Risk Adjustment and Predictive Modeling for Medicaid

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Promoting Fair and Efficient Health Care

Overview

- Medicaid management and business needs addressed by risk adjustment and predictive models
- DxCG's Medicaid models
  - Build
  - Performance
  - Application examples
- New research activities

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Risk Adjustment and Predictive Models Can Help With Addressing Important Issues in Medicaid

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Budgeting and Financial Forecast

- Medicaid budget crunches
  - Economy – national and state
  - Federal budget
  - Medicaid-specific
    - Aging population
    - Reimbursement rate not keeping up with actual cost
    - Uncompensated care

→ Need a more accurate and robust prediction of Medicaid program budget

Special Populations

- Disabled/Blind – early identification, move members to better benefit coverage, access issues, implications on budget and reimbursement
- High risk and high cost members – for case and disease management, accurately identify before they actually become high cost
- Under and uninsured – predict disease burden and resource use

Utilization Management

- Hospital admissions
- Emergency Department
- Pharmacy
- Imaging test

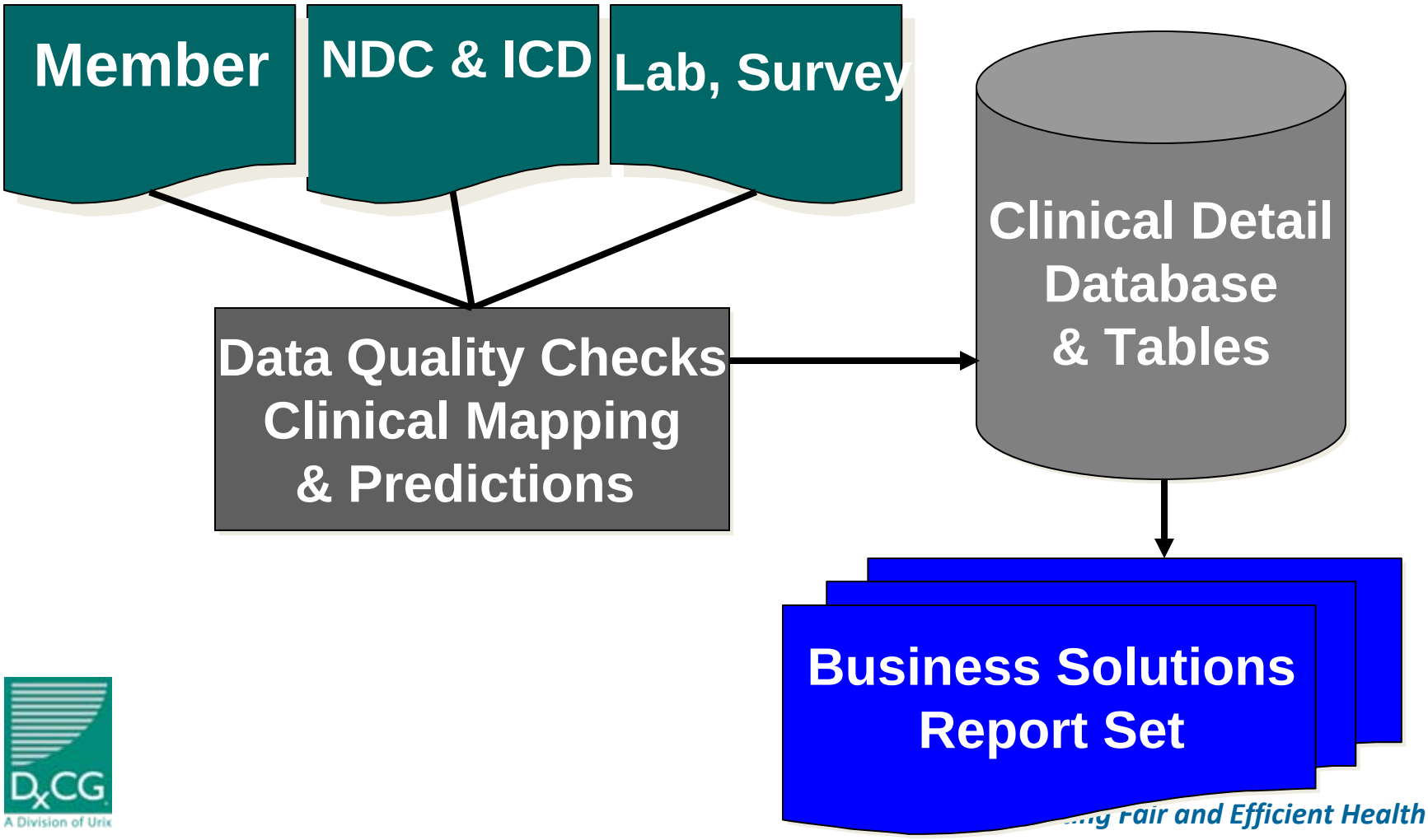
→ Need to set health-risk adjusted target measures

DxCG Medicaid Models in Product

- Separate models for FFS and MC
- Diagnosis-based Medicaid DCG models – most robust and serving general purposes (budgeting, risk stratification, UM)
  - Concurrent and prospective
  - Topcoded and untopcoded
- Rx-based Medicaid RxGroups models – serving similar purposes when Dx data is problematic
  - Finer groupings for OTC drugs
  - Concurrent and prospective
  - Rx + IPHCC
- Medicaid LOH models – case identification

The Building Blocks of DxCG's Medicaid Models

Software Processing



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Model Input

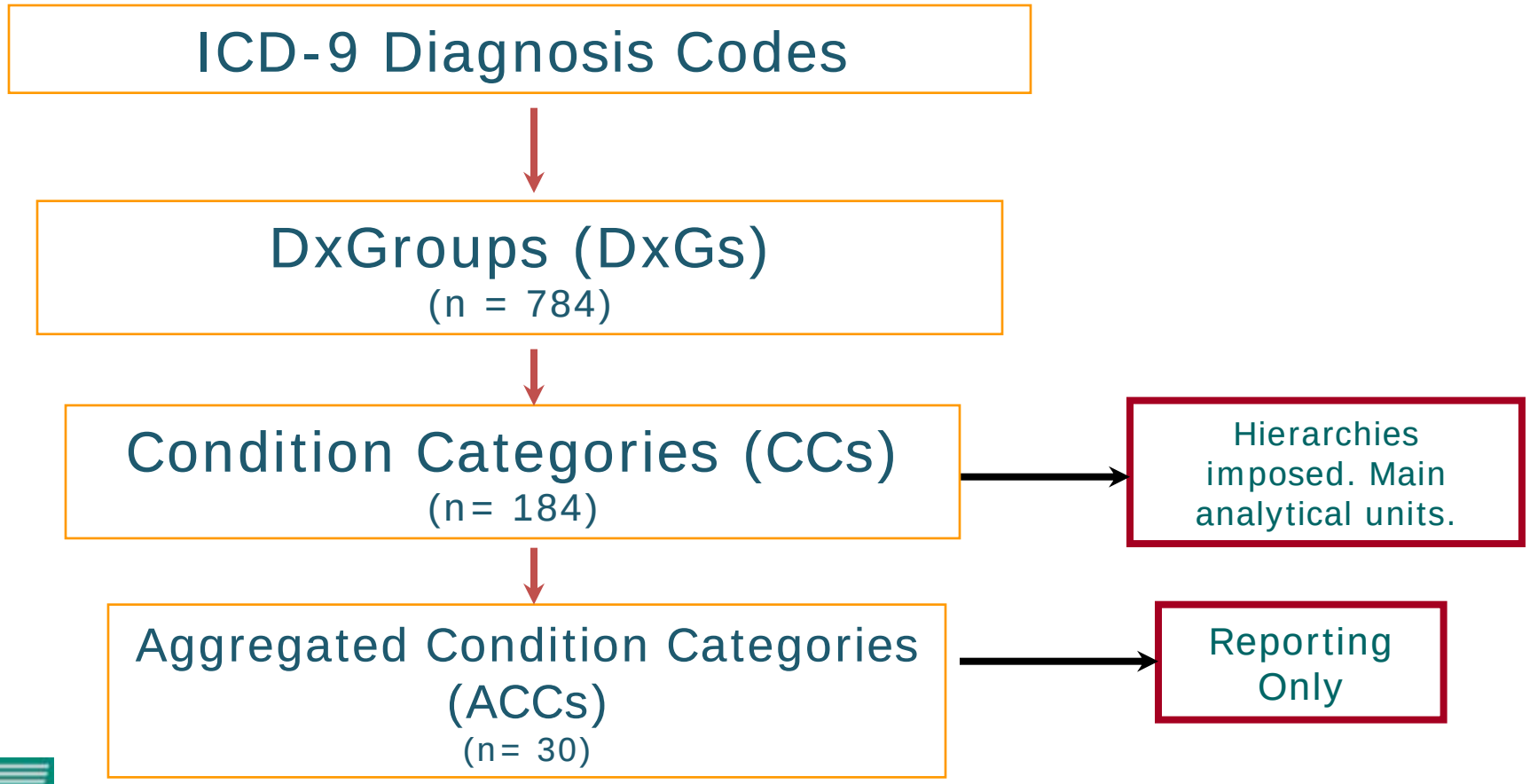
- Enrollment information:
  - age, sex, eligible months, basis of eligibility (e.g., disabled)
- Claims information
  - Diagnosis
  - Procedures
  - Pharmacy
  - Long term care
  - Spending – timing, categories
  - Utilization – hospital, ED, specialty

