

Closing the Education Gap

Make Predictive Modeling Easier to Understand

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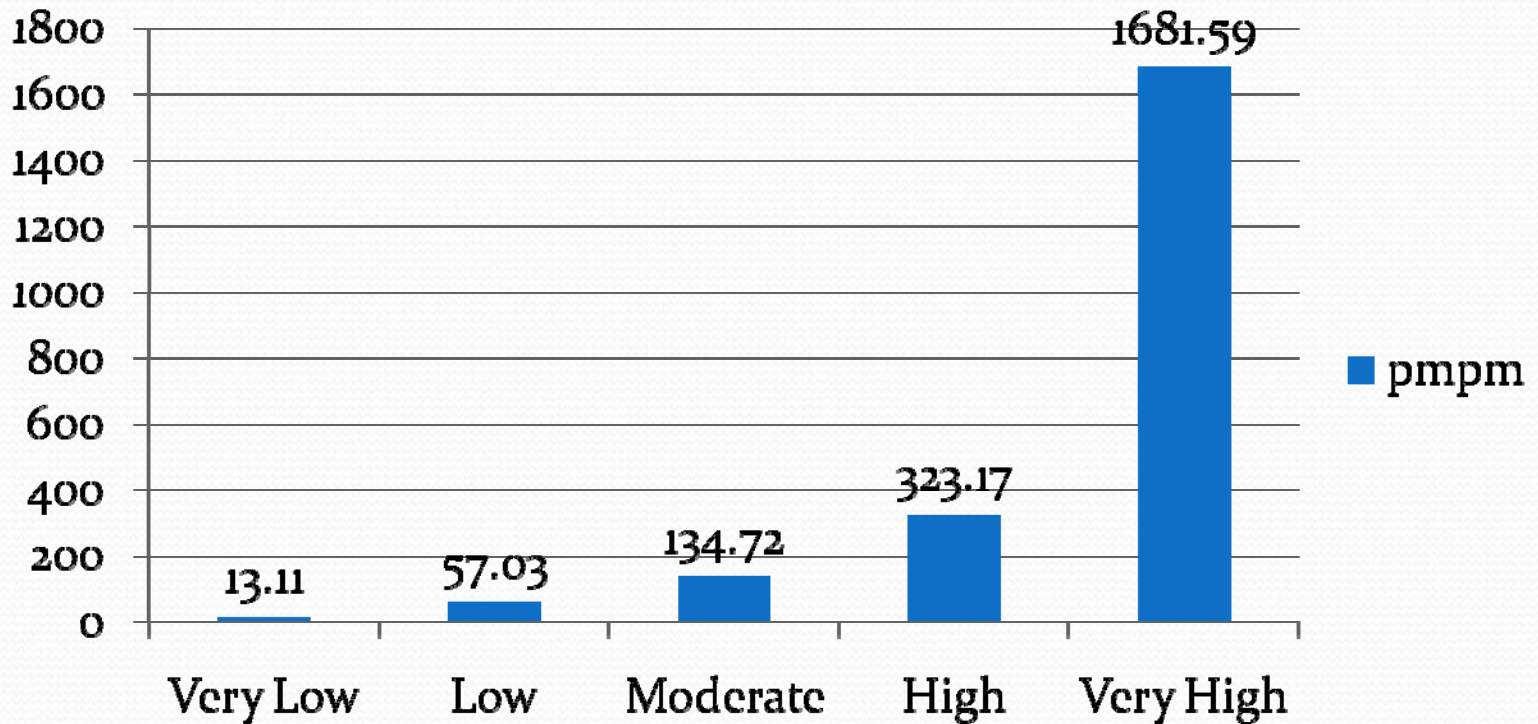
Workshop Objectives

- Why do we need predictive modeling?
- What is predictive modeling and how do we describe it?
- Why high cost or high risk scores do not always equate with high opportunity.
- Predictive modeling and
 - Disease management
 - Medical underwriting
 - Pay-for-Performance

