



# Medicare Part D Risk Adjustment: Performance of the RxHCC Risk Adjustment Model

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# Disclosure

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“I, Steve Calfo, declare no conflicts of interest or financial interests in any product or service mentioned in this presentation, including grants, employment, gifts, stock holdings, or honoraria.”

# Learning Objectives

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- Describe the RxHCC Risk adjustment model.
- Identify the three data sources used by CMS to measure the performance of the RxHCC Risk Adjustment Model.

# Objectives

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- Overview of Risk Adjustment – Part D
- Overview of the original and revised CMS RxHCC Risk Adjustment Model (RAM)
- Describe how to measure the performance or the predictive accuracy of the RxHCC RAM
- Describe the key steps, elements of the analysis, and results using 2007- 2010 data
- Describe the landscape of actual plan liability over time
- Illustrate that the revised CMS RxHCC RAM is predicting costs more accurately than the original model

# Risk Adjustment Models

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- Each model segment is developed using ordinary least squares which is a method for estimating unknown parameters in a linear regression model
- The method minimizes the squared differences between the observed and predicted values
- Dependent variable is annualized Medicare Part D Plan Liability and the independent variables are demographic and disease binary values
- Development of a risk adjustment model is referred to as calibration

# Risk Adjustment Models

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- Prospective - Uses demographic information and diagnosis in a given year to predict expenditures in the following year
- Calibration – uses historical data to develop a model
- Ex. Demographic and diagnosis data in 2007 and expenditure data in 2008 are used to calibrate a model
- Model is applied in a payment year by using demographic and diagnosis data for 2009 to predict expenditures in 2010

## Part D Risk Adjustment (RxHCC)

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- Risk Adjustment Methodology
  - Designed to predict plan liability for prescription drugs under the Medicare drug benefit
  - Explanatory power of the RxHCC model is  $R^2=0.25$  for plan liability, on par with other drug models and is higher than similar Part A/B models because drug costs are more stable

# Commonly used Terms in Risk Adjustment

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- Health Risk or Health Status is measured by risk factors to determine an estimate for the level of health of an individual
- Risk factors use information that assist in determining proxies or estimates for health status. They include:
  - Age, Sex, Medicaid, Disability, Institutionalization
  - Diagnosis



## Commonly used Terms in RA (cont)

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- Risk Scores are calculated using both demographic and diagnosis data
- Calibration Year – year relating to model development
- Data Collection Year –year prior to payment year

# Steps in Developing a RAM & Risk Score

- Create calibration database at a beneficiary level
  - Demographic & Diagnosis matrix : Year X
  - Costs : Year (X+1)
- Run regression to develop coefficients
  - Coefficients represent dollar amounts and are the incremental cost associated with having an HCC or demographic factor
- Develop denominator
  - Overall average cost of beneficiaries in calibration
- Create relative factors
  - Divide coefficients by denominator
- Calculate risk score
  - Sum of demographic and disease relative factors

# Calibration Data

Medicare RX Liability (X+1)	Demographic & HCCs -X											
	M 65-74	M 75-84	M 85-94	M 95+	HCC1	HCC5	HCC8	HCC9	HCC10	HCC11	HCC14	HCC15
500	1	0	0	0	1	0	0	0	0	0	0	0
1,120	0	0	0	1	1	1	0	0	0	0	1	0
899	0	1	0	0	1	1	1	0	0	0	1	1
233	0	0	1	0	1	1	1	1	0	0	0	1
311	0	1	0	0	1	0	0	0	1	1	1	1
2,344	1	0	0	0	1	0	1	1	1	0	0	0
1,456	0	0	0	1	0	0	0	0	0	0	0	0
1,600	0	1	0	0	0	0	1	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	1	0	0
0	1	0	0	0	0	1	0	0	0	1	0	0
3,010	0	0	0	1	0	0	0	1	0	1	1	0
2,600	0	1	0	0	0	0	0	0	0	0	1	0
1,565	0	0	1	0	1	1	0	0	0	1	0	0
762	1	0	0	0	0	0	0	0	0	0	1	0



# Relative Factor Calculation

Regression Equation												
$Y = C_1 * D_1 + C_2 * D_2 + C_3 * D_3 + C_4 * D_4 + C_5 * HCC_1 + C_6 * HCC_5 + C_7 * HCC_8 + C_8 * HCC_9 + \dots$												
where												
Y = Expenditures												
C <sub>i</sub> -Coefficients in dollars, represent incremental plan liability of having demographic or disease												
D <sub>i</sub> -Demographic Factors												
HCC <sub>i</sub> - Hierarchical Condition Category -Disease Class												
	65-74	75-84	85-94	95+	HCC1	HCC5	HCC8	HCC9	HCC10	HCC11	HCC14	HCC15
Coefficients	\$461.93	\$449.28	\$454.47	\$466.11	\$1,770.09	\$130.63	\$1,827.66	\$1,212.17	\$228.04	\$43.17	\$277.86	\$193.73
Relative Factors	0.417	0.406	0.411	0.421	1.599	0.118	1.651	1.095	0.206	0.039	0.251	0.175
R Squared	0.25											
Observation	14.3 M											

# (Original vs. Revised) RxHCC Model

Original Model	New (Revised) Model
Based on FEHBP and Medicaid Data	Based on actual Part D expenditure data Uses 2007 diagnosis to estimate 2008 expenditures
Used in payment years 2006-2010	Used in 2011+
Used multipliers for LIS and INST	Uses separate model segments for LIS and INST

# Risk Score Example

- Risk Adjustment Methodology
- Calculation of an RxHCC Risk Score
  - 71 year old male – .417
  - HCC 5 – Opportunistic Infections – .118
  - HCC 11 – Prostate Cancer – .039
  - HCC 15 – Diabetes w/o Complications – .175
  - Risk Score = Demographic + Disease Factors
  - $= .417 + .118 + .039 + .175$
  - $= .749$

## Part D Risk Adjustment Model Performance Analysis

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- Health Plan Management System – HPMS
  - Plan Sponsor Bid Information
- Risk Adjustment System – RAS (Risk Scores)
  - Beneficiary demographic information
  - Enrollee status
  - Risk scores
- Payment Reconciliation System – PRS
  - Actual Part D Expenditure Data and plan liability
  - Rebates

# Part D Risk Adjustment Model Performance Analysis

- Beneficiary and Plan information used to assign beneficiaries into model segments
  - Model segments represent groups of beneficiaries with significant cost and utilization differences
  - Segments-8
    - Low Income Aged, Low Income Non-Aged
    - Non-Low Income Aged, Non-Low Income Non-Aged
    - Institutional
    - New Enrollee, (Low Income Aged, Non-Low Income , Institutional )
- Analysis done in the aggregate and separately
  - Aggregate
  - Segment
  - Plan type – PDP, MA-PD
  - Beneficiary Type – Non LIS, LIS, INST
  - Organization – NOT PRESENTED
  - Predicted Risk Score Bands



