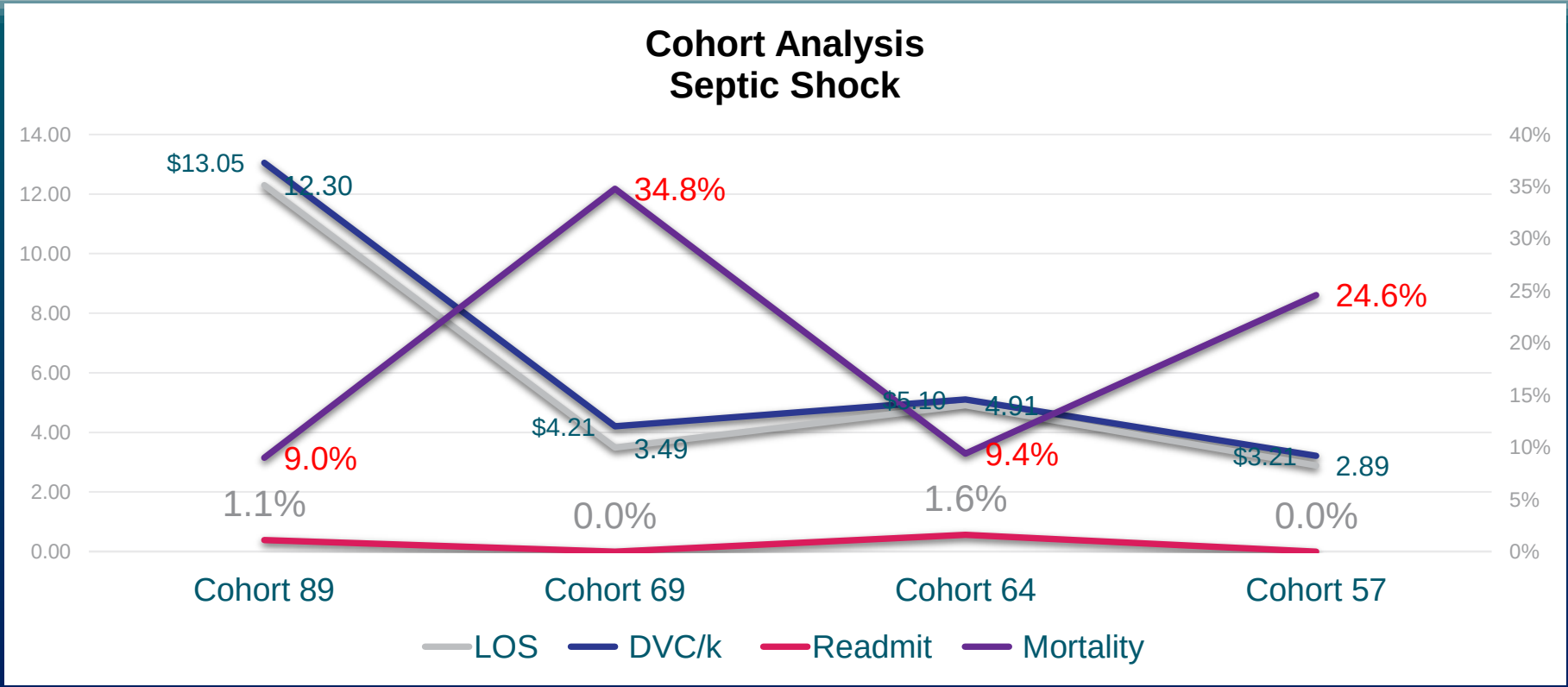

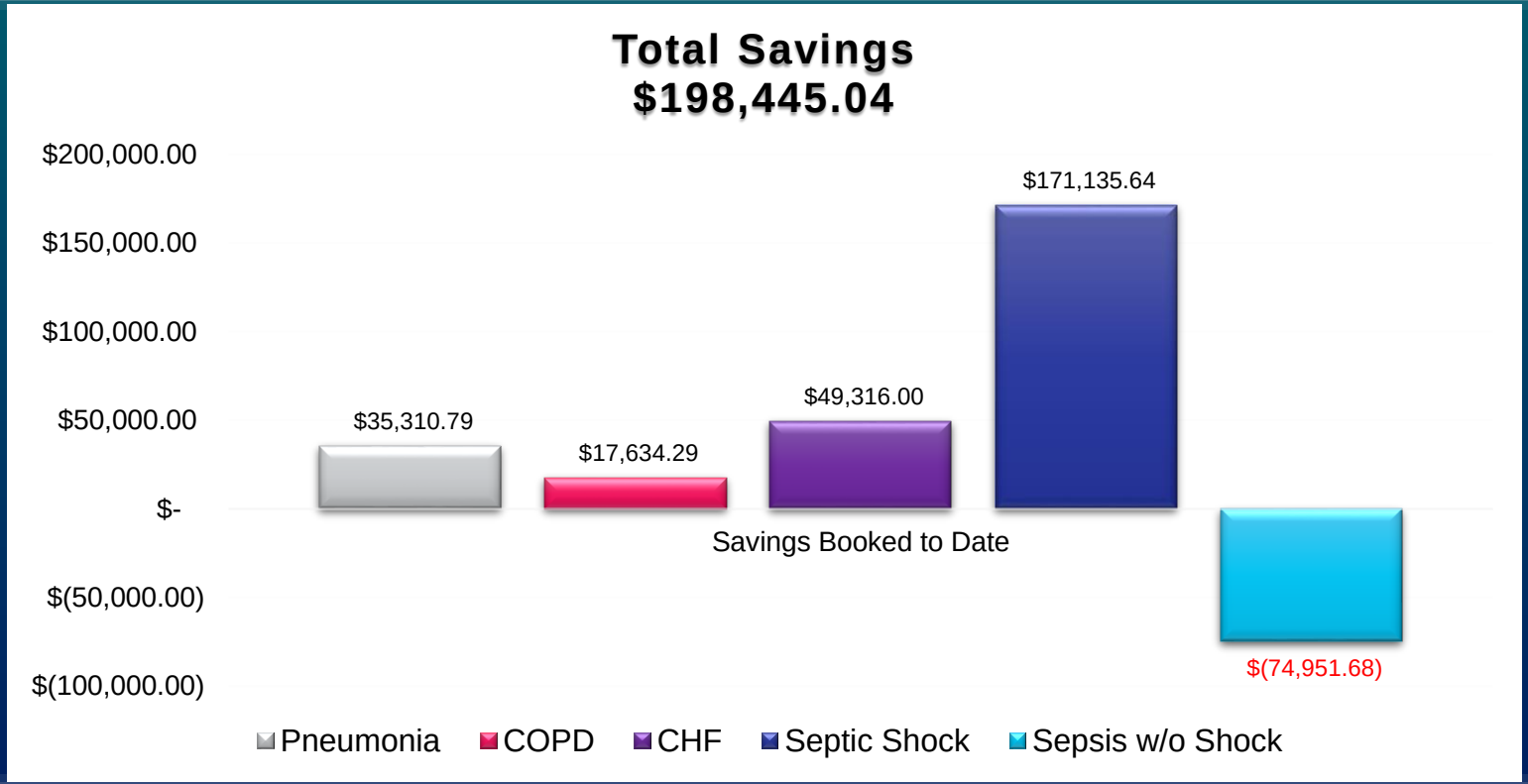
Total Savings
$198,445.04
$200,000.00
$150,000.00
$100,000.00
$50,000.00
$-
$(50,000.00)
$(100,000.00)
$35,310.79
$17,634.29
$49,316.00
$171,135.64
$(74,951.68)
Savings Booked to Date
Pneumonia
COPD
CHF
Septic Shock
Sepsis w/o Shock

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  - Work hard
- We can change the world!

Michael C. Sanders, M.D.

Flagler Hospital

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