- Not everything is used for prediction!
  - Depends on client needs, model's intended use, and the tradeoff between easy of use and added predictive accuracy

Organization of Clinical Information

- Grouping ICD-9-CM diagnosis codes – DCG/HCC
  - ICD-10 ready
- Grouping of NDC codes – RxGroups
  - ATC (WHO drug codes) ready

DCG/HCC Classification System



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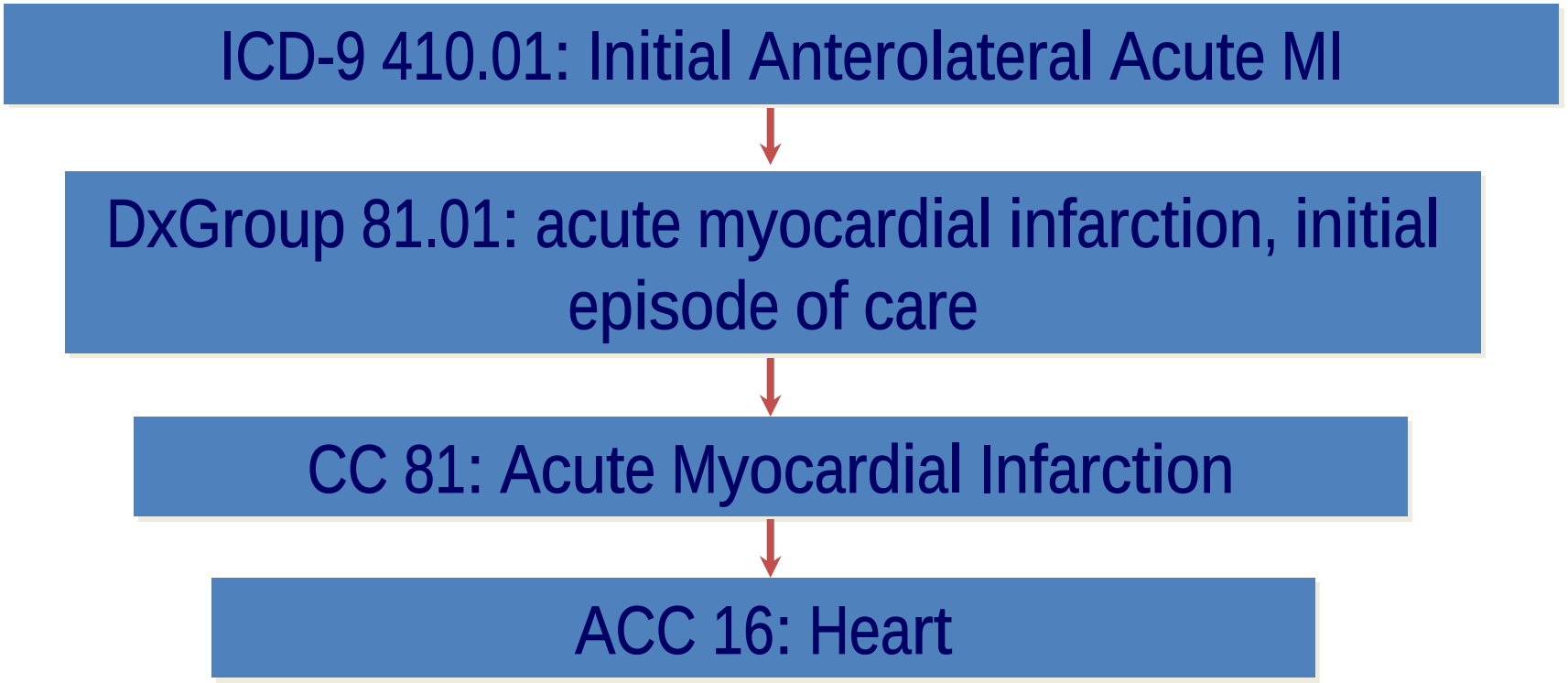
Diagnosis Grouping Example