# Results of Original and Revised Part D RxHCC RAM Analysis

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- The analysis shows that the revised model is predicting plan liability more accurately than the original RxHCC RAM in the aggregate
- Revised model is performing well in standardizing payments across all levels of risk (low to high)

# Actual Plan Liability Analysis 2007-2010

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- In the aggregate and for most segments average plan liability is increasing from year to year
- Segments are increasing at different rates over time
- Low Income segments are increasing the fastest, followed by moderate increases for institutional segments, and Non Low income segments have the smallest increases

# Actual Plan Liability Analysis 2007-2010

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- Relative costs are decreasing for Non Low Income segments and relative costs are increasing for Low Income and Institutional segments
- Average cost per script is increasing for most segments from 2009-2010 with the Low Income and Institutional segments increasing faster than Non Low Income
- Average cost per script for brand are increasing significantly faster than for generic

# Actual Plan Liability Analysis 2007-2010

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- Scripts per beneficiary are decreasing slightly in the aggregate and across most segments
- Brand scripts per beneficiary are decreasing significantly while generic scripts per beneficiary are increasing significantly
- Average risk scores are increasing over the period with larger increases in MA-PD relative to PDP

## Part D Model Performance Analysis

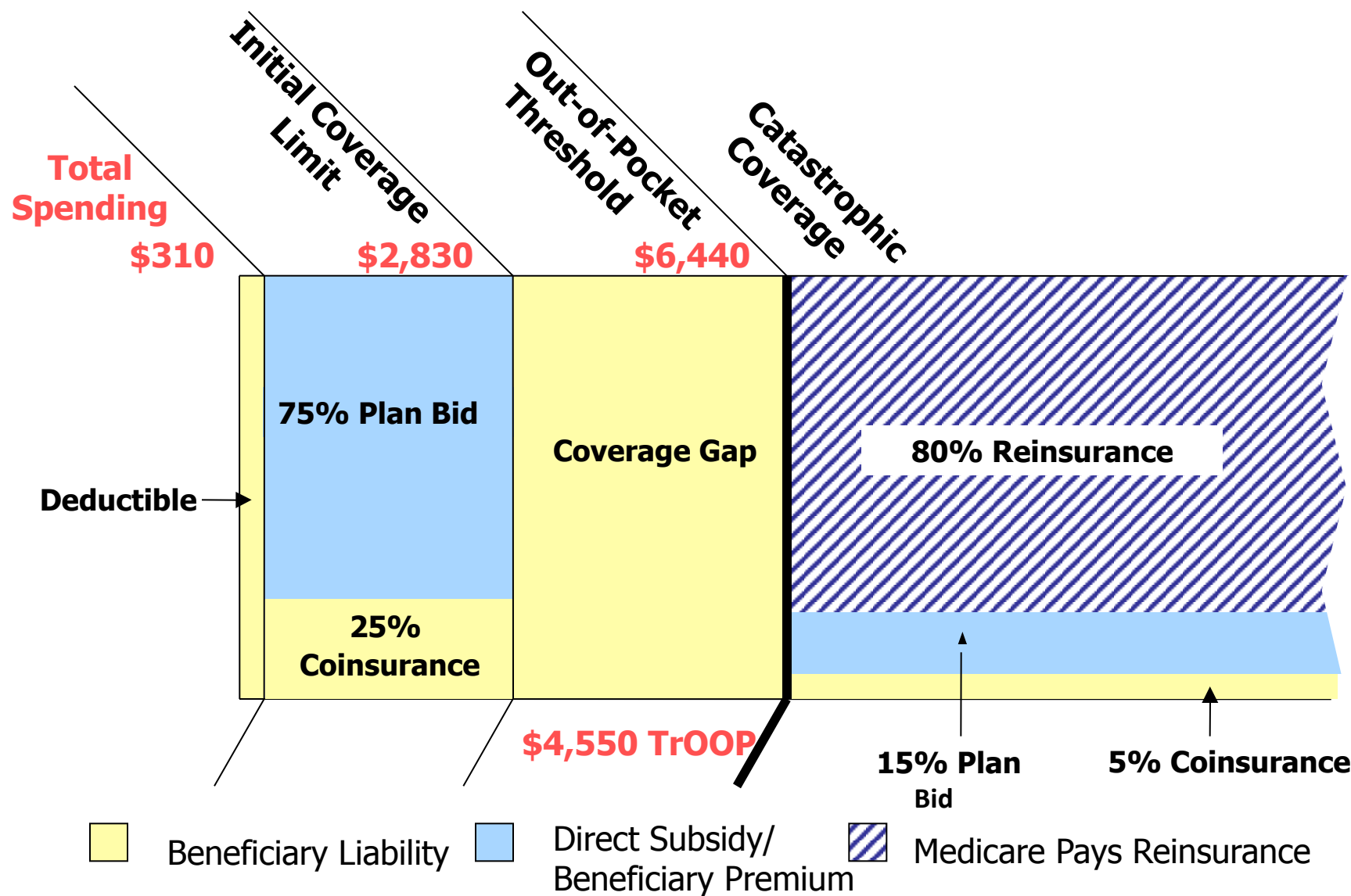
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- Compare predicted costs to actual costs across the following dimensions of analysis:
  - Aggregate
  - Segment
  - Plan Type
  - Varying levels of risk

## Part D Model Performance

- 2 fundamental ways of evaluating performance or accuracy of the model
- Examining Predictive Ratio based on plan liability
  - Predictive Ratio =  $(\text{Predicted Liability} / \text{Actual Plan Liability})$
  - Compare ratio to 1.0
  - Ratio > 1.0 implies over predicting
  - Ratio < 1.0 implies under predicting
- Examining Normalized costs
  - Normalized Predicted costs =  $(\text{Predicted Plan Liability} / \text{Risk Score})$
  - Normalized Actual costs =  $(\text{Actual Plan Liability} / \text{Risk Score})$
  - Compare normalized predicted costs to normalized actual costs
- Presentation focuses on Predictive Ratios

