SOLUCIA, INC.

THE NATIONAL PREDICTIVE MODELING SUMMIT

Innovations and Consumer Driven Track: The New Frontier - Incorporating Lab Values and HRAs into Predictive Models

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Questions

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- Are health risk assessment (HRA) responses and specific lab values correlated with future medical costs?
- Do HRAs and lab values provide additional predictive power over claims-only predictive models?
- Can HRAs help predict future medical costs if claims are not available?

Population

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- Commercial members within large regional health plan
- More than 2 million members with continuous enrollment between April 2005 and March 2007
- Over $7 Billion in total annual allowed claims or $3,500 per member per year (PMPY)

Linear Model

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- DxCG Med+Rx Prospective Model
- Developed from diagnoses on claims incurred between April 2005 and March 2006
- Validated against total medical and pharmacy allowed costs incurred between April 2006 and March 2007
  - High-cost claimants truncated at $100,000
  - Claims include three months of runout
- R^2 equals .1625

Distribution of Actual and Predicted Costs

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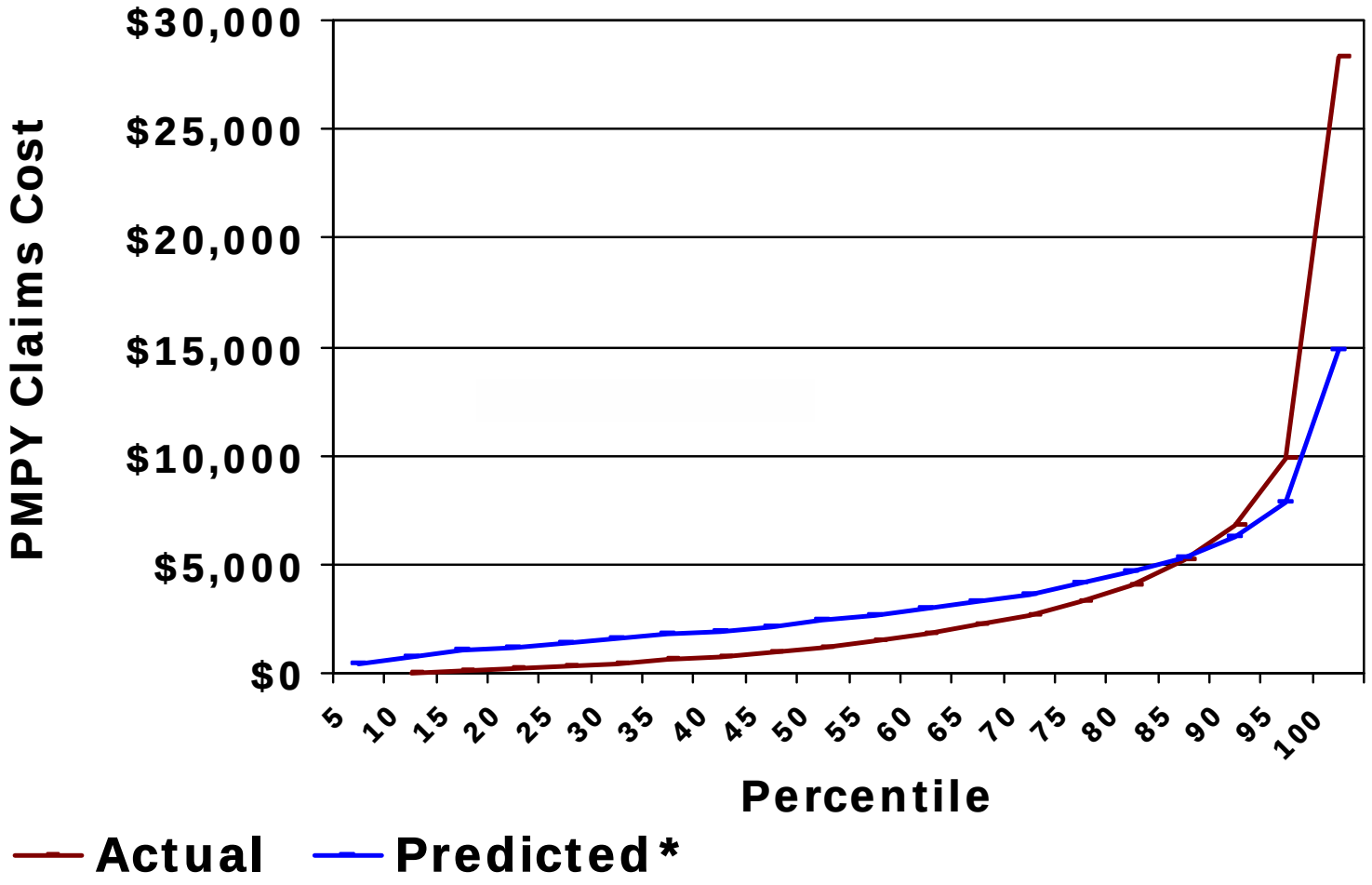