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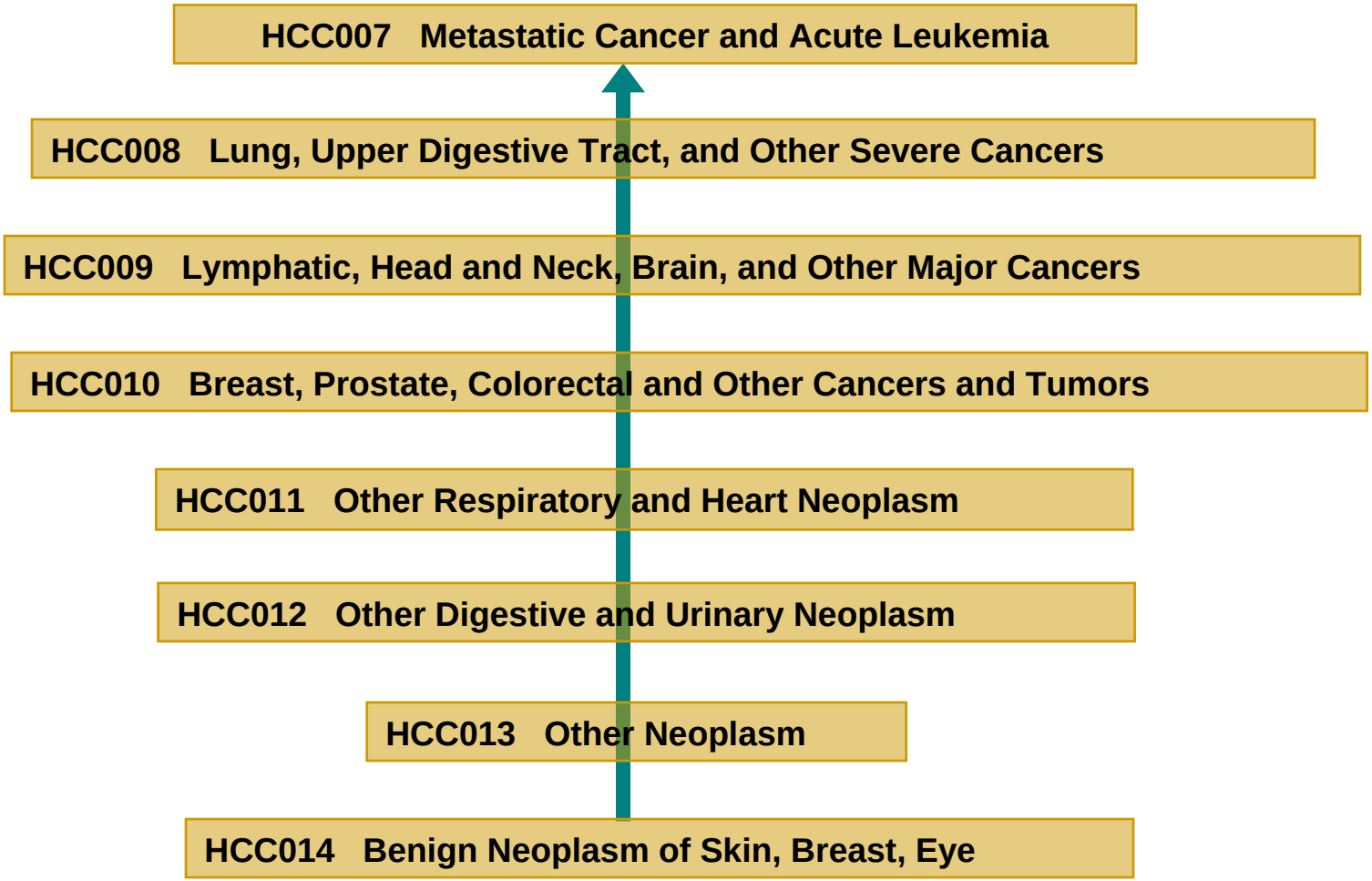
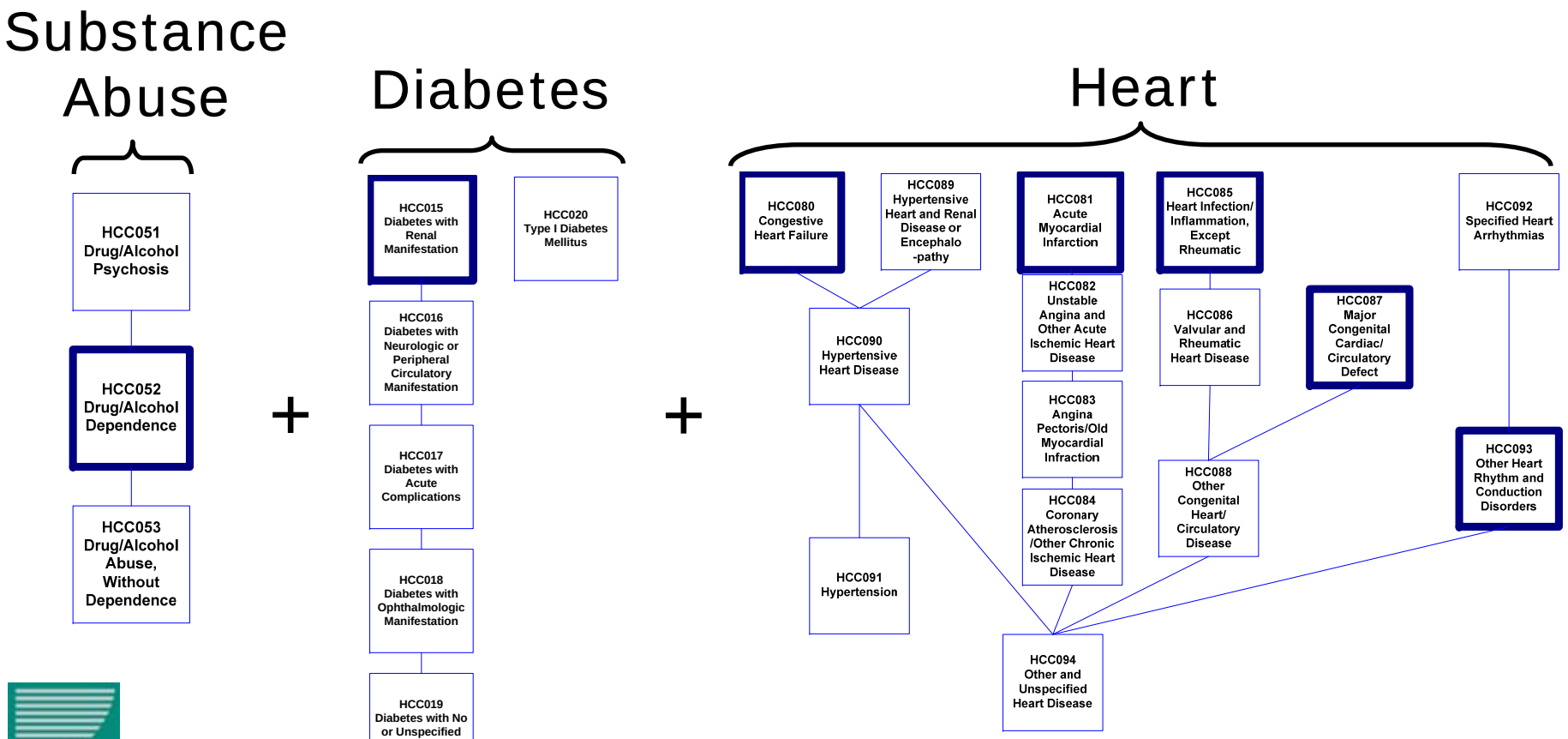
Hierarchical Condition Category (HCC) Example



Example: John Smith has Multiple Conditions



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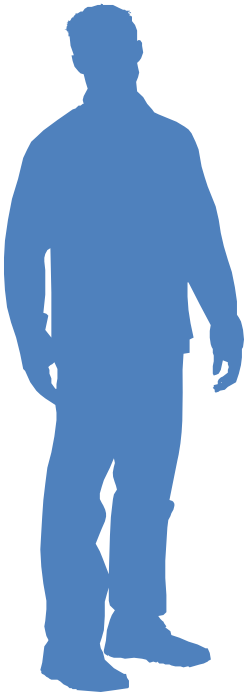
Risk Scoring using DCG/HCC



John Smith
Age: 45
Sex: M
Eligible months: 7

- ☐ **Hypertension**
  - essential hypertension
- ☐ **Type I Diabetes Mellitus**
  - type I diabetes w/ renal manifestation
- ☐ **Congestive Heart Failure**
  - hypertension heart disease, w/ heart failure
- ☐ **Drug/Alcohol Dependence**
  - alcohol dependence