# Part D Benefit Structure - 2010

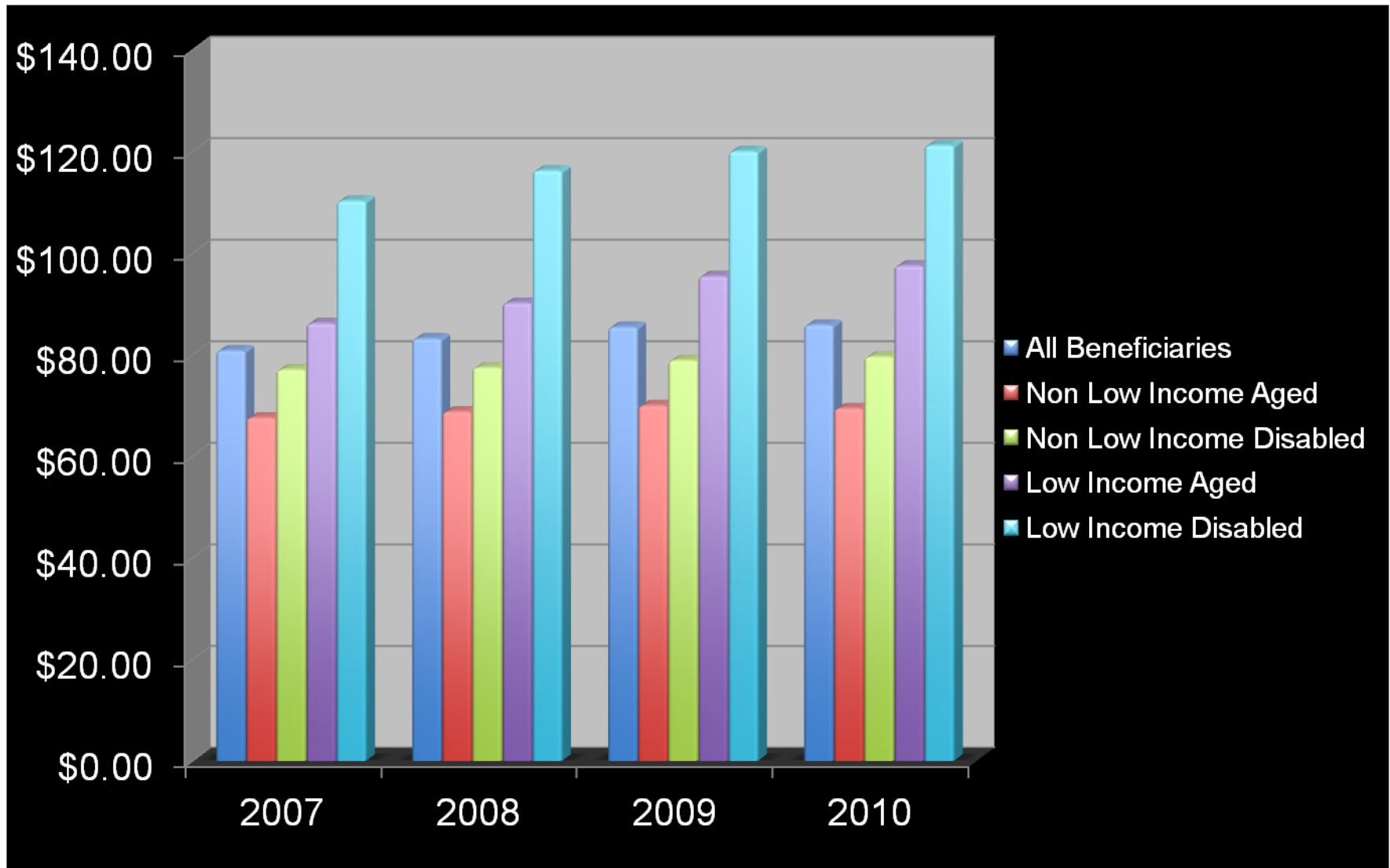


# Medicare Part D Actual Plan Liability PMPM (2007-2010)

		Actual Liability PMPM				Percent Change			
	Beneficiaries (millions)	2007	2008	2009	2010	2007-2008	2008-2009	2009-2010	2007-2010
All Beneficiaries	25.1	\$80.78	\$83.13	\$85.42	\$85.84	2.91%	2.75%	0.49%	6.26%
Non Low Income Aged	13.8	\$67.56	\$68.74	\$69.98	\$69.40	1.74%	1.80%	-0.83%	2.72%
Non Low Income Disabled	1.2	\$77.05	\$77.44	\$78.85	\$79.56	0.51%	1.83%	0.90%	3.27%
Low Income Aged	4.9	\$86.15	\$90.16	\$95.43	\$97.49	4.65%	5.85%	2.16%	13.16%
Low Income Disabled	3.6	\$110.28	\$116.23	\$120.04	\$121.19	5.40%	3.27%	0.96%	9.90%