*Based on DxCG's prospective Med+Rx risk score

Context

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- Prioritize members for care management interventions
- Focus on relative risk of future costs rather than absolute predicted costs for a member
- More interested in maximizing prediction of high-risk members than predicting cost across the entire population

Logistic Model Performance Assessment

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- Receiver Operating Characteristic (ROC) curve:
  - Definition: A graphical representation of the trade off between the false negative and false positive rates for every possible cut off. By tradition, the plot shows the false positive rate (1-specificity) on the X axis and the true positive rate (sensitivity or 1 - the false negative rate) on the Y axis
  - Interpretation:
    - .90-1.0 = Excellent
    - .80-.90 = Good
    - .70-.80 = Fair
    - .60-.70 = Poor
    - .50-.60 = Fail

Population Logistic Model

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- Prediction of high-cost individuals having total medical and pharmacy claims greater than or equal to $10,000
- A split sample approach was used randomly selecting 50% of the population for model calibration and 50% for model validation

	Calibration Group	Validation Group
Members (n)	1,068,844	1,067,391
Average Cost	$3,535	$3,532
High cost (n)	71,064	70,850
High cost (%)	6.65%	6.64%

Population Model Performance

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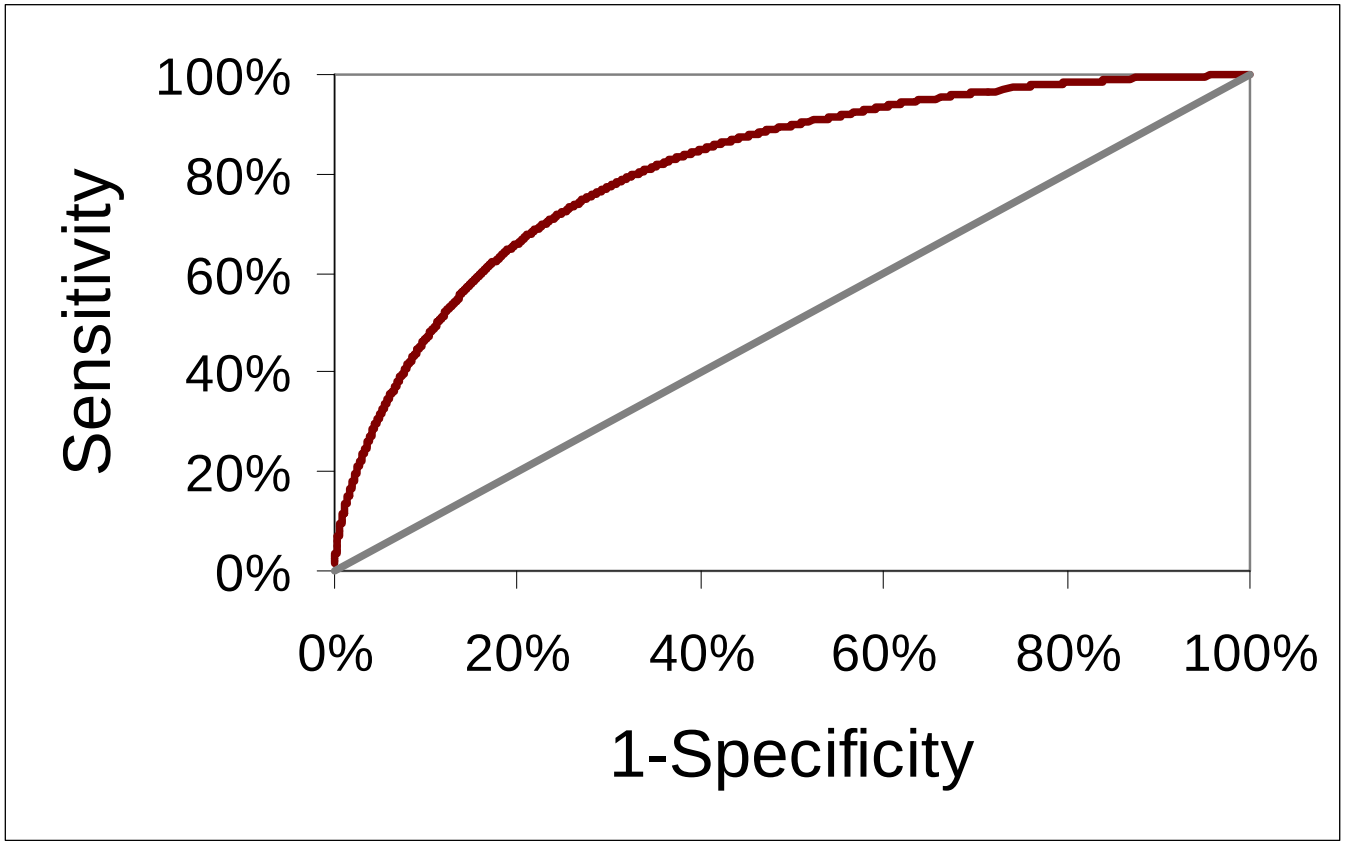
- ROC Curve Description of Model
  - Area = .811



