Predictive Analytics and Accountable Care Organizations

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Data-Driven Performance.

Application of Models for Managing Populations and Provider Networks

Ron Russell

December 5, 2012

The Healthcare Challenge

What is Contributing to the Rising Trend in Spending?

$3 of every $4 spent in healthcare is on chronic disease*

Diabetics who are not compliant with taking their insulin, not visiting a physician, and not managing their weight will eventually end up in the ER or be hospitalized

Almost 18% of Medicare patients are readmitted within 30 days of discharge**

This outcome is often related to uncoordinated post-hospitalization care or a lack of focus on prevention and quality outcomes

- Diagnostic imaging from CAT scan and MRI contribute $26.5 billion in unnecessary use of health services***

  Fee-for-service payment systems incent providers to do more with too little focus on quality of care or appropriate utilization

*CDC
**CMS
***McKinsey Global Institute

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Accountability

- Reduce cost
- Improve quality
- Value based reimbursement
- Shared risk arrangements
- Bundled payments

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Successful population health management requires the effective application of predictive modeling and analytics to patients and providers

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Data Driven Strategy

Population Health Management

Identify patients with high-risk score AND at risk of expensive medical services

Practice Variation Management

Support providers with higher than expected utilization with care management services

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Choosing a Predictive Model

Age and gender only explain 3-5% of variation

Predictive models achieve up to 27% of variation at the individual and level and provide a highly accurate cost projection at the population group level

Today predictive models are tailored to payer type, a wide range of outcomes (cost, events, payment), and prediction periods

Prediction Period

- Concurrent predictive models (retrospective) measure the risk of population groups for an historic period, based on all of the conditions present in the period
- Prospective models predict risk for a future period based on the demographic and clinical mix of the population in the baseline period

    Diagnosis only or Diagnosis with prior cost and utilization

Outcome Predicted

- Medical plus pharmacy cost = Total risk
- Medical cost only
- Pharmacy cost only
- Primary Care funding
- Likelihood of hospitalization or Emergency Room encounters
- Range of utilization services

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Population Health Management

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Selecting Members for Care Management:

Clinical Interventions with an Impact

- Assess the health status of the population
- Identify the group of individuals at high risk of future utilization or poor health outcomes
- Focus on the subset of people that case managers believe they can impact through a defined intervention

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Allocate Resources to Highest Risk Patients Based on Predicted Cost

High Cost Case Identification

Generate a list of predicted high cost individuals

The Care Manager at the practice site can analyze the patient roster each month and provide a case review for each PCP

Focused on medication compliance, gaps in care, and regular office visits in an effort to avoid urgent care services in the ER, avoidable hospitalizations, and complications

								Selected Manageable Conditions				
Rank	Member ID	Age	Gender	Months Eligible in Baseline Period	Age/Gender Prediction	High Cost Case Prediction	Predicted Monthly Cost	Diabetes	CAD	COPD	CHF	Asthma
1	1277124301	56	M	1	1.70	59.92	$26,606	X		X		
2	524814701	60	M	12	2.13	52.54	$23,329					
3	1014874001	45	F	12	1.41	51.01	$22,649	X			X	
4	177752102	64	F	12	2.09	47.14	$20,930					
5	1307230903	1	M	12	0.70	47.11	$20					
6	1364122307	7	F	12	0.28	46.52	$20					
7	606841201	65	M	5	2.54	42.58	$18					
8	311666901	60	M	12	2.13	42.41	$18					
9	137203602	65	M	2	2.54	41.96	$18					
10	726372402	53	M	12	1.14	39.48	$17,5					

Incorporating conditions and prior utilization into predictions will improve the predictive accuracy of cost projections. These patients are high priority for care management

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Disease Registry of the Member Population

Clinical Condition	Prospective Risk Score	Total	Current	New	Rate /1,000	
					Plan	** Norm
Hypertension	2.33	14,431	11,585	80	104.3	77.1
Hyperlipidemia	2.02	10,225	8,475	36	73.9	66.4
Diabetes	3.01	7,291	5,490	41	52.7	44.7
Asthma	1.80	3,078	2,476	23	22.2	19.4
Coronary Artery Disease	4.00	2,812	2,129	28	20.3	14
Cerebrovascular Disease	4.73	1,084	813	11	7.8	5.7
COPD	4.62	958	708	12	6.9	5.1
Chronic Renal Failure	9.43	642	464	4	4.6	3.6

Clinical Condition	Cost PMPY		ER Visits/1,000		Adm/1,000	
	Plan	** Norm	Plan	** Norm	Plan	** Norm
Hypertension	$8,187	$9,911	341	325	146	138
Hyperlipidemia	$6,641	$7,943	226	222	85	84
Diabetes	$10,189	$12,672	380	372	192	177
Asthma	$7,129	$8,777	598	533	150	152
Coronary Artery Disease	$16,012	$23,555	626	641	391	407
Cerebrovascular Disease	$22,832	$33,288	935	964	587	580
COPD	$18,007	$28,209	756	860	486	494
Chronic Renal Failure	$32,240	$43,605	861	801	615	587