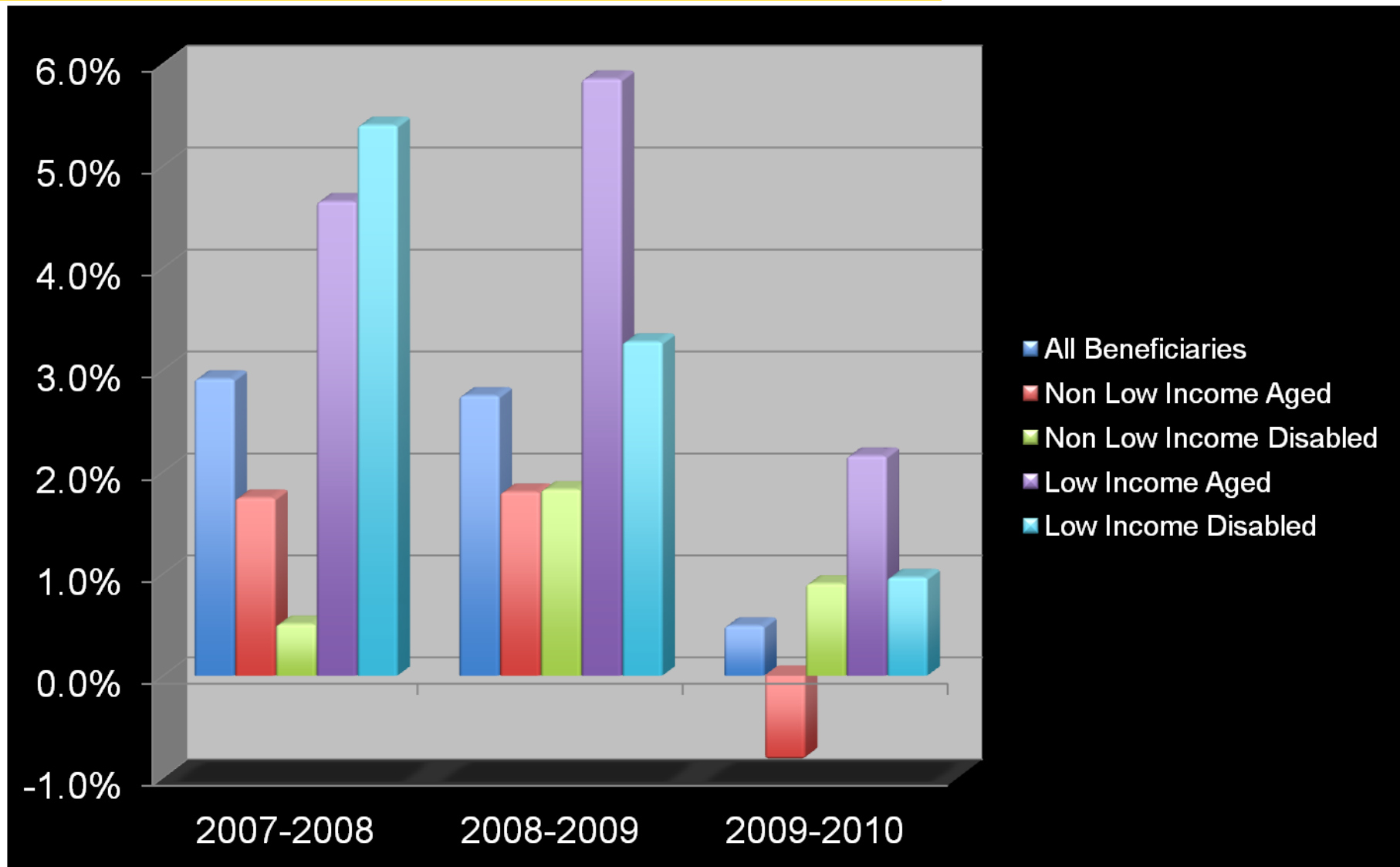


# Plan Liability by Beneficiary group 2007-2010



# Percentage Changes Plan Liability by Beneficiary Group

## 2007-2010



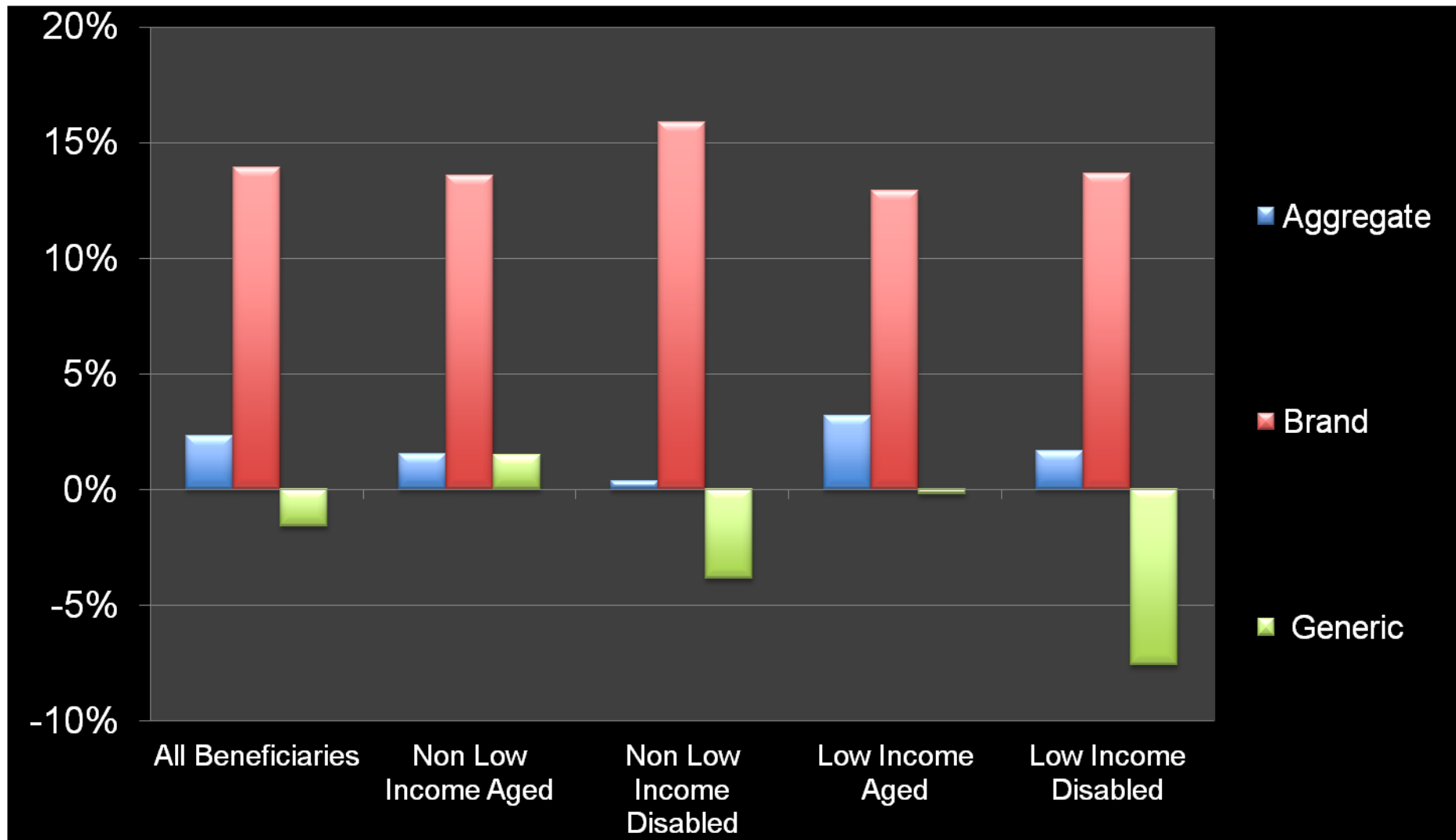
# Medicare Part D Actual Plan Liability Institutional PMPM (2007-2010)

		Actual Liability PMPM				Percent Change			
	Beneficiaries	2007	2008	2009	2010	2007-2008	2008-2009	2009-2010	2007-2010
Non Low Income Aged	92,712	\$115.76	\$120.51	\$123.24	\$125.47	4.10%	2.27%	1.81%	8.39%
Non Low Income Disabled	1,891	\$127.10	\$129.31	\$134.56	\$140.52	1.74%	4.06%	4.43%	10.56%
Low Income Aged	703,844	\$129.11	\$134.89	\$139.89	\$144.28	4.48%	3.71%	3.14%	11.76%
Low Income Disabled	87,430	\$173.20	\$182.28	\$186.06	\$191.08	5.24%	2.07%	2.70%	10.32%

# 2009-2010 Cost Per Prescription

Cost per Script	Aggregate			Brand			Generic		
	2009	2010	Percent Change	2009	2010	Percent Change	2009	2010	Percent Change
All Beneficiaries	\$66.97	\$68.52	2.3%	\$167.83	\$191.15	13.9%	\$23.46	\$23.08	-1.6%
Non Low Income Aged	\$57.42	\$58.30	1.5%	\$146.46	\$166.33	13.6%	\$22.18	\$22.51	1.5%
Non Low Income Disabled	\$69.42	\$69.68	0.4%	\$204.65	\$237.13	15.9%	\$27.50	\$26.44	-3.9%
Low Income Aged	\$62.92	\$64.93	3.2%	\$148.57	\$167.78	12.9%	\$20.17	\$20.13	-0.2%
Low Income Disabled	\$95.79	\$97.38	1.7%	\$236.91	\$269.29	13.7%	\$29.38	\$27.16	-7.6%