HRA Overview

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- HRA administered to select large employer groups with questions in the following areas:
  - General Demographics
  - Biometrics
  - Health Screening and Immunizations
  - Personal and Family Disease History
  - Weight Management
  - Nutrition
  - Physical Activity
  - Tobacco and Alcohol
  - Stress and Well-Being
  - Injury Prevention
  - Sexual Behavior
- 25,708 members completed HRAs between November 2005 and March 2006 and were continuously enrolled through March 2007

Preliminary HRA Assessment

SOLUCIA, INC.

- Specific responses are clearly associated with higher future costs
- See attached Excel file for detailed findings

HRA Model Population

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- Three logistic models predicting high cost claimants were developed on the HRA population
  - Claims only using DxCG prospective Med+Rx risk
  - Claims and HRA survey responses
  - HRA survey responses only

	Development Group	Validation Group
Members (n)	12,854	12,854
Average Cost	$3,556	$3,552
High cost (n)	954	954
High cost (%)	7.42%	7.42%

Claims Only Model Performance

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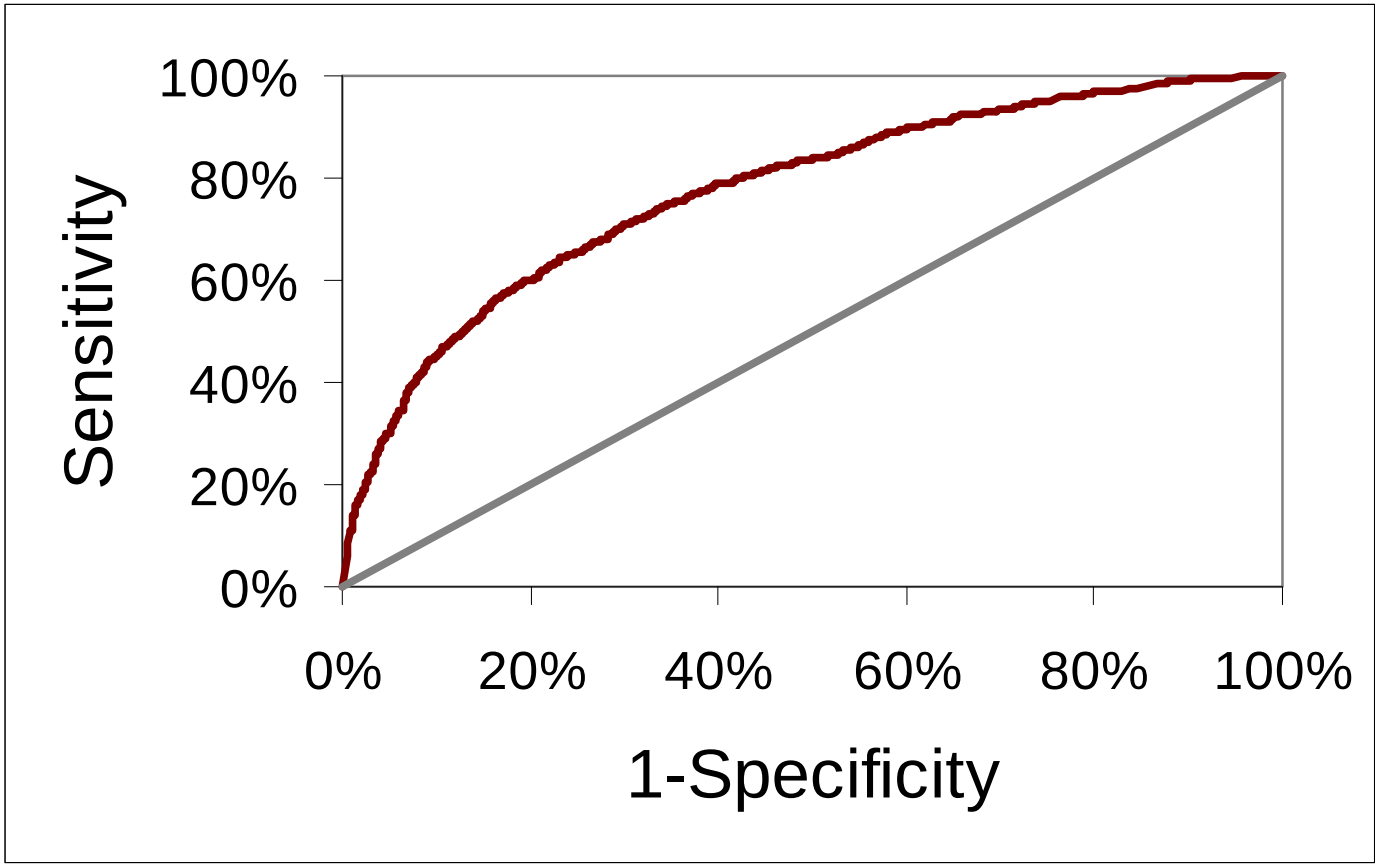
- ROC Curve
  - Area = .775



Claims and HRA Model Summary

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Variable	Direction	P-value
DxCG Prospective Risk	Positive	<.0001
Body Mass Index	Positive	<.0001
On average, how often do you have a drink containing alcohol?	Negative	0.0006
During the past week, I had crying spells.	Positive	<.0001
Have you ever been diagnosed with CHF	Positive	0.0107
Please rate how confident you are that you can be physically active when you don't have someone to exercise with.	Negative	0.0479
On a typical day, how many servings do you eat of whole grain or enriched bread, cereal, rice, and pasta?	Negative	0.0572