3.11x sicker than average Medicaid Managed Care enrollee

Relative Risk Score: 3.11

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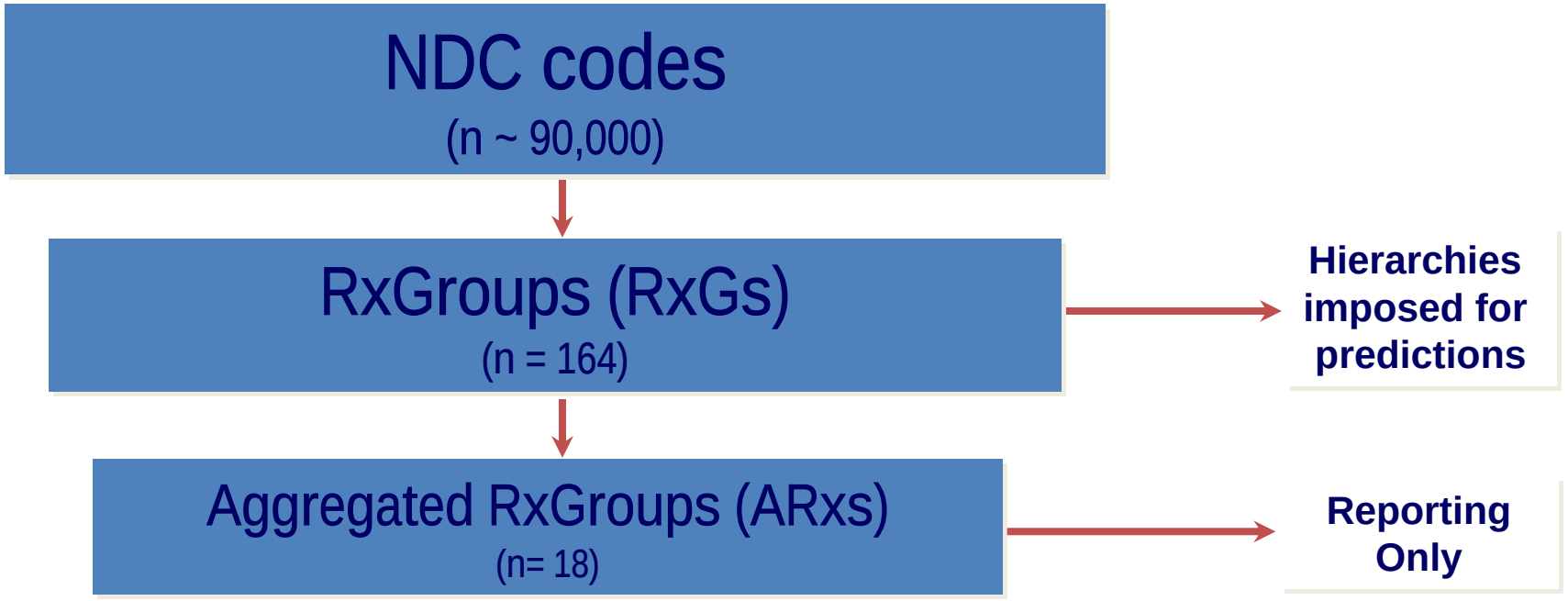
Care

RxGroups® Clinical Classification System



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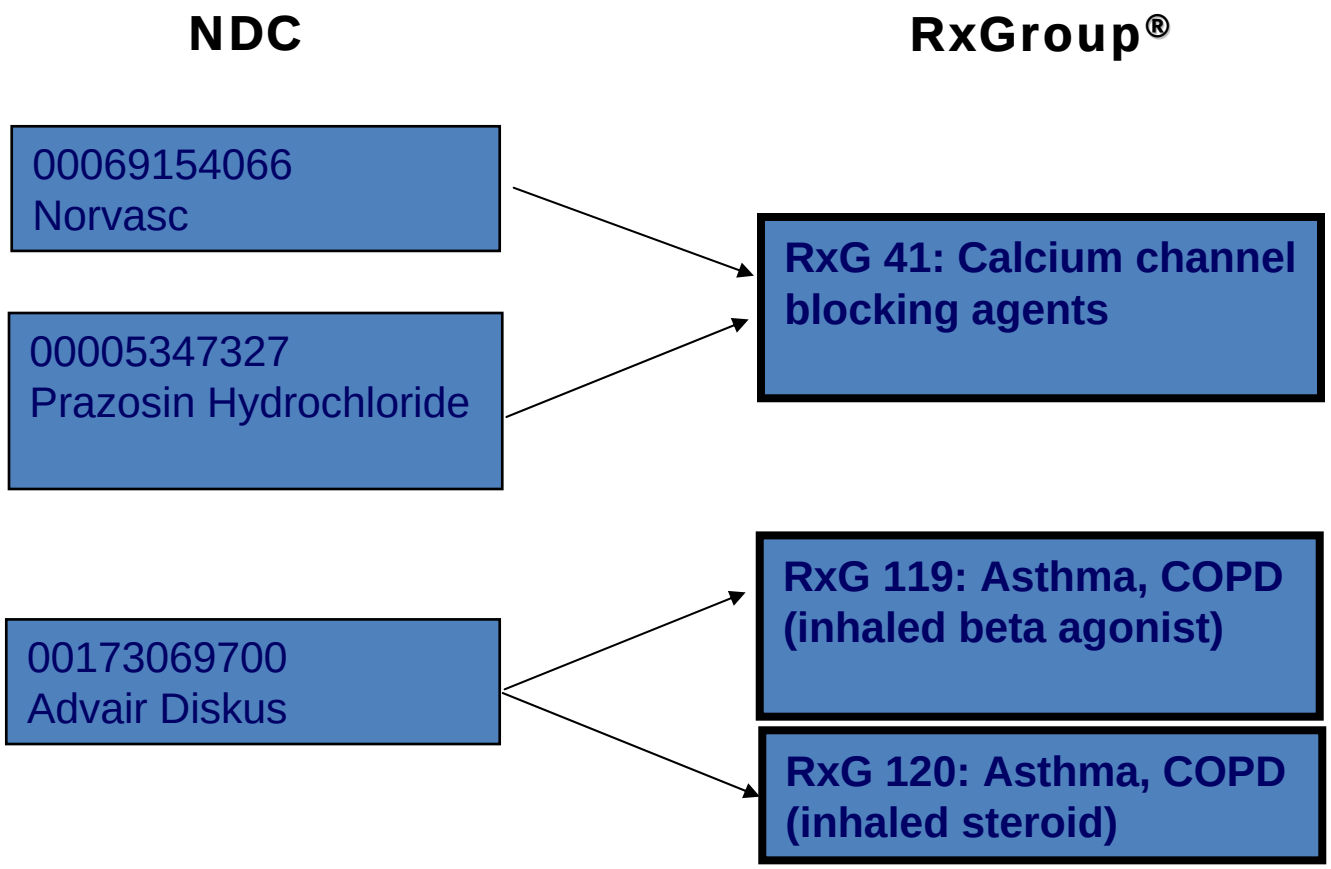
RxGroups® Example



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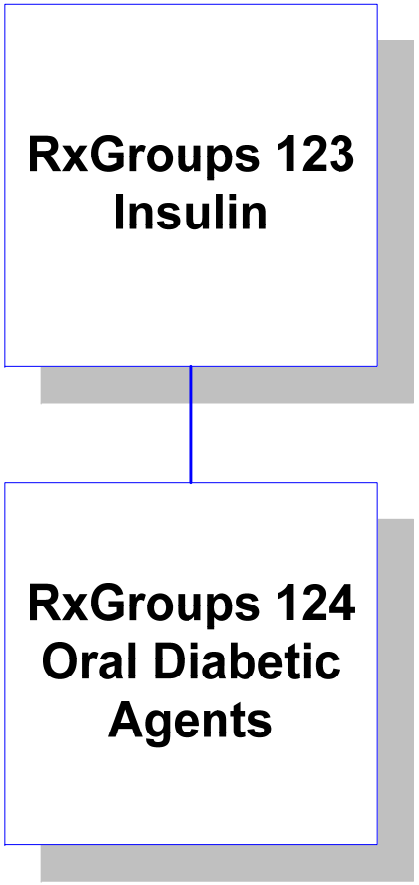
RxGroups® Simple Hierarchy Example: Diabetes