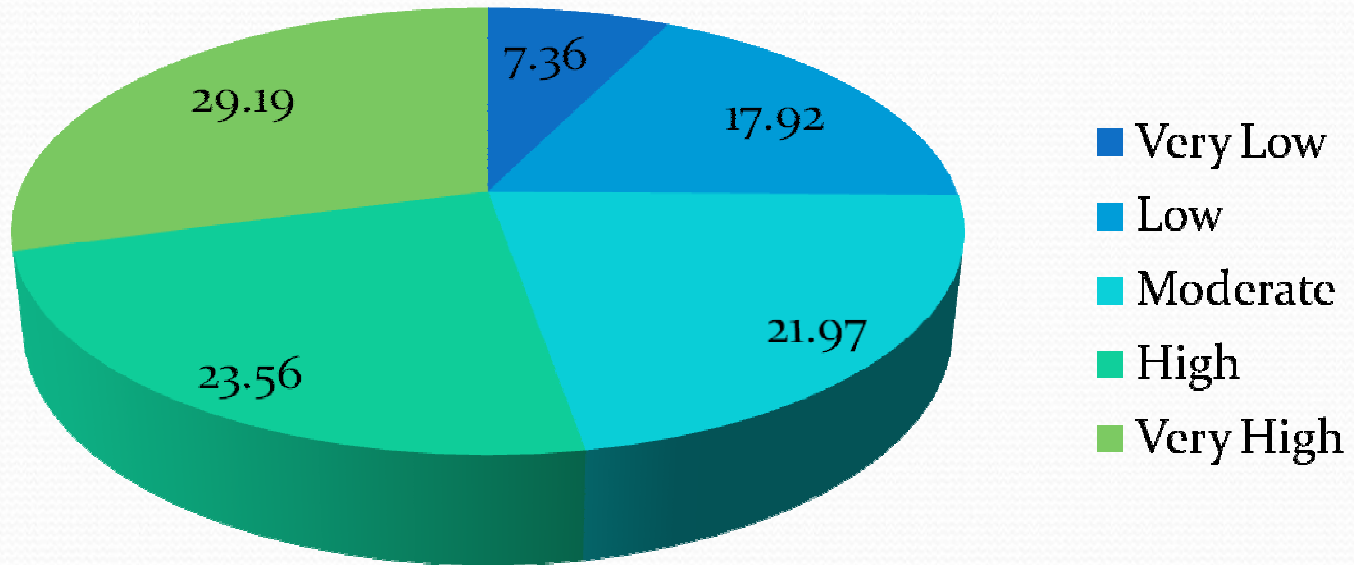
The Impetus for PM

- Prevailing “wisdom” is that a relatively small proportion of a health plan’s membership consumes the bulk of the total annual premium revenue.
- Predictive modeling allows us to identify who these high cost members are and intervene, lowering costs and improving outcomes.
- Focusing on specific chronic conditions doesn’t identify these members.