Claims and HRA Model Performance

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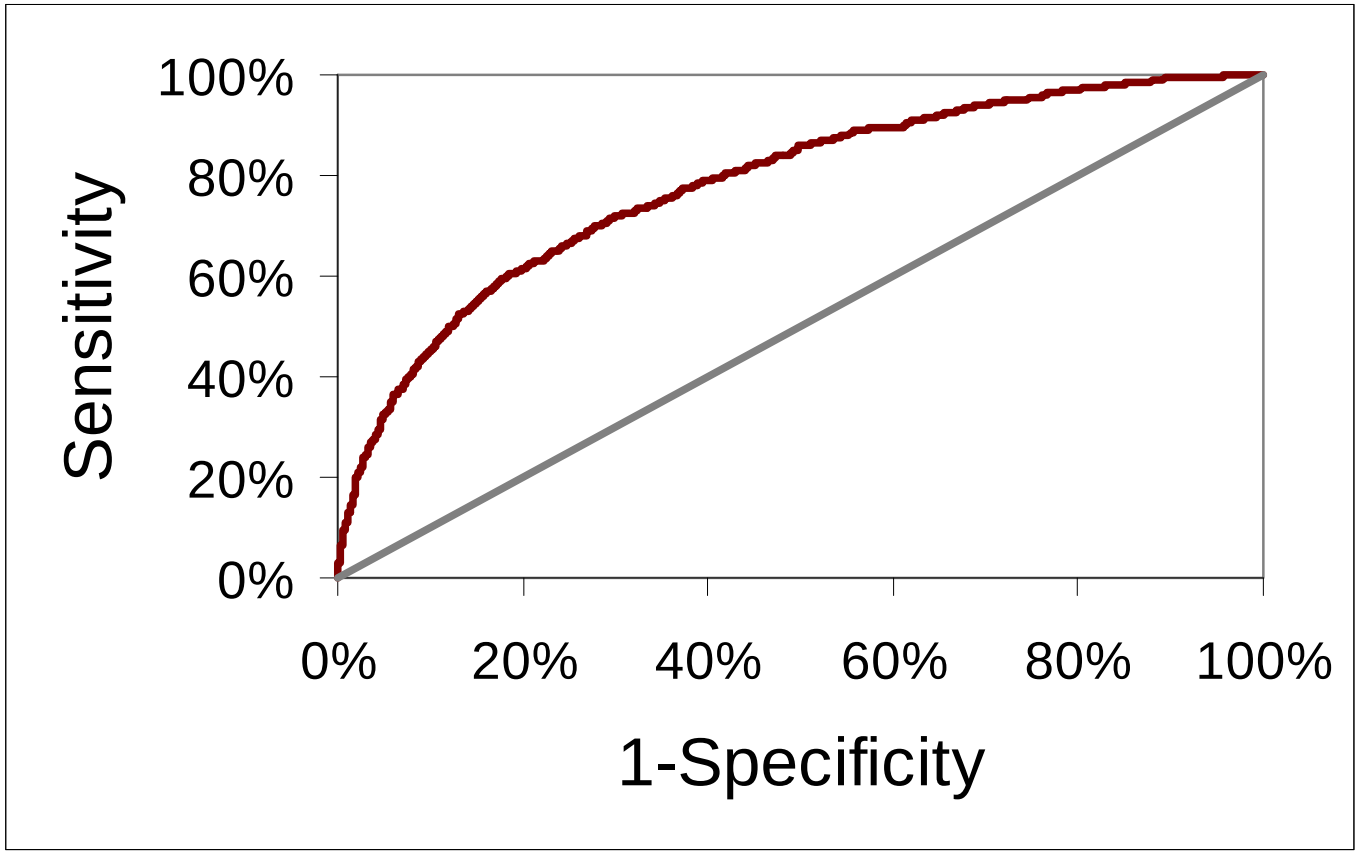
- ROC Curve
  - Area = .781



HRA Only Model Summary

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Variable	Direction	P-value
Body Mass Index	Positive	<.0001
On average, how often do you have a drink containing alcohol?	Negative	<.0001
Influenza (flu) within the last 12 months?	Positive	<.0001
Please rate how confident you are that you can have your skin checked by a doctor once a year?	Positive	<.0001
During the past week, I had crying spells.	Positive	<.0001
Have you ever been diagnosed with Coronary Artery Disease?	Positive	<.0001
Are you currently on hormone replacement therapy (Estrogen Therapy, Premarin) or planning to start?	Positive	<.0001
Have you ever been diagnosed with CHF?	Positive	<.0001
Non, Medium or Heavy Smoker (derived from several items)	Positive	<.0001
Moderate-intensity physical activity - days per week	Negative	<.0001
Please rate how confident you are that you can be physically active when you don't have someone to exercise with.	Negative	0.006
On a typical day, how many servings do you eat of whole grain or enriched bread, cereal, rice, and pasta?	Negative	0.010
In the last month, how often have you felt nervous and stressed?	Positive	0.016