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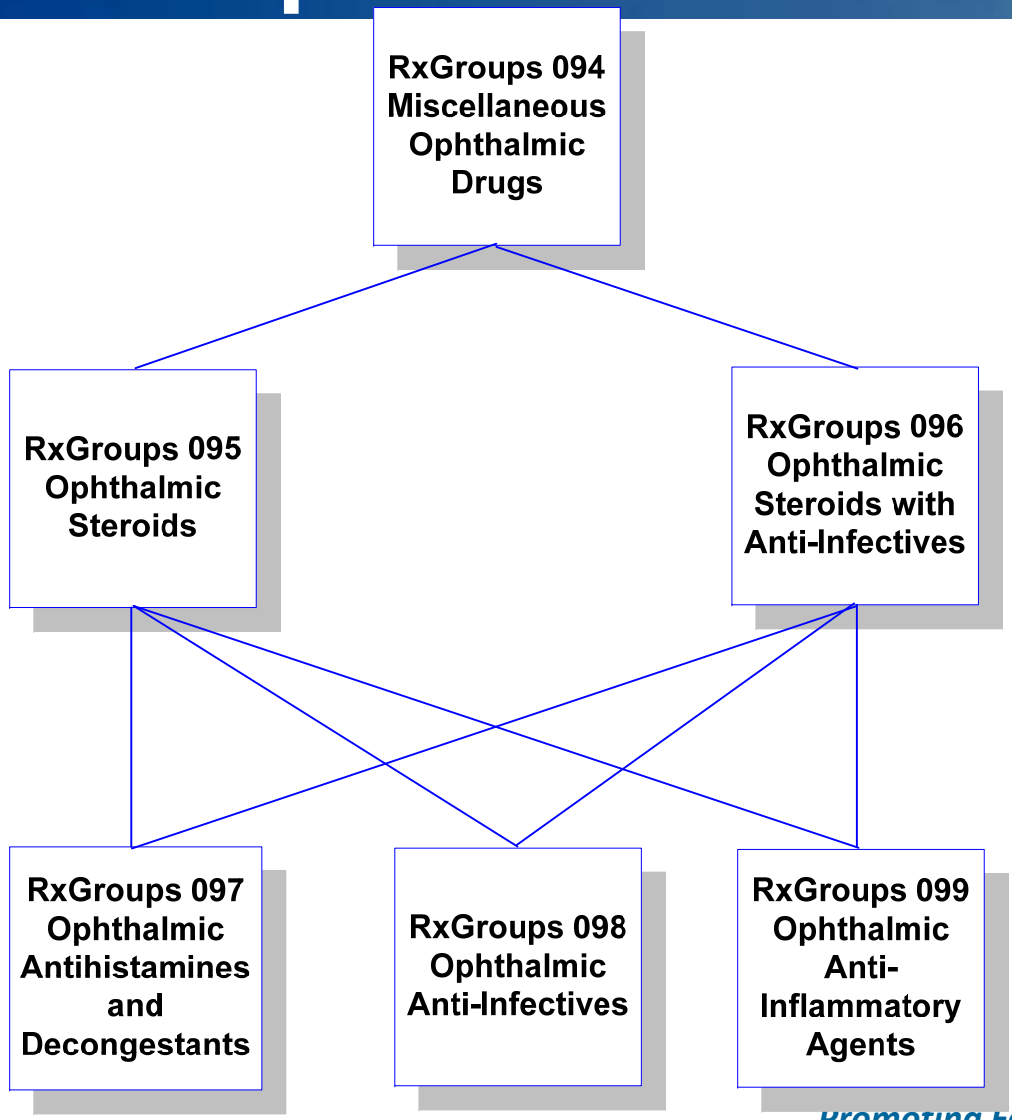
RxGroups® Complex Hierarchy Example: Ophthalmic



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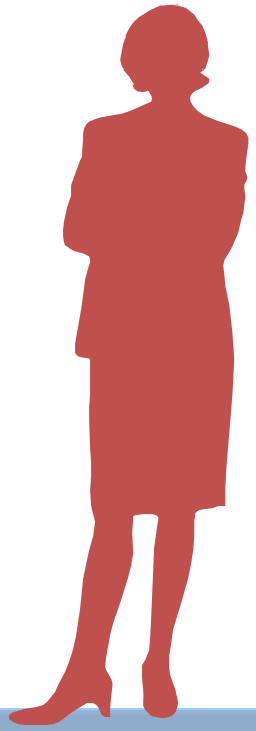
Risk Scoring Using RxGroups®



Jane Doe is 2.57x sicker than average

Name: Jane Doe
Age: 43
Sex: F
Eligible months: 10

RxG 40: Beta-adrenergic blocking agents
RxG 41: Calcium channel blocking agents
RxG 66: Insulin

2.57 RELATIVE RISK SCORE

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Model Development Sample and Performance Statistics

Mass Medicaid Data 2003-2005
- sample size and cost -

Sample Size

	FFS		MC	
	Unique ID	Full Year Equivalent	Unique ID	Full Year Equivalent
Conc	1,431,313	1,032,083	2,477,242	1,988,997
Prosp	683,945	580,835	1,332,891	1,156,831

Average Cost

	FFS	MC
Conc	$12,066	$4,688
Prosp	$13,143	$4,614

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Mass Medicaid Data 2003-2005
- age/sex distribution -

	Conc FFS	Prosp FFS	Conc MC	Prosp MC
Female	59.10%	60.21%	56.26%	57.47%
Male	40.90%	39.79%	43.74%	42.53%
Child: Age 0 to 17	24.25%	18.67%	48.82%	49.17%
Young Adult: Age 18 to 44	27.63%	24.68%	37.36%	36.68%
Older Adult: Age 45 to 64	17.36%	19.57%	13.26%	13.56%
Senior: Age 65+	30.76%	37.08%	0.56%	0.60%
Mean Age	44.47	49.57	22.59	22.88

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Mass Medicaid Data 2003-2005
- selected ACC prevalence rates -

	Conc FFS	Conc MC
01: Infectious and Parasitic	655	1,557
02: Malignant Neoplasm	267	108
04: Diabetes	729	353
10: Cognitive Disorders	448	124
11: Substance Abuse	312	675
13: Developmental Disability	162	585
15: Cardio-Respiratory Arrest	150	63
16: Heart	1,659	807
17: Cerebro-Vascular	303	87
18: Vascular	552	159
21: Ears, Nose and Throat	1,155	3,314
23: Genital System	509	1,192
24: Pregnancy-Related	230	500
25: Skin and Subcutaneous	915	1,447
26: Injury, Poisoning, Complications	1,060	1,963
27: Symptoms, Signs and Ill-Defined Conditions	2,456	3,677
28: Neonates	14	300
30: Screening / History	1,890	5,559

Model Performance (Prospective R^2) - diagnosis based models -

	MA Medicaid FFS	MA Medicaid MC
DxCG DCG/HCC for Medicaid	25.21%	26.62%
CDPS unrecalibrated	2.42%	5.28%
CDPS recalibrated	17.74%	19.95%

The SOA 2007 Risk Adjustment Report has a similar finding.

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Predictive Ratios
- diagnosis based model -

- Nearly perfect predictive ratios for subgroups:
  - Blind/disabled
  - Diabetes
  - Asthma
  - Mental health
  - Developmental disability

Model Performance (Prospective R^2) - pharmacy based models -

	MA Medicaid FFS	MA Medicaid MC
DxCG RxGroups for Medicaid	24.11%	21.53%
DxCG Rx+IPHCC for Medicaid	29.38%	26.17%
Medicaid Rx unrecalibrated	8.81%	6.68%
Medicaid Rx recalibrated	18.21%	16.65%

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Applicability to Other States

- Medicaid programs differ significantly from state to state. Experience may not be transferable from one state to another.
  - Coverage
  - Geography
  - Socioeconomic mix
  - Disease prevalence
  - Provider-specific factors

Applicability to Other States (cont.)