NOTE: the benchmark norm includes 11 Million lives and is adjusted for age, gender & region of the country

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Tools to Assess Care Strategies

Stratification of the Diabetic population by comorbidity

Diabetes by Comorbidity	Prospective Risk Score	Total	Current	Rate/1,000	PMPY	ER	ADM
All Diabetics	**3.01**	**7,291**	**5,490**	**52.7**	**$10,189**	**380**	**192**
Hypertention	4.02	2,238	1,825	16.2	$14,256	487	277
Complicated Hypertension	6.93	278	225	2	$22,632	740	470
Uncomplicated Hypertension	3.60	1,960	1,600	14.2	$13,051	451	250
Hyperlipidemia	3.26	1,315	1,135	9.5	$11,011	322	165
Back Pain	4.14	1,167	940	8.4	$13,601	501	258
CAD	5.67	758	593	5.5	$22,005	751	531
Cancer	6.38	436	327	3.2	$26,735	535	413
Chronic Renal Failure	11.48	235	178	1.7	$38,987	975	733
Cerebrovascular Disease	7.96	231	173	1.7	$32,748	1,283	914
COPD	8.70	185	130	1.3	$34,469	1,053	857
CHF	11.89	183	129	1.3	$52,476	1,622	1,339
Asthma	4.92	175	142	1.3	$19,614	852	441
Atrial Fibrillation	6.89	174	137	1.3	$32,658	882	785
Major Depression	5.47	173	134	1.3	$21,422	789	519

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Quantify Opportunities

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Target Individuals for Care Coordination

Cohort: Diabetes + Hypertension + Obesity without Antihyperlipidemic Rx= 20 Members

ID	220239164	Total Paid	$185,081.31	# of ER Visits	2	Height	N/A
Name	Blinded, Blinded	Medical Paid	$177,844.50	# of Admissions	3	Weight	176 lbs
Status	Current/Spouse	Pharmacy Paid	$7,236.81	# of Re-admissions	0	Smoking	No
Age/Gender	46/F	Highest Paid Diag	Diabetes	# of Office Visits	63	CM Status	N
RI/CGI	50/11	2nd Highest Paid Diag	Asthma	# of Scripts	65	DM Status	N
				ALOS	3.3 days		

Care Gaps

Gap#	Condition	Gap	Status
3401(E)	Diabetes + Hypertension + Obesity (E)	Patients without antihyperlipidemic drugs in the last 12 months.	
16016(E)	Hypertension (E)	Patients without thiazide diuretic in the last 24 months.	
3069(E)	Diabetes (E)	Patients without statin drugs in the last 12 months.	
3396	Diabetes	Patients without semiannual HbA1c test.	
2010(E)	Hypertension (E)	Patients without flu vaccination in the last 12 months.	
3064(E)	Diabetes (E)	Patients without retinal eye exam in the last 12 months.	
15148	Patients with Intervertebral disc disorder or back pain or neck pain, with seizure medication, muscle relaxants, benzodiazepines or opiates	Patients with more than 5 prescribing providers for the mentioned drugs	
8834	Narcotic use	Patients taking > 2 different and overlapping narcotic preparations in the analysis period.	
9015(E)	Two of claims for Pain Syndrome, opiates, insomnia or sleep medications in the last 12 months (E)	Patients without any antidepressants in the last 12 months.	
12085	ER Visits	Patients without primary physician office visit within 4 days after an ER Visit (not hospitalized)	

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Ambulatory Care Sensitive Admissions

1. **ACS admissions are potentially avoidable admissions given timely and appropriate ambulatory care**
2. **Their prevalence is influenced by age and the clinical condition mix of the population**
3. **Higher than risk expected rates may be indicative of restricted access to primary care services, delayed attention to a medical need, or poor patient compliance**
4. **Variation in ACS rates can lead us to a rich set of opportunities for care improvement and cost savings**

ACS Admissions Provide a Window on Ambulatory Care Management Opportunities

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ACS Conditions

Consensus around key factors that will reduce ACS admissions

- Improve access to primary care services
- Create clinical care teams
- Engage patients to foster compliance
- Strengthen social support systems

There is no “one” right rate

- The prevalence of chronic conditions will influence the likelihood of an ACS admission

ACS Conditions can be separated into Acute and Chronic

Selected Conditions

Top 5 Chronic Conditions of interest include:

- Angina
- Asthma
- Congestive Heart Failure
- COPD
- Diabetes

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Seeking ACS Admissions

Using a likelihood of hospitalization (LOH) model, we analyzed the ability of the model to correctly identify individuals at risk of hospitalization in general