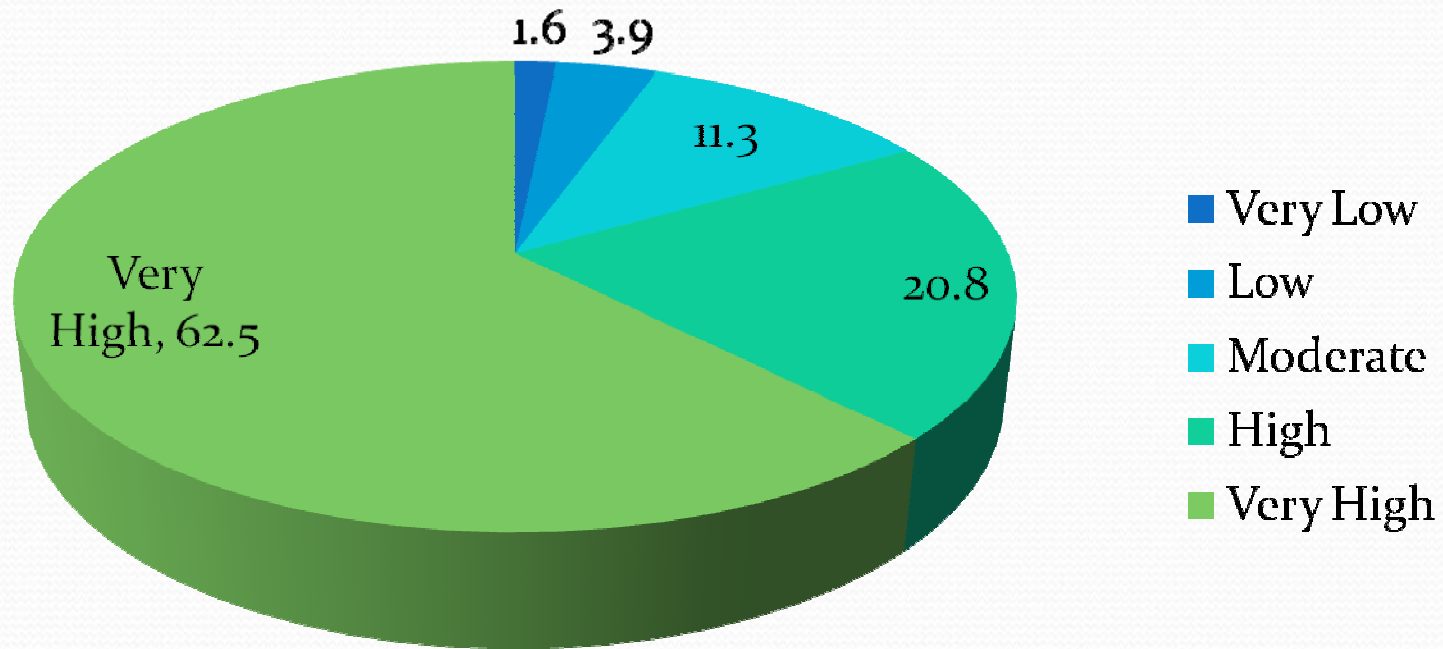
Medical Claim Cost by Cost Group



Percent of Diabetics in Each Cost Group



Percent of Diabetics + CHF in Each Cost Group



Role of Comorbidity

- In order to understand which patients a health plan needs to focus its attention on (either for financial or clinical reasons), we must accept that comorbidity is the primary driver of resource consumption.
- Co-morbidity is the concurrent existence of one or more unrelated conditions in an individual with any given condition. Multi-morbidity is the co-occurrence of biologically unrelated illnesses.
 - For convenience and by common terminology, we use co-morbidity to represent both co-and multi-morbidity.

Focus on People, Not Diseases

- When people (not diseases) are the focus of attention
 - Outcomes are better
 - Side effects are fewer
 - Costs are lower
 - Population health is greater

Predictive Modeling is Beneficial because:

- It replaces a disease-orientation with a person-orientation.
- It puts people into categories that are relatively homogenous with respect to morbidity.

A Simple Definition of Predictive Modeling

- Predictive modeling is a mathematical method that can express patient's co-morbidity as a number. The larger the number, the sicker the member and the more likely they are to require a greater share of a health plan's resources.

Predictive Modeling Approaches

- Is predictive modeling an end, or a means to an end?
- If PM is an end:
 - The scores rank members in order of their expected need for resources in some future time period. Members with the highest scores are the ones a health plan should focus its resources on.
 - This is typically a prospective, or forward-looking approach.
- If PM is a means to an end:
 - The scores serve as a measure of co-morbidity.
 - We typically use PM in this way when we are performing analytic tasks, such as provider profiling, quality assessment, P4P programs, etc.

Using PM to Identify High-Cost Members

- Predictive models typically output their results in one of three ways:
 - As a probability score that ranges from zero to one. The score represents that probability that the member is in the high cost group, typically the 5 percent or the top 1 percent.
 - As a predicted multiplier of year 2 costs.
 - As a category from a decision-tree

Different Types of PM Scores

MemberID	Linear	Probability	Percent
1	3.712	0.30917	31%
2	0.453	0.02053	2%
3	2.081	0.1164	12%
5	0.385	0.00455	0%
8	0.537	0.01101	1%
9	2.376	0.28577	29%
10	29.118	0.90141	90%

The Illusion of Precision



- There are two areas where there is false precision
 - In the marketing of predictive models
 - My R^2 can beat up your R^2
 - Ascribing too much significance to a particular score
 - It's the ranked (or grouped) values that matter.