- Diagnosis-based models are the most robust
- Geographic differences in Medicaid MC are much less pronounced
- Depending on state programs and data, certain recalibration may be needed
  - Compare prevalence rates
  - Do simple goodness-of-fit tests

Model Application Example 1

- Budgeting and Resource Allocation (Medicaid DCG/HCC Model)

Which Managed Care Organizations Care for a sicker Population?

	System-wide	MCO A	MCO B	MCO C
PMPM Expenditures	$420	$456	$352	$724
Age/Sex Relative Risk Score	1.00 (normalized to sample)	1.15	0.64	1.22
Diagnosis-Based Relative Risk Score	1.00 (normalized to sample)	1.16	0.61	1.52

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What Accounts for Differences in Health Status?

Rate Per 10,000 Selected CCs

Diabetes With…	System-wide	MCO A	MCO B	MCO C
Neurologic or Periph. Circ. Manifestations	24	16	8	169
Ophthalmologic Complications	22	21	12	141
No or Unspecified Complications	170	166	68	410

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Which Managed Care Organizations Are "More Efficient?"

PMPM Expenditures	System-wide	MCO A	MCO B	MCO C
Observed	$420	$456	$352	$724
Expected	$420	$488	$256	$640
Observed/ Expected	1.00	0.93	1.38	1.13

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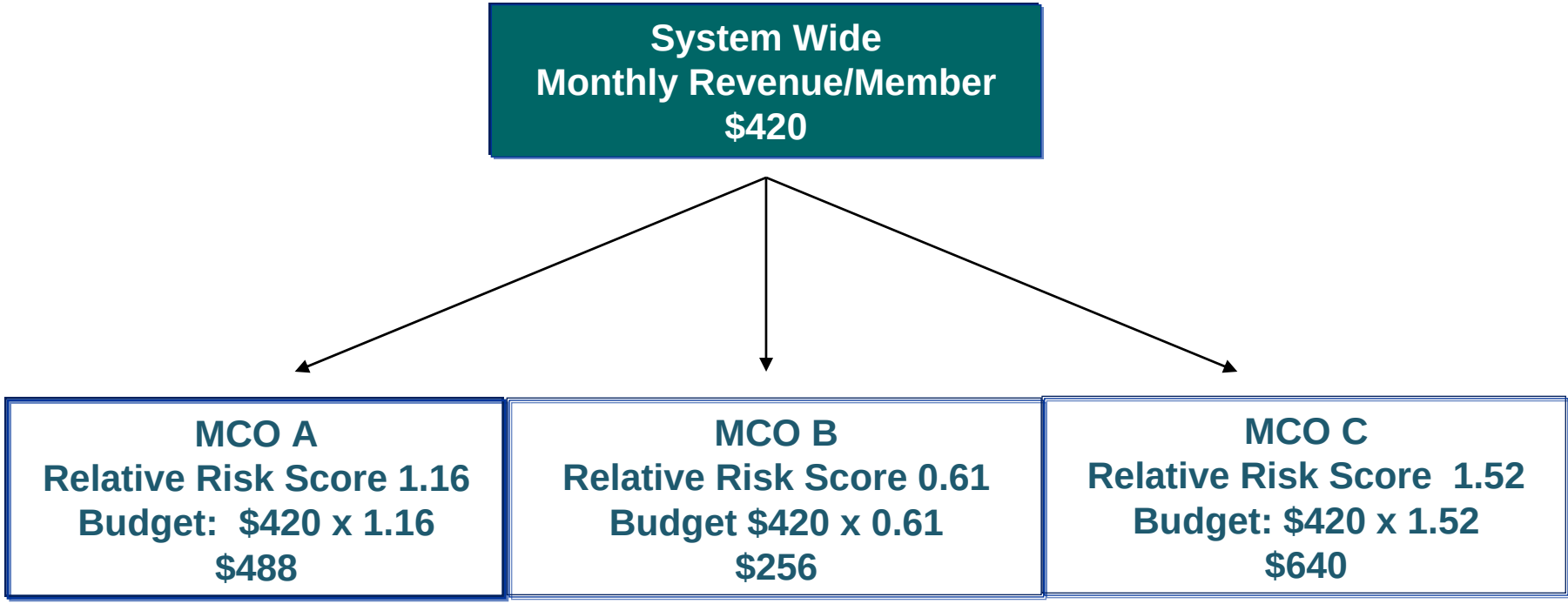
How Should We Allocate Resources?



* Further adjustments may be needed

Multi-Year Budgeting and Planning

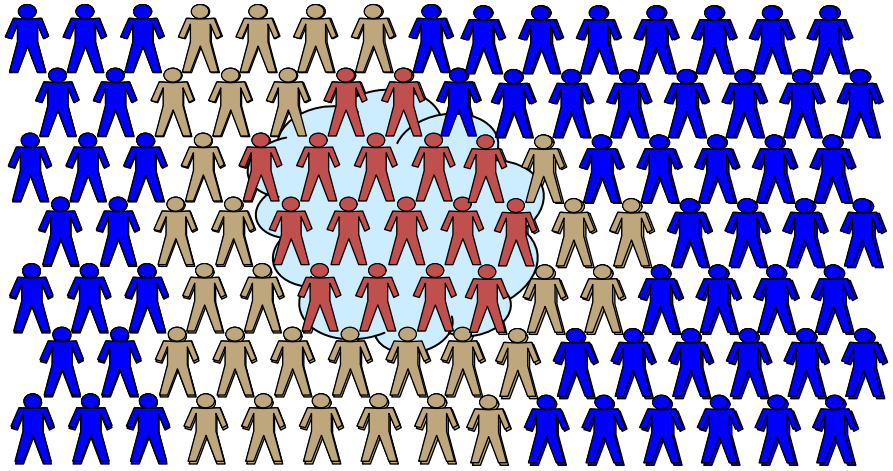
- Predictions need to be based on
  - State and federal coverage expansion
  - Socioeconomic mix of future enrollment
  - Aging
  - Disease prevalence, pharmacy use, utilization
  - Efficiency and cost-saving initiatives
  - Medical inflation and adjustments to reimbursement rates

Model Application Example 2

- Identification for Case Management (Likelihood of Hospitalization Model)

Point Solutions: Finding the Target Population for Intervention

- 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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LOH Model Improves the Identification and Prioritization of Individuals for Case Management

Traditional Approach	LOH Model Approach
Focus on members who are *already in the hospital*	Use statistical methods and clinical algorithms to identify members who are *likely* to be hospitalized
Arrange follow up services *during* the admission	Coordinate services *prior* to incurring an admission
Select people with high prior costs and a long length of stay for case management	Identify potential *avoidable* admissions *in time* for actionable intervention

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LOH Model Data Period and Model Structure

Model Variables

Prospective DCG risk score
Utilization pattern
Cost trend over 12 months
Evidence of various medical conditions
And other factors

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How to Use the LOH Model

- Take the probability score as is and select based on cutoff points
- Use the scores for sorting and ranking
- Look at changes in scores over time

Model Performance Measures

Model and Threshold	Number of people correctly identified	Positive Predictive Value	Number of admissions by Individuals Correctly Identified	Rate of Admission per Individual Correctly Identified	Number of Admissions for the study population with the Exclusion of selected categories	Percent of All Admissions in the Prediction Period generated by the target List
Top 0.5 percent: 10,512	3,267	31.1%	5,909	1.8	63,945	9.2%
Top 1 percent: 21,024	5,094	24.2%	8,780	1.7	63,945	13.7%