Of the individuals listed in the top 0.5% at risk, 37% of them were admitted to the hospital in a 6 month period

Our assumption was that a significant proportion of admissions were potentially avoidable so we used ACS criteria to test our hypothesis

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Targeted Individuals Incur ACS Admissions that are Potentially Avoidable

Performance statistics for six-month validation study

ACS Admissions	Individuals with ACS Adm	ACS Admissions	Total Allowed	Days Incurred	Avg Cost	ALOS
ACS 0.5% LOH List	192	224	$1.4 M	1,010	$ 6,376	4.5
Cohort .05 - 5% LOH List	310	337	$2.3 M	1,335	$ 6,802	4.0
Cohort 6 - 20% LOH List	520	540	$2.4 M	1,679	$ 4,352	3.1

Reaching out to the top 0.5% of members proactively holds the potential of reducing admissions and improving outcomes through high quality ambulatory care

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List of ACS Admissions from the Study

Sample ACS conditions in six-month period top 0.5% Cohort

TOP VOLUME ACS ADMISSIONS	Individuals	# ADM	Total Allowed	Days	Avg Cost	ALOS
Bronchitis & Asthma	31	38	$172,634	125	$4,543	3.3
Gastroenteritis	26	27	$83,243	132	$3,083	4.9
Chest Pain	18	23	$132,381	72	$5,756	3.1
Pneumonia	17	17	$85,294	82	$5,017	4.8
Diabetes	16	20	$98,251	78	$4,913	3.9
COPD	13	15	$67,043	59	$4,470	3.9
Seizures	12	15	$52,738	35	$3,516	2.3
Cellulitis	7	7	$30,886	36	$4,412	5.1

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Accurate Identification of Individuals Most Likely to Seek Care in the ED

Likelihood of Emergency Department Encounter: Performance statistics for 6 month Validation study

Member Cohort on Likelihood List LOED	Individuals	Correctly Identified	Positive Predictive Value	Visit Count for these Individuals	Rate per Person
Top 0.5% on LOED List	1,251	1,031	82%	4,131	4.0
0.5 to 5%	11,292	6,253	55%	12,722	2.0

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Analysis of Emergency Room Encounters

Top 10 Diagnosis in ER for 6 month Validation study

Top 0.5% Members: LOED Model has 82% PPV			
Description Primary Diagnosis ED Visit	**Visits**	**Patients**	**Pct All Visits**
Acute Upper Respiratory Infection	1,524	1,376	1.9%
Fever, No other symptoms	1,394	1,259	1.7%
Otitis Media, No other symptoms	1,281	1,156	1.6%
Viral Infection, No other symptoms	591	567	0.7%
Acute Pharyngitis	467	440	0.6%
Cough	420	397	0.5%
Noninfectious Gastroenteritis	394	369	0.5%
Vomiting Alone	393	370	0.5%
Pneumonia, Organism	276	251	0.3%
Headache	276	246	0.3%
Total Top Ten Causes	7,016		**9%**
TOTAL ED VISITS	**81,583**	**76,034**	

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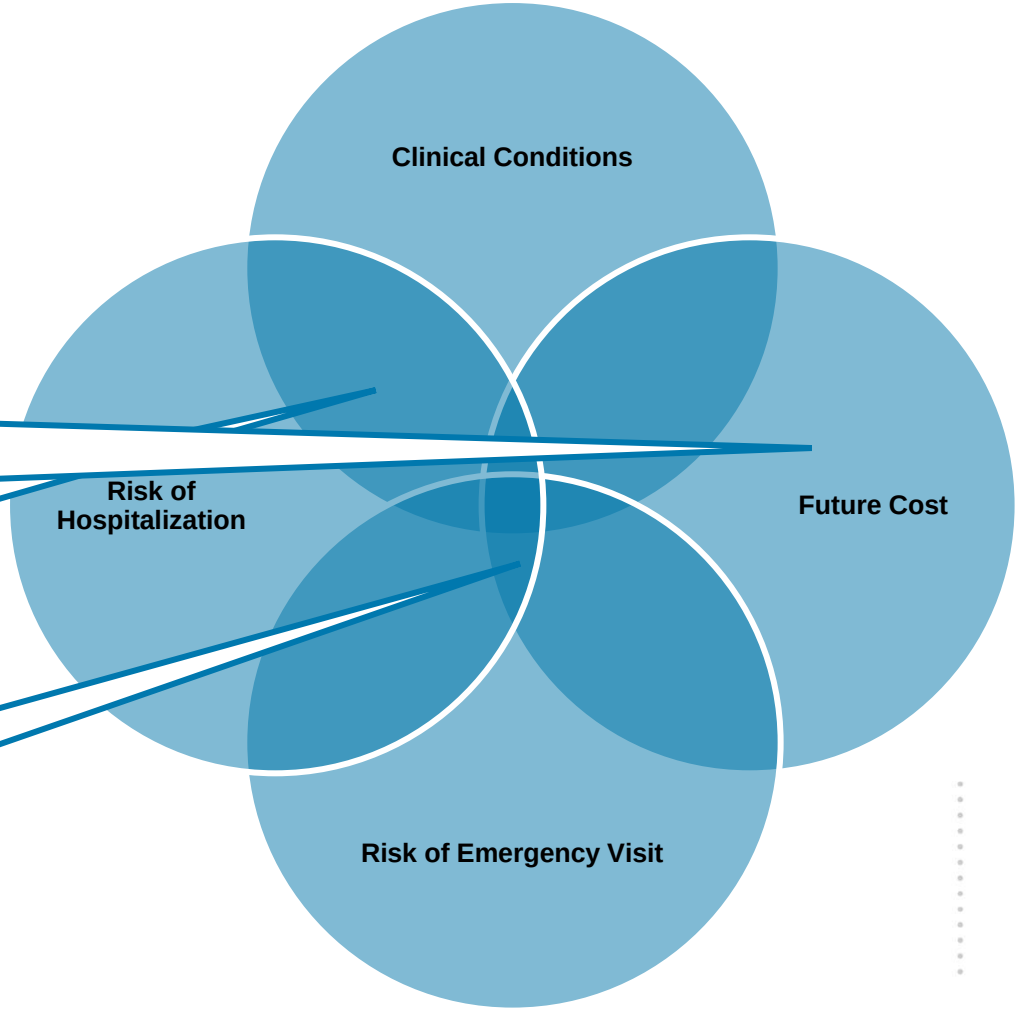
Bringing It All Into Focus