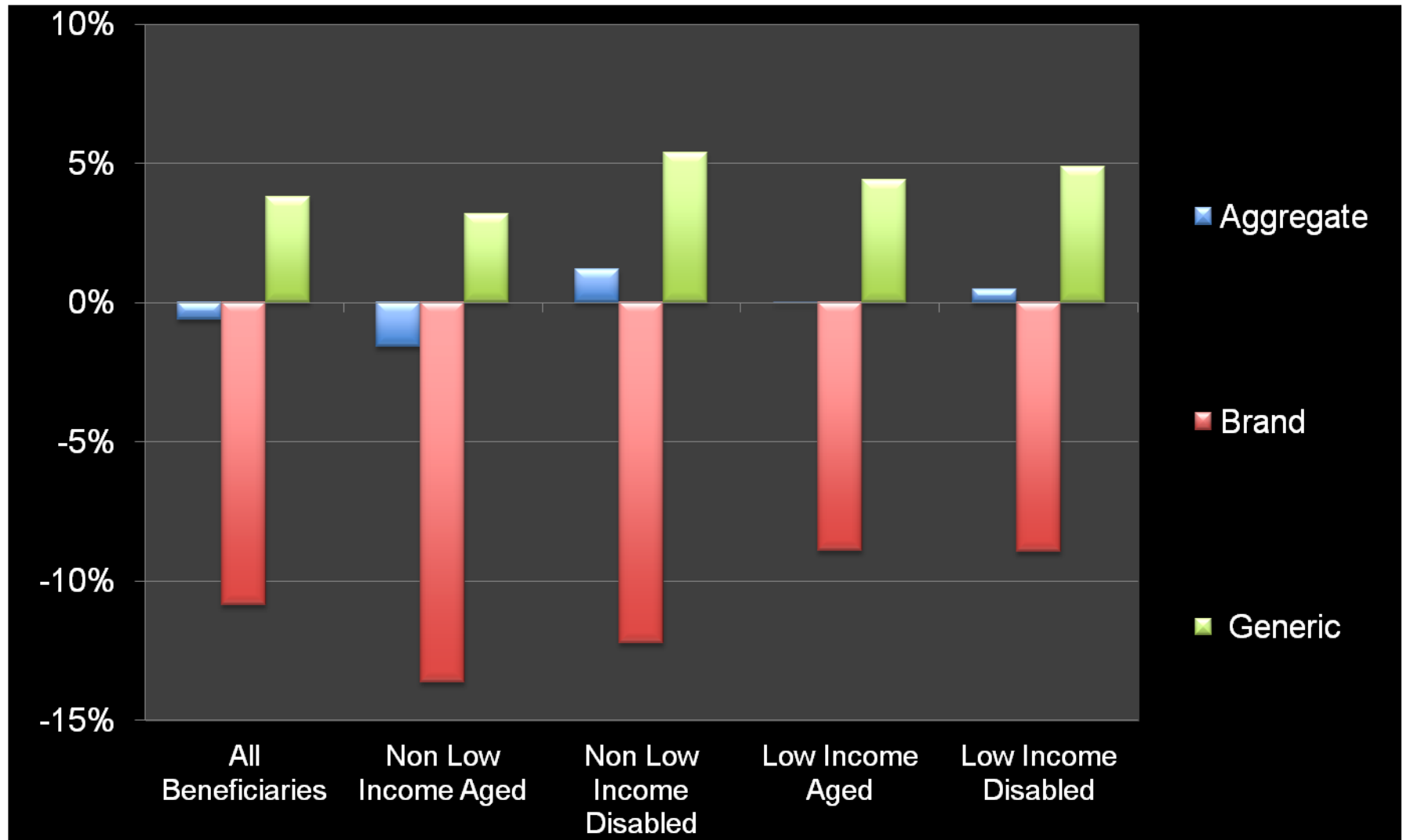
# 2009-2010 Cost Per Prescription Percentage Changes



# 2009-2010 Prescription Per Beneficiary

Script Per Beneficiary	Aggregate			Brand			Generic		
	2009	2010	Percent change	2009	2010	Percent change	2009	2010	Percent change
All Beneficiaries	38.86	38.62	-0.6%	11.71	10.44	-10.8%	27.15	28.18	3.8%
Non Low Income Aged	29.49	29.02	-1.6%	8.36	7.22	-13.6%	21.13	21.80	3.2%
Non Low Income Disabled	34.34	34.75	1.2%	8.13	7.13	-12.2%	26.21	27.62	5.4%
Low Income Aged	49.68	49.66	0.0%	16.54	15.07	-8.9%	33.14	34.59	4.4%
Low Income Disabled	51.55	51.79	0.5%	16.49	15.02	-8.9%	35.05	36.77	4.9%