Total population count is 2.1 million

Many Individuals on the List Have Chronic Medical Conditions

Chronic Medical Conditions	Prevalence Rate
Diabetics	31.8%
Congestive Heart Failure	31.0%
COPD	25.3%
Coronary Artery Disease	17.8%
Asthma	15.5%
Cerebrovascular Disease	10.0%

3,267 Members in the top 0.5 percent LOH Model

Top Rank Members Have Multiple Admissions in the Prediction Period

Adm/Person in the 6 month period	Frequency Distribution	Percent of the Target Population
1	2,144	65.6%
2	714	21.9%
3	276	8.4%
4	91	2.8%
5	28	0.9%
6	8	0.2%
7	4	0.1%
8	2	0.1%
Total Members	3,267	

3,267 Members in the top 0.5 percent LOH Model

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Age Distribution of People Identified Prospectively

- Distribution of members correctly identified among the top 1 percent of members most likely to be hospitalized

Cohort	Males	Females
Age 0-5	0.4%	0.6%
Age 6-12	0.3%	0.3%
Age 13-17	0.4%	0.2%
Age 18-24	0.6%	0.4%
Age 25-34	2.1%	0.4%
Age 35-44	6.0%	1.6%
Age 45-54	13.8%	7.8%
Age 55-64	24.6%	26.1%
Age 65+	7.0%	7.4%
Total	55.2%	44.8%

Many Admissions are Amenable to Management in the Outpatient Setting

DRG	DRG Description	Frequency Count	Percent Adm At Risk Pop
127	HEART FAILURE & SHOCK	219	4.38%
88	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	132	2.64%
89	SIMPLE PNEUMONIA & PLEURISY AGE >17 W CC	129	2.58%
182	ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE >17 W CC	128	2.56%
430	PSYCHOSES	99	1.98%
296	NUTRITIONAL & MISC METABOLIC DISORDERS AGE >17 W CC	96	1.92%
144	OTHER CIRCULATORY SYSTEM DIAGNOSES W CC	89	1.78%
468	EXTENSIVE O.R. PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS	83	1.66%
143	CHEST PAIN	81	1.62%
316	RENAL FAILURE	71	1.42%
124	CIRCULATORY DISORDERS EXCEPT AMI, W CARD CATH & COMPLEX DIAG	69	1.38%
183	ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE >17 W/O CC	63	1.26%
82	RESPIRATORY NEOPLASMS	60	1.20%
209	MAJOR JOINT & LIMB REATTACHMENT PROCEDURES OF LOWER EXTREMITY	60	1.20%
416	SEPTICEMIA AGE >17	60	1.20%
478	OTHER VASCULAR PROCEDURES W CC	60	1.20%
462	REHABILITATION	59	1.18%
130	PERIPHERAL VASCULAR DISORDERS W CC	58	1.16%
132	ATHEROSCLEROSIS W CC	53	1.06%
517	PERC CARDIO PROC W NON-DRUG ELUTING STENT W/O AMI	53	1.06%
294	DIABETES AGE >35	52	1.04%
410	CHEMOTHERAPY W/O ACUTE LEUKEMIA AS SECONDARY DIAGNOSIS	50	1.00%
14	INTRACRANIAL HEMORRHAGE & STROKE W INFARCT	49	0.98%
96	BRONCHITIS & ASTHMA AGE >17 W CC	49	0.98%

3,267 Members in the top 0.5 percent LOH Model

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Case Example :

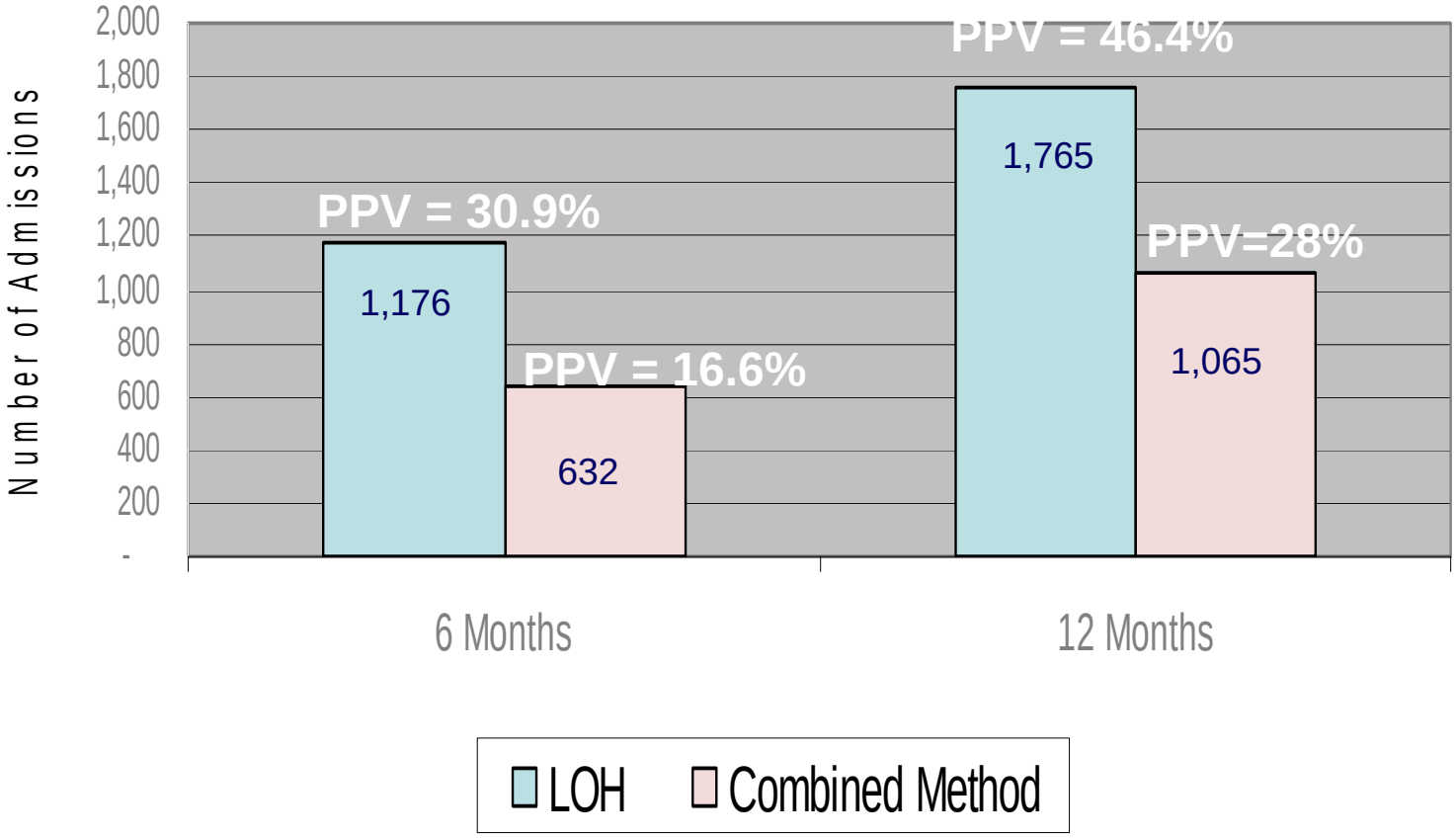
Multiple Admissions in the 6 Month Prediction Period