Data driven analytic tools allow for understanding risk and making decisions about where to focus resources

High cost case management

Programs for unstable clinical conditions

Complex case management at the epicenter of risk



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Practice Variation Management

Building a Strong Primary Care Foundation

- Primary Care Activity Level model can be used for prospective payment
  - Risk score reflects the resource intensity for direct primary services and for care coordination services
  - Individual scores varied from 16 times average for the top 0.5% of the physician panel to a low of 1/10th the average for the lower 30% of the panel

http://journals.lww.com/lww-medicalcare/toc/2012/08000

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Building a Strong Primary Care Foundation

- Service utilization models estimate the comparative rate of hospitalization, readmissions, ACS admissions, ER, specialty physician services, diagnostic testing, outpatient imaging, and pharmacy cost

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Building a Strong Primary Care Foundation

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Commercially Insured Populations

- ❑ There is not one “right” rate for ACS admissions
- ❑ Benchmarks are useful
- ❑ Risk adjustment is essential

Admission Category	Verisk Health Benchmark	Commercial Client Example	Client Tiered Network Provider	Variation from Risk Expected Rate
All Admissions	53.7	59.9	121.7	1.07
Chronic Condition Admissions	19.1	20.6	54.0	
ACS Admissions	7.8	9.0	21.2	1.36