# 2009-2010 Prescription Per Beneficiary Percentage Changes

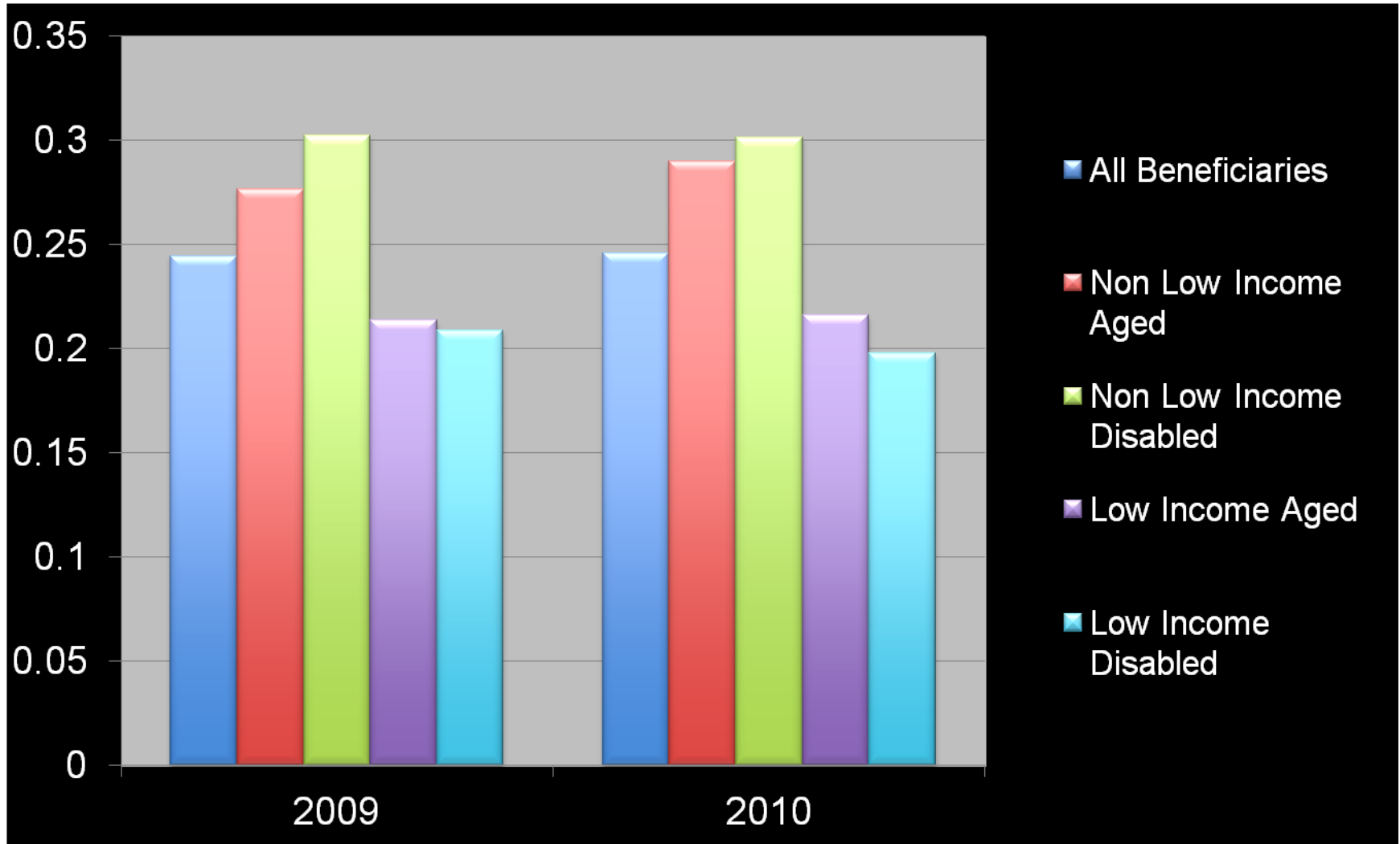


## 2009-2010 Generic Share of Total Dollars

	2009	2010	Percent Change
All Beneficiaries	0.245	0.246	0.44%
Non Low Income Aged	0.277	0.290	4.80%
Non Low Income Disabled	0.302	0.302	-0.28%
Low Income Aged	0.214	0.216	1.00%
Low Income Disabled	0.209	0.198	-5.10%



# Generic Share 2009-2010



# Predicted vs. Actual Plan Liability PMPM (2008)

		Old Model Predicted	New Model Predicted	Actual	Predicted Ratio	
	Beneficiaries (millions)	2008	2008	2008	Old / Actual	New / Actual
Non Low Income Aged	13.4	\$74.88	\$72.73	\$68.74	1.09	1.06
Non Low Income Disabled	1.1	\$89.31	\$86.25	\$77.44	1.15	1.11
Low Income Aged	4.7	\$88.32	\$85.77	\$90.16	0.98	0.95
Low Income Disabled	3.5	\$98.92	\$107.00	\$116.23	0.85	0.92

# Predicted vs. Actual Plan Liability PMPM (2010)

		Old Model Predicted	New Model Predicted	Actual	Predicted Ratio	
	Beneficiaries (millions)	2010	2010	2010	Old / Actual	New / Actual
Non Low Income Aged	13.8	\$77.24	\$74.90	\$69.40	1.11	1.08
Non Low Income Disabled	1.2	\$93.44	\$90.61	\$79.56	1.17	1.14
Low Income Aged	4.9	\$91.59	\$89.25	\$97.49	0.94	0.92
Low Income Disabled	3.6	\$102.66	\$111.87	\$121.19	0.85	0.92

# Predicted vs. Actual Plan Liability PMPM (2008)- Institutional

		Old Model Predicted	New Model Predicted	Actual	Predicted Ratio	
	Beneficiaries	2008	2008	2008	Old / Actual	New / Actual
Non Low Income Aged	90,012	\$99.64	\$116.26	\$120.51	0.83	0.96
Low Income Aged	670,328	\$105.48	\$126.55	\$134.89	0.78	0.94
Low Income Disabled	85,716	\$147.11	\$166.83	\$182.28	0.81	0.92

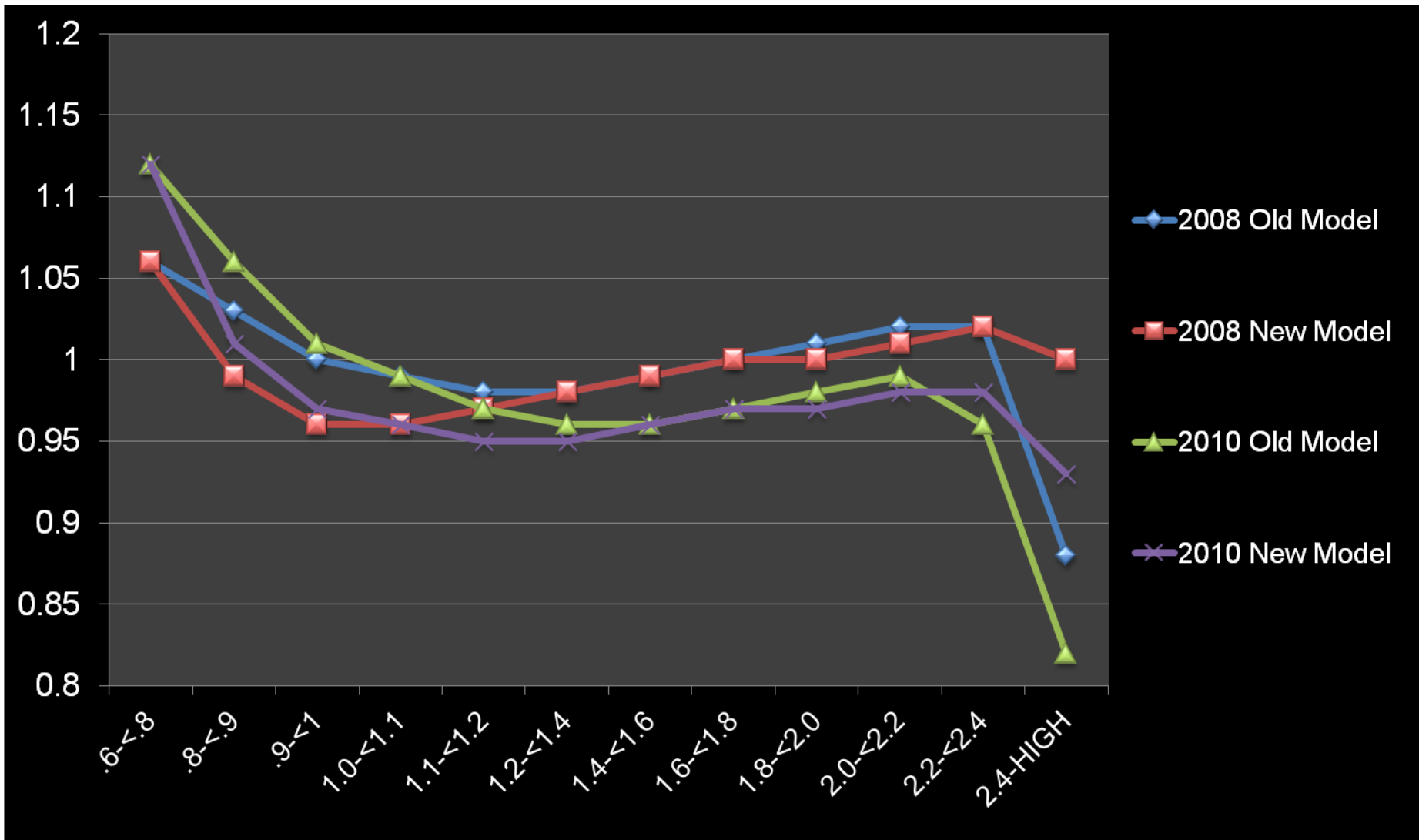
# Predicted vs. Actual Plan Liability PMPM (2010) – Institutional