- 50 Year Old Female with Diabetes and Unstable Angina

DRG	Admission Description
416	SEPTICEMIA AGE >17
277	CELLULITIS AGE >17 W CC
96	BRONCHITIS & ASTHMA AGE >17 W CC
182	ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS AGE >17 W CC
294	DIABETES AGE >35
296	NUTRITIONAL & MISC METABOLIC DISORDERS AGE >17 W CC
213	AMPUTATION FOR MUSCULOSKELETAL SYSTEM & CONN TISSUE DISORDERS
113	AMPUTATION FOR CIRC SYSTEM DISORDERS EXCEPT UPPER LIMB & TOE

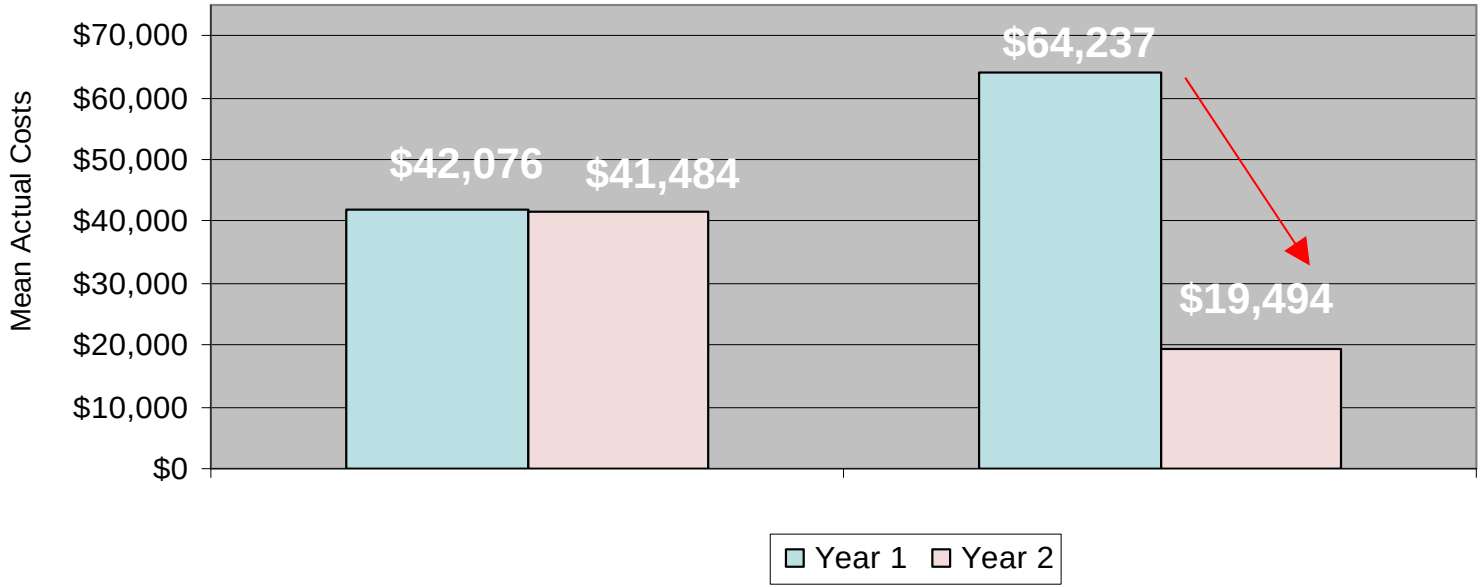
Comparison between Individuals Identified by LOH Model and Traditional Means

LOH has a 14.3% higher predictive accuracy in the 6 month prediction period and a 18.4% higher value in the 12 month prediction period



Comparison between Individuals Identified by LOH Model and Traditional Means

Costs for the Non Overlapping Individuals on the Combined List drop by 70% in Year 2. By contrast, the non overlapping Individuals on the LOH List drop by only 1% in Year 2



N = 3,805

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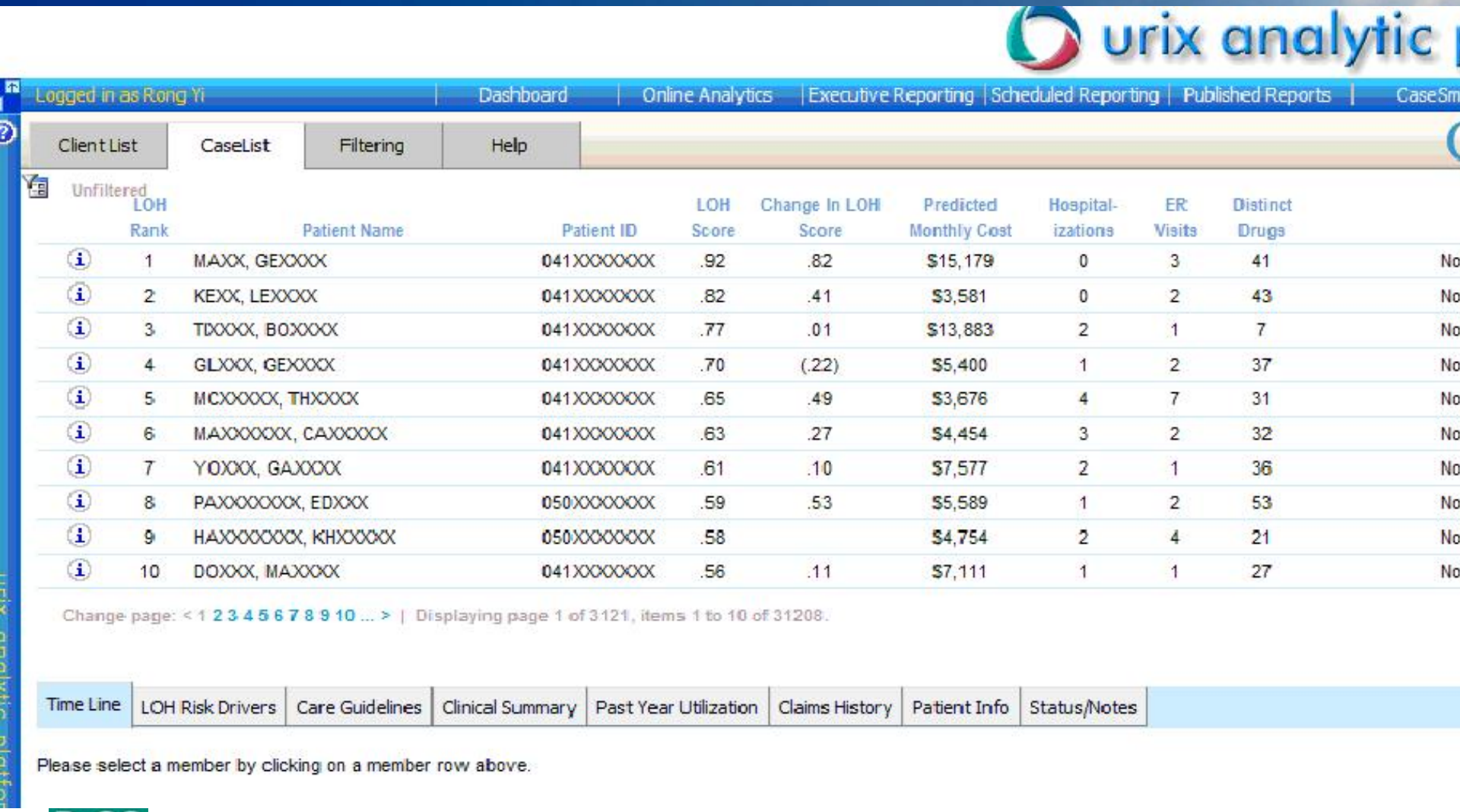
Comparing Changes in LOH Scores Overtime



New Research Efforts

- Client input – DxCG has a client-driven research agenda
- Data from other states
- Medicaid ER use
- Early identification of disabled members
- Under and un-insured
-

Questions and Comments?

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