The annual ACS rate is 36% higher than risk

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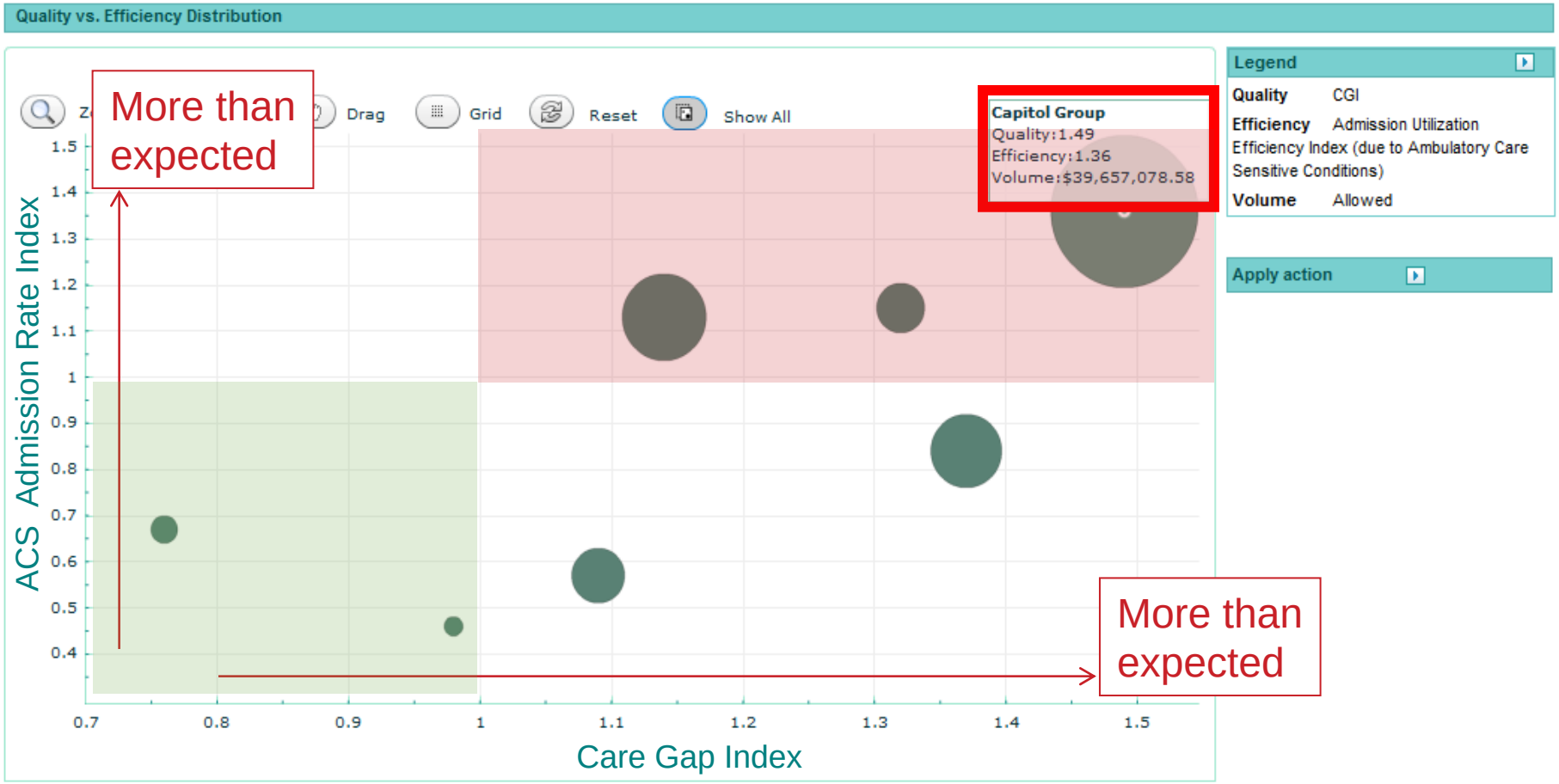
Comparative Performance Profiles

Plotting two quality measures for seven large provider groups: care gap index and ACS admission ratio of actual-to-expected rate



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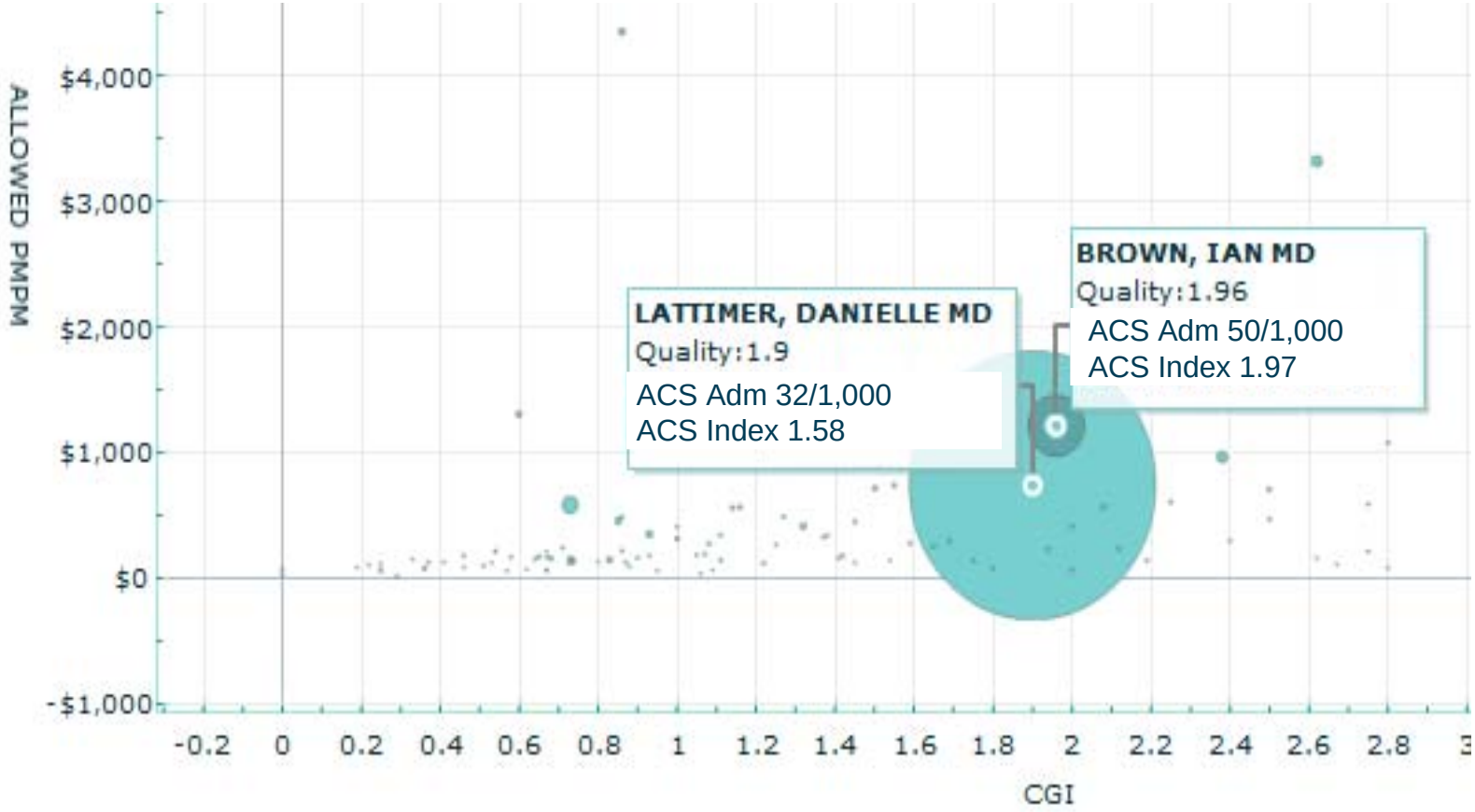
Comparative Performance Profiles