		Old Model Predicted	New Model Predicted	Actual	Predicted Ratio	
	Beneficiaries	2010	2010	2010	Old / Actual	New / Actual
Non Low Income Aged	92,712	\$102.97	\$118.49	\$125.47	0.82	0.94
Low Income Aged	703,844	\$109.85	\$129.58	\$144.28	0.76	0.90
Low Income Disabled	87,430	\$154.19	\$171.42	\$191.08	0.81	0.90

# Predicted Ratios for Old vs. New Model 2008 & 2010

		Predicted Ratios			
Risk Score	Share	2008 Old Model	2008 New Model	2010 Old Model	2010 New Model
0-<.4	3.5%	1.71	1.83	1.81	1.97
.4-<.6	14.2%	1.23	1.40	1.24	1.41
.6-<.8	19.0%	1.06	1.06	1.12	1.12
.8-<.9	11.3%	1.03	0.99	1.06	1.01
.9-<1	9.3%	1.00	0.96	1.01	0.97
1.0-<1.1	8.6%	0.99	0.96	0.99	0.96
1.1-<1.2	7.1%	0.98	0.97	0.97	0.95
1.2-<1.4	10.5%	0.98	0.98	0.96	0.95
1.4-<1.6	7.0%	0.99	0.99	0.96	0.96
1.6-<1.8	4.2%	1.00	1.00	0.97	0.97
1.8-<2.0	2.4%	1.01	1.00	0.98	0.97
2.0-<2.2	1.3%	1.02	1.01	0.99	0.98
2.2-<2.4	0.7%	1.02	1.02	0.96	0.98
2.4-HIGH	1.2%	0.88	1.00	0.82	0.93

# Predicted Ratios for Old vs. New Model 2008 & 2010



# Predicted Ratios for Old vs. New Model 2008 & 2010 MA-PD

		Predicted Ratios			
Risk Score	Share	2008 Old Model	2008 New Model	2010 Old Model	2010 New Model
0-<.4	4.1%	2.45	2.35	2.64	2.88
.4-<.6	15.7%	1.68	1.94	1.70	1.90
.6-<.8	21.2%	1.42	1.36	1.46	1.42
.8-<.9	12.1%	1.32	1.22	1.32	1.22
.9-<1	9.8%	1.24	1.17	1.23	1.15
1.0-<1.1	8.6%	1.20	1.15	1.18	1.12
1.1-<1.2	6.9%	1.18	1.14	1.15	1.10
1.2-<1.4	9.5%	1.16	1.14	1.12	1.10
1.4-<1.6	5.5%	1.17	1.15	1.12	1.11
1.6-<1.8	3.1%	1.17	1.17	1.12	1.13
1.8-<2.0	1.6%	1.18	1.18	1.12	1.13
2.0-<2.2	0.8%	1.19	1.20	1.13	1.15
2.2-<2.4	0.4%	1.20	1.23	1.12	1.14
2.4-HIGH	0.7%	1.04	1.20	0.94	1.06



# Predicted Ratios for New Model 2008-2010

		Predicted Ratios		
Risk Score	Share	2008	2009	2010
0-<.4	3.5%	1.83	1.81	1.97
.4-<.6	14.2%	1.40	1.41	1.41
.6-<.8	19.0%	1.06	1.09	1.12
.8-<.9	11.3%	0.99	1.00	1.01
.9-<1	9.3%	0.96	0.97	0.97
1.0-<1.1	8.6%	0.96	0.96	0.96
1.1-<1.2	7.1%	0.97	0.96	0.95
1.2-<1.4	10.5%	0.98	0.96	0.95
1.4-<1.6	7.0%	0.99	0.98	0.96
1.6-<1.8	4.2%	1.00	0.99	0.97
1.8-<2.0	2.4%	1.00	1.00	0.97
2.0-<2.2	1.3%	1.01	1.01	0.98
2.2-<2.4	0.7%	1.02	1.01	0.98
2.4-HIGH	1.2%	1.00	0.98	0.93

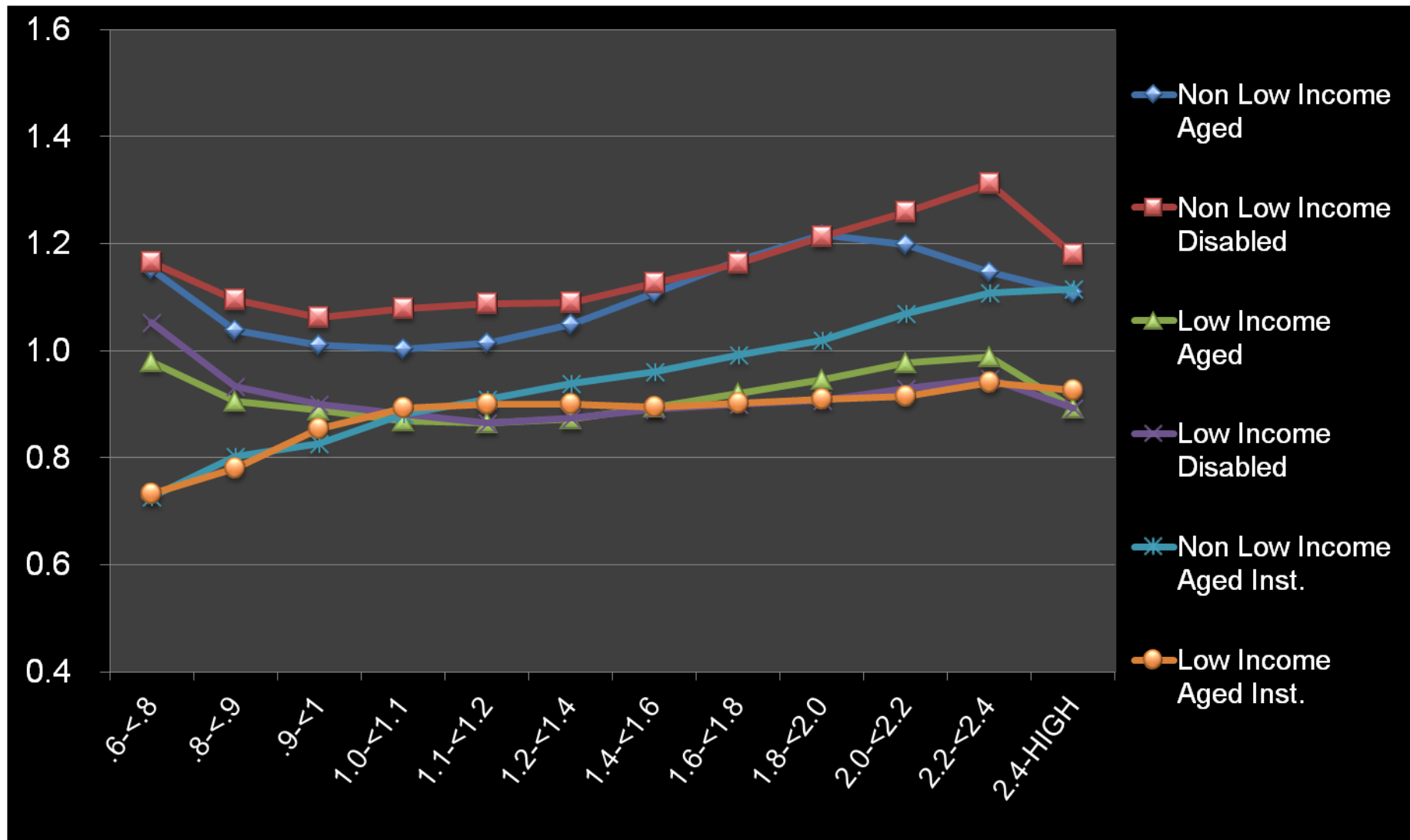
# Predicted Ratios for New Model 2010 for Selected Segments