HRA Only Model Performance

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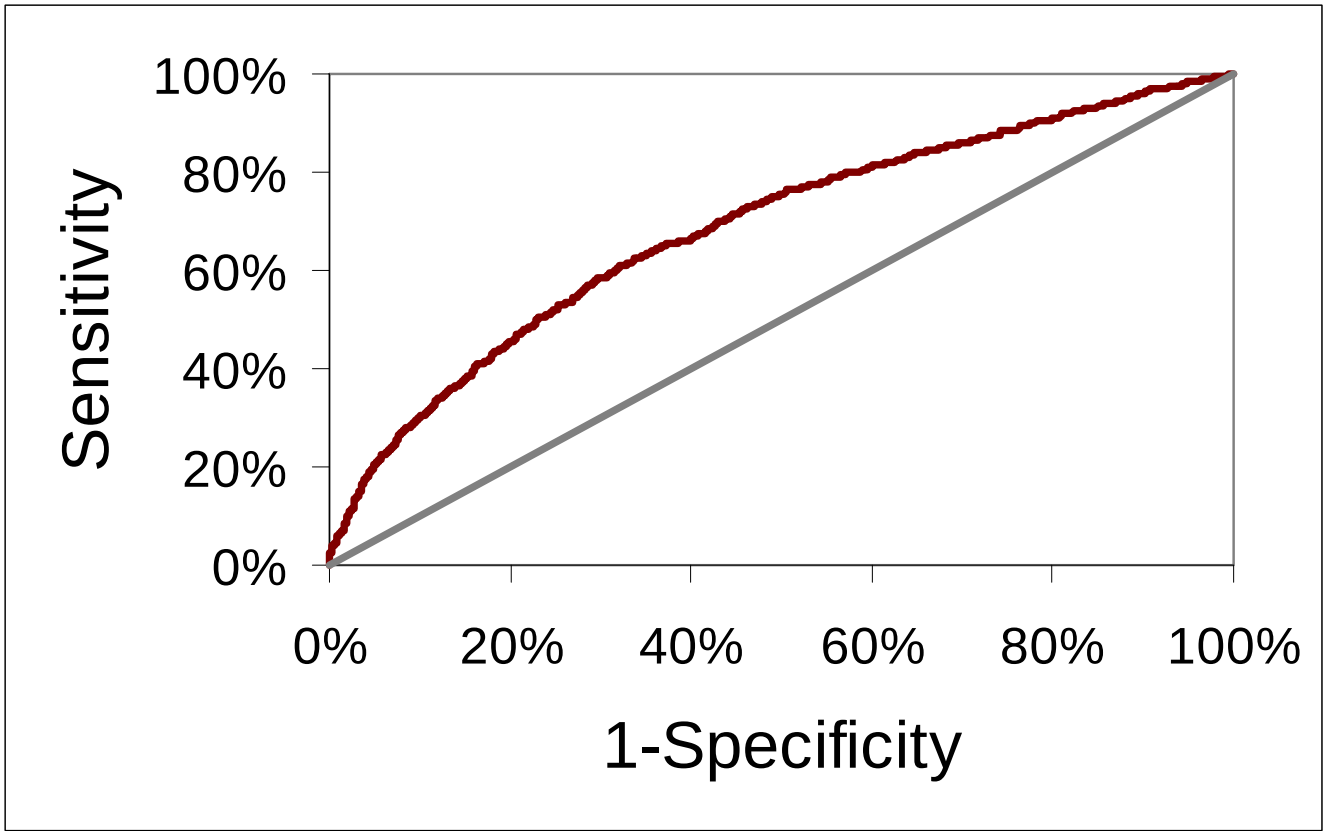
- ROC Curve
  - Area = .685



Lab Value Overview

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- Lab values were provided by a large national laboratory
- Values available for approximately 20% of the total population having lab tests
- 65,906 members had lab values for tests administered between April 2005 and March 2006 and were continuously enrolled through March 2007

Preliminary Lab Value Assessment

SOLUCIA, INC.

- Specific lab tests are associated with higher future costs
- See attached Excel file for detailed findings

Lab Value Model Population

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- Two logistic models predicting high cost claimants were developed on members with lab values available
  - Claims only using DxCG prospective Med+Rx risk
  - Claims and lab values for specific tests

	Development Group	Validation Group
Members (n)	32,953	32,953
Average Cost	7,156	7,154
High cost (n)	5667	5666
High cost (%)	17.20%	17.19%