Two of the Capitol Group providers with large patient panels have a high care gap index and higher than expected ACS Admission rate



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Performance Profile Physician with the Largest Practice

General Analysis		Selected Provider	Client Norm
Demographic Metrics			
	% Female	68.24%	52.04%
	Relative Risk Score	2.28	1.06
	Most Prevalent Disease	Hypertension	-
Quality and Outcomes			
General Metrics			
	CGI	1.90	1.25
Efficiency and Cost			
General Metrics			
	Allowed PMPM	$740.19	$373.95
	Top-Coded ($250K/yr) Allowed PMPM	$739.99	$360.06
	Top-Coded Cost Efficiency Index	0.89	0.94
Inpatient Metrics			
	Admission Allowed PMPM	$193.14	$96.12
	Admission Count	382	8,898
	Re-admission Count**	1	23
	Re-admission Rate per 1000**	0.49	0.15
	Inpatient Re-admission Rate(IRR)**		
	Overall	0.029	0.023
	Admission Rate Per 1000*		
	Overall	186.07	59.88
	Chronic Persistent Conditions	78.42	20.61
	due to Ambulatory Care Sensitive Conditions	31.66	8.96
	Admission Utilization Efficiency Index		
	Overall	1.21	0.93
	due to Ambulatory Care Sensitive Conditions	1.58	1.03

The provider's illness burden is 2.2 higher than average

The Provider's care gap index is higher than peers

Total cost of care is lower than risk expected cost

Admission rate is 21% higher than risk expected

ACS Admissions are 58% higher than risk expected

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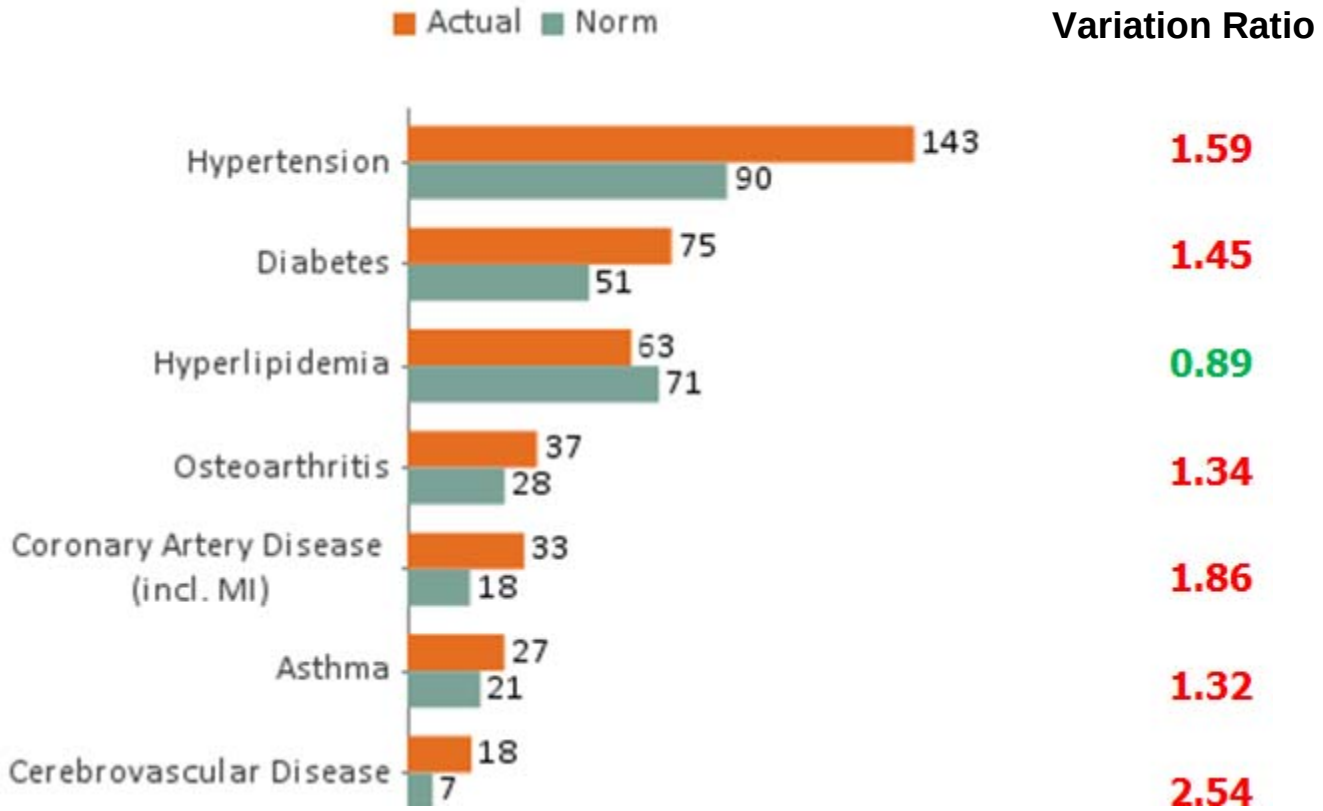
Chronic Condition Prevalence in this Provider's Panel