Does High Cost = High Opportunity

- One must look “under the clinical hood”
- We will now turn our attention to the attached report that shows how I used another component of the ACG System to examine the diagnosis distribution of specific patients.

Selecting Members for Disease Management Programs

PM Group	Members	pmpm Claim Cost
All	7,041	\$687.88
1	1,407	\$109.59
2	1,408	\$233.25
3	1,409	\$439.52
4	1,409	\$836.01
5	1,408	\$1,820.70

DM Cohorts Differ In Terms of Case-mix

Disease Group (Based on EDCs)	ACG Distribution by Resource Group			Relative Cost of Those in this Group		
	Low	Mid	High	Low	Mid	High
Total Population	49.0	27.5	4.0	0.33	1.64	9.80
Asthma	24.0	63.8	12.2	0.44	1.76	10.05
Hypertension	20.7	65.4	13.9	0.34	1.85	11.60
Ischemic Heart Disease	3.9	49.0	47.1	0.58	2.20	12.19
CHF	2.6	35.1	62.3	0.58	2.33	16.47
Diabetes	13.9	63.2	22.9	0.39	1.92	11.75
Osteoporosis	11.1	50.0	38.9	0.33	2.27	12.43
Thrombophlebitis	12.2	53.8	33.9	0.45	2.15	13.68
Depression	8.1	66.3	25.6	0.42	2.20	13.14

A Fictitious Case Study

You receive good news from one of your health plans reporting promising results from a DM program that targeted enrollees from your firm. They reported that a program targeted to diabetics and heart disease patients was able to reduce hospital admissions by 4 percent and ED admissions by 6 percent over a one year period. The intervention involved telephone calls by nurses to check on the patients' health and encourage them to seek treatment if needed.

The Hidden Story

Intervention targeted all enrollees who had a hospital admission within the previous year.

Problem of regression to the mean.

Intervention encouraged patients to seek care from their “regular physician.” Visits to ambulatory care physicians by this group tripled over the same period.

A shift in utilization has occurred over the same time period (history effect) that represents a competing cause.

The Hidden Story Continues

Calls were made only to the home during the day, reaching only the sickest patients in this working population.

Selection bias that potentially made the intervention less effective.

Patients became aware of the intervention and eventually got the nurse to call them at work.

A maturation effect that caused the intervention to be truly effective only later in implementation.

No effort made to standardize the intervention or to document what each nurse did.

An inconsistent intervention that will make it hard to determine the "cause" of this effect.

Integrating Predictive Modeling Technology into Underwriting

Factors Involved in the Underwriting Process

- **Pool's Experience**
- **Medical Risk**
- Trend (unit price, utilization, etc.)
- Administrative Expense
- Reserve Contribution
- State Regulations

Integrating Predictive Modeling

- In the absence of a morbidity categorization system, an underwriter has two choices: 1) equate the pool's experience with medical risk; or 2) estimate medical risk from a manual review of claims.
- PM allows for medical risk to represent morbidity, separating it from the pool's financial experience.
- PM is an automated approach to quantifying medical risk.

What Is Pay for Performance?

“The use of incentives to encourage and reinforce the delivery of evidence-based practices and health care system transformation that promote better outcomes as efficiently as possible.” American Healthways, 2005



High Risk Also Translates to Worse Clinical Outcomes

Measure (Per Year)	ACG-PM “High Risk”	ACG-PM “Low Risk”	Risk Ratio (High / Low)
≥1 Hospitalization	27.0%	5.7%	4.7
≥1 ICU admit	1.9%	0.2%	9.5
Medical Specialist Visit Rate	3.8 visits	0.6 visits	6.3
Mortality	4.6%	0.5%	9.2

“High risk” reflects individuals with ACG-PM risk probability score in the top 5%. Based on 3.6 million residents of all ages in the Canadian Province of British Columbia. Results are for 1999, risk factor information is from 1998.