Claims Only Model Performance

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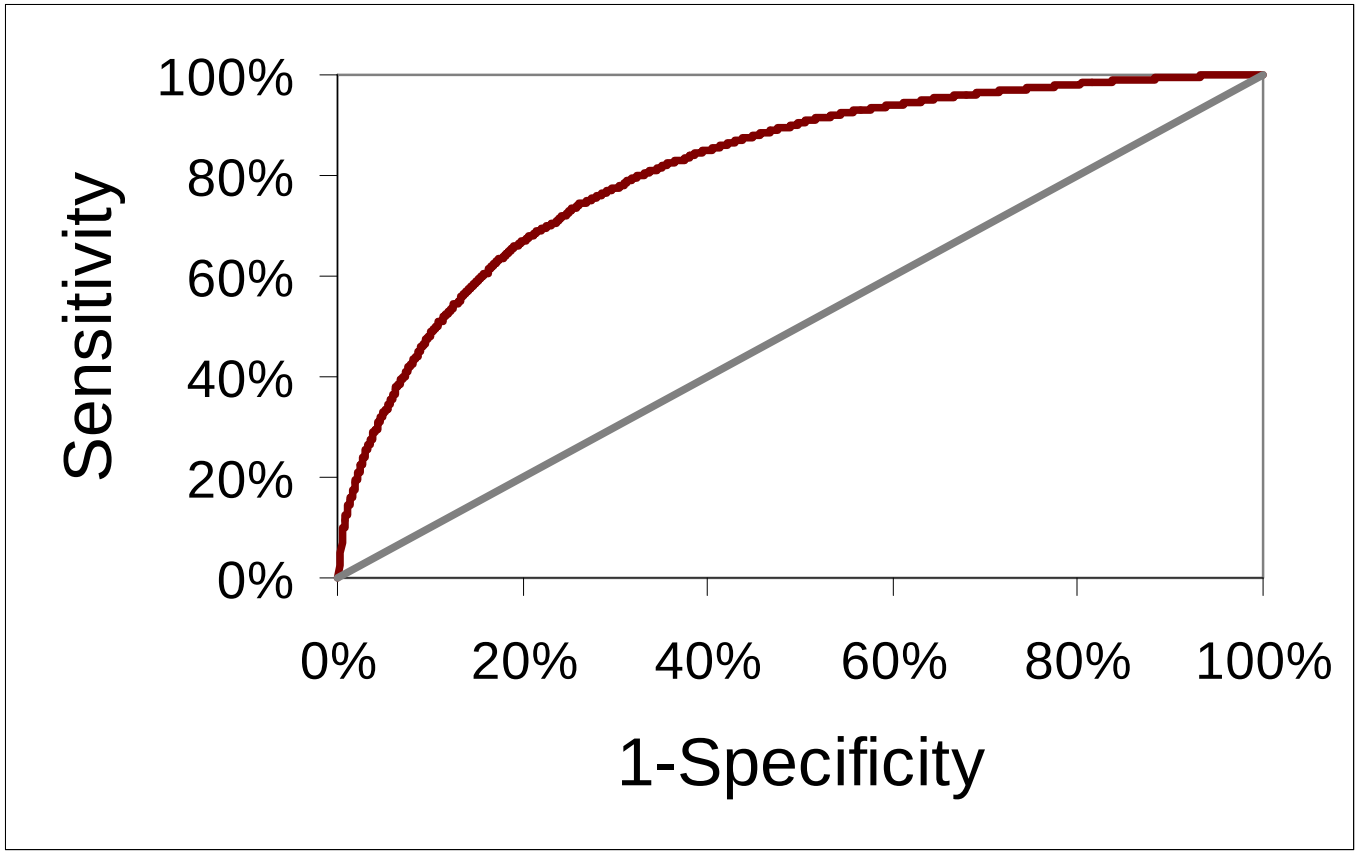
- ROC Curve
  - Area = .815



Claims and Lab Value Model Summary

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Variable	Association	P-Value
DxCG Prospective Risk	Positive	<.0001
HDL (maximum)	Negative	<.0001
Neutrophils (maximum)	Positive	<.0001
LDL (maximum)	Negative	0.0002
Hemoglobin (n)	Positive	0.001
Neutrophils (n)	Positive	0.0011
Alkaline Phosphatase (maximum)	Positive	0.0033