The prevalence of chronic conditions is a factor in the calculation of the provider's expected ACS admission rate

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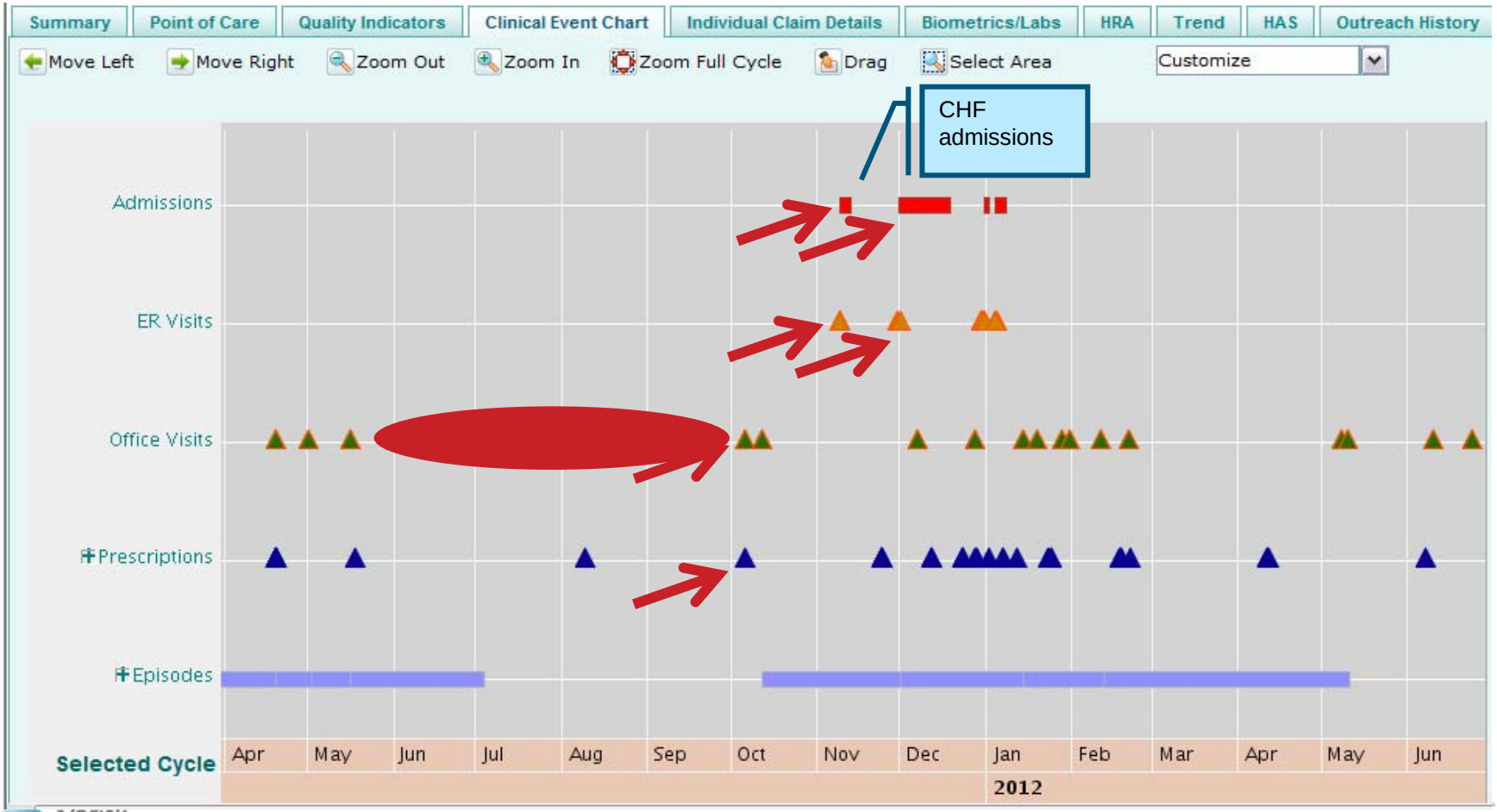
Sample Timeline for a Patient with an ACS Admission

Signature of a patient history with low office encounters, exacerbation of a cardiac condition, resulting in two ACS admissions for CHF



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Patient Scorecard

Outlining both care gaps and rule-based risk measures

Legend

- Open Gap/Risk
- Closed Gap/Risk
- MIXED

Care Gaps

Severity Level	Gap#	Condition	Gap	Status
HIGH	3033	CHF-related admission	Patients with readmission within 30 days of CHF-related hospital discharge.	
MEDIUM	5003	Atrial fibrillation on coumadin	Patients with prescription refill gaps of more than six months.	
LOW	12081	CHF	Patients without flu vaccination in the last 12 months	
	12085	ER Visits	Patients without primary physician office visit within 4 days after an ER Visit (not hospitalized)	

Risk Measures

Risk	Risk#	Condition	Risk Notes	Status
> 4 ER Visits in last year	8527	Utilization Issue		
Atrial Fibrillation Related ER Visit in Analysis Period	8706	Atrial Fibrillation		
Atrial Fibrillation Related ICU Days	8779	Atrial Fibrillation		
Atrial Fibrillation with > 1 Hospitalizations in Analysis Period	8705	Atrial Fibrillation		
CAD Related ICU Days	8741	CAD		

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Clinical Profile Including Predicted Risk

MM	Medical	Pharmacy	Medical+Pharmacy	Model #71	Model #126	Model #10	Model #18	Model #55	Model #56	Model #121	Model #18	Model #55	Model #56
12	$25,741.11	$534.44	$26,275.55	0.29	0.47	1.18	8.92	5.11	5.71	0.00	7.56	4.60	5.19

Likelihood of Hospitalization (LOH) Summary

HCC	HCC Description	% Contribution to LOH Score
220	Acute Heart Failure and CHF Exacerbation	57.72%
230	Specified Heart Arrhythmias	10.14%
219	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease	9.38%
55	Disorders of Fluid/Electrolyte/Acid-Base Balance	8.34%
386	Major Postsurgical States / Convalescence	4.25%

Clinical Summary (Diagnostic Groups)

Diagnostic Groups
▼ Nutritional and Metabolic
▶ Hyperlipidemia and Lipidoses
▶ Other Nutritional and Metabolic Conditions
▼ Hepatobiliary
▶ Hepatitis
▶ Gastrointestinal
▶ Musculoskeletal and Connective Tissue
▶ Psychiatric
▼ Cardiovascular
▶ Coronary Artery Disease
▶ Congestive Heart Failure
▶ Cardiac Arrhythmias
▶ Hypertension

Aggregated Condition Categ

Related Condition Category(

Condition Category(CC)

DxGroups

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Quality Scores for the Provider

Service Measure: Flu Vaccination Vulnerable Patients	Patients with the Condition	Patients with the Gap	Pct with Gap
CAD (E) Patients without flu vaccination in the last 12 months	47	42	89.36%
Hypertension (E) Patients without flu vaccination in the last 12 months	198	181	91.41%

Service Measure: Subset for Diabetics with Continuous Enrollment	Patients with the Condition	Patients with the Gap	Pct with Gap
Patients without HbA1c test in the last 12 months	145	19	13.1%
Patients without lipid profile test in the last 12 months	105	20	19.1%
Patients without LDL-C test in the last 12 months	145	30	20.7%

Service Measure: Asthma Gaps & Risks	Patients with the Condition	Patients with the Gap	Pct with Gap
Patients with asthma-related ER visit in the analysis period	45	15	33.33%
Patients with asthma-related hospitalization in the analysis period	45	2	4.44%
Patients with more than one asthma-related hospitalization in the analysis period	45	0	0.00%
Patients with more than one asthma-related ER visit in the analysis period	45	6	13.33%
Patients with more than 20 Rx for asthma medication in the analysis period	45	6	13.33%

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How Do We Connect the Dots ….

1. Well defined provider – patient population groups create the context that is critical to achieving accurate estimates of resource needs
2. Organize primary care teams that continually assess where to focus care coordination and outreach activities
3. Apply sophisticated predictive models to elevate variation analysis
4. Analyze systematic variation and engage providers in a review of factors that contribute to low quality outcomes

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