Claims and Lab Values Model Performance

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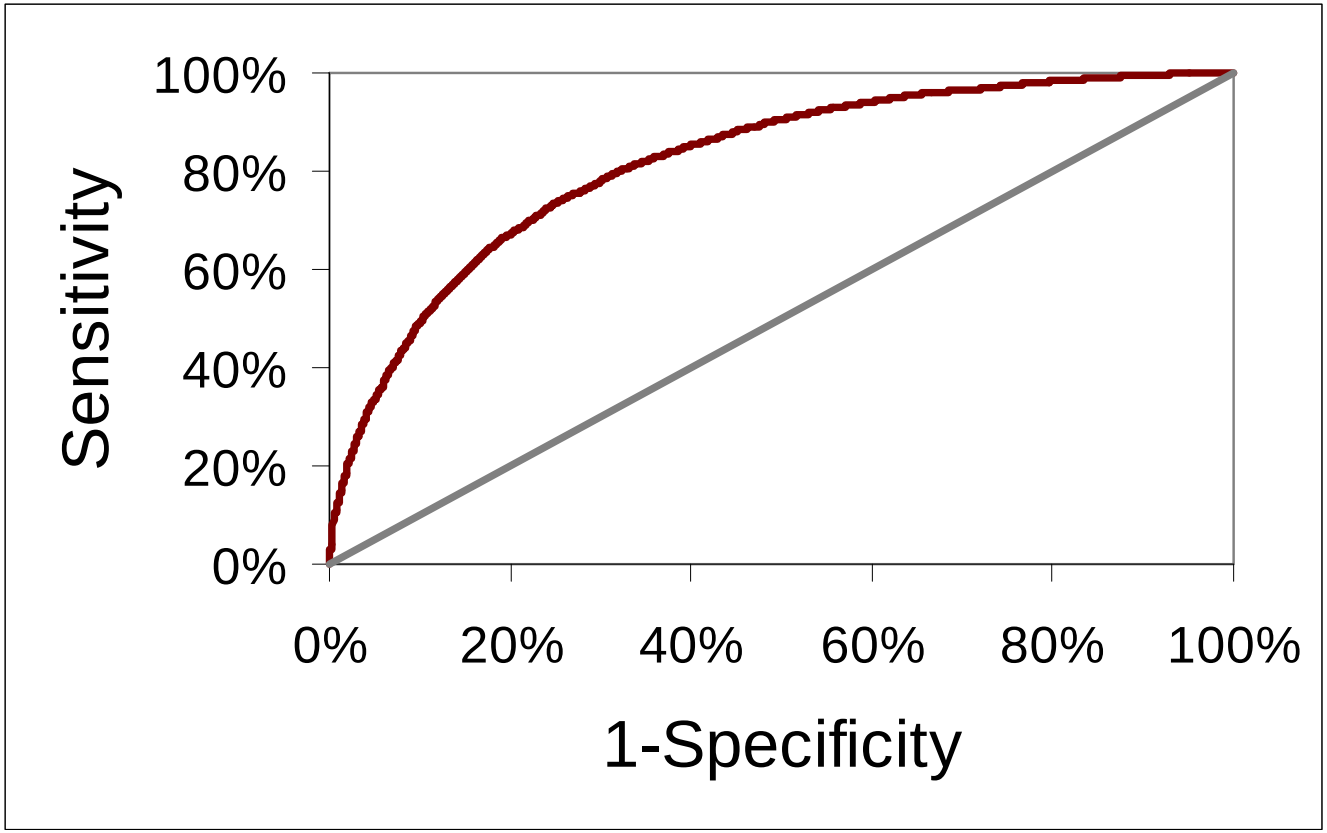
- ROC Curve
  - Area = .817



Summary

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- Claims-based models are very effective in predicting high-cost claimants
- HRA
  - Survey responses are correlated with future costs
  - HRAs can be used to identify high-risk individuals if claims are not available
  - Survey responses do not provide material improvement over claims in first year
- Lab values
  - Lab values for specific tests are correlated with future costs, particularly for members with specific conditions
  - Lab values provide little improvement over claims in identifying high-cost members across the population

Limitations

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- HRA
  - Models developed for single population with one year of follow-up
  - Short term risk already identified through claims
  - Costs associated with behavioral issues may take longer than one year to manifest
  - HRA responses may provide insights into other factors key to care management success:
    - Identify members receptive to intervention
    - Identify members with opportunity to impact

Limitations (continued)

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- Lab values
  - Models developed for single population with one year of follow-up.
  - Short term risk already identified through claims
  - Costs associated with sub-optimal lab values may take longer than one year to be experienced
  - Lab values may provide more value in specific sub-populations (e.g., diabetics)
  - Members with out of range lab values may provide greater opportunity to impact

Questions?

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