	Predicted Ratios						
Risk Score	Non Low Income Aged	Non Low Income Disabled	Low Income Aged	Low Income Disabled	Non Low Income Aged Inst.	Low Income Aged Inst.	Non Low Income Aged
.6-<.8	1.15	1.17	0.98	1.05	0.73	0.73	1.15
.8-<.9	1.04	1.10	0.90	0.93	0.80	0.78	1.04
.9-<1	1.01	1.06	0.89	0.90	0.83	0.85	1.01
1.0-<1.1	1.00	1.08	0.87	0.88	0.88	0.89	1.00
1.1-<1.2	1.01	1.09	0.86	0.87	0.91	0.90	1.01
1.2-<1.4	1.05	1.09	0.87	0.87	0.94	0.90	1.05
1.4-<1.6	1.11	1.13	0.89	0.89	0.96	0.90	1.11
1.6-<1.8	1.17	1.16	0.92	0.90	0.99	0.90	1.17
1.8-<2.0	1.22	1.21	0.95	0.91	1.02	0.91	1.22
2.0-<2.2	1.20	1.26	0.98	0.93	1.07	0.91	1.20
2.2-<2.4	1.15	1.31	0.99	0.95	1.11	0.94	1.15
2.4-HIGH	1.11	1.18	0.89	0.89	1.12	0.93	1.11

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# Predicted Ratios for New Model 2010 for Selected Segments

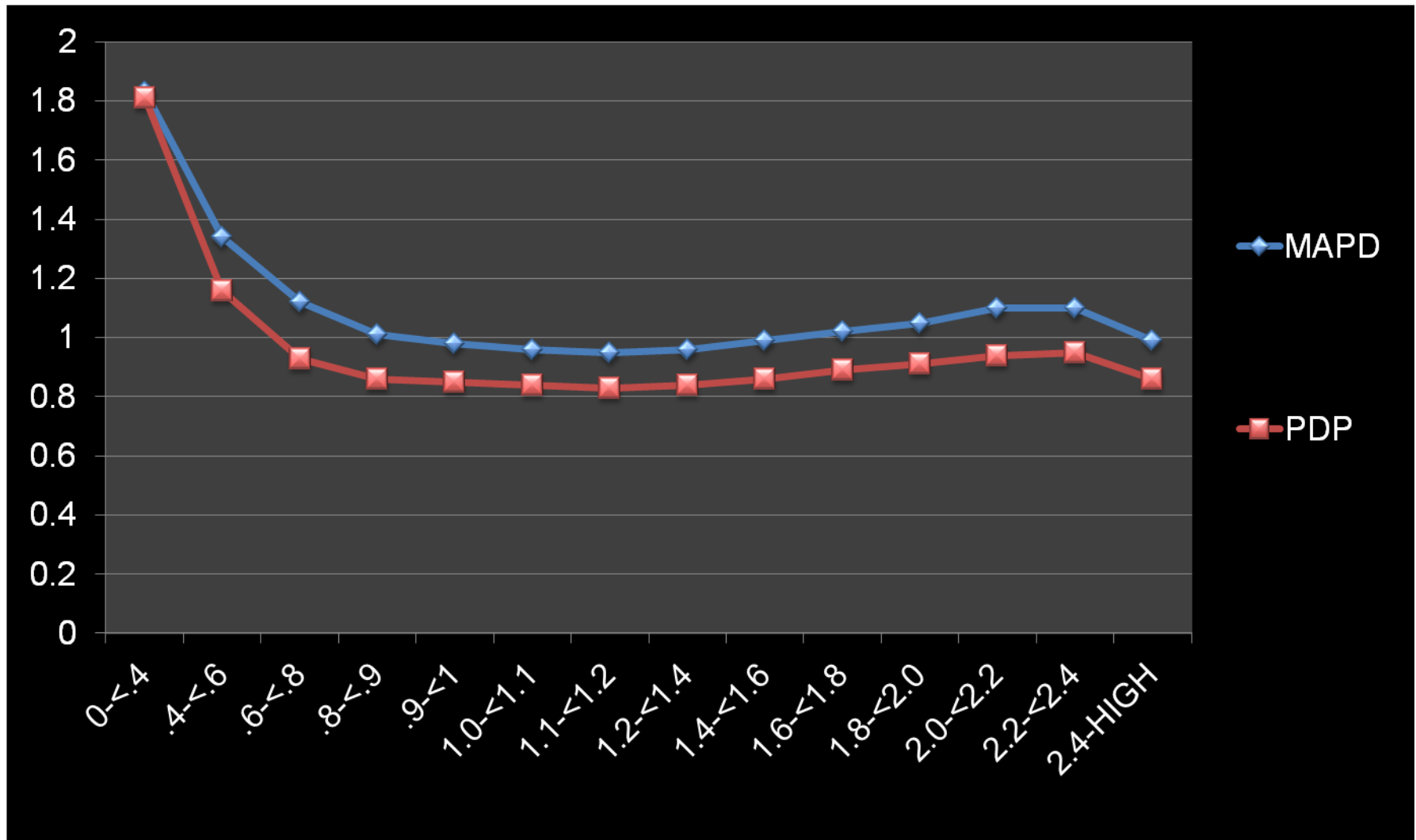


# Predictive Ratios New Model 2010 Low Income Aged

## – MA-PD vs. PDP

	Predicted Ratios		
Risk Score	MAPD	PDP	Ratio
0-<.4	1.83	1.81	1.01
.4-<.6	1.34	1.16	1.16
.6-<.8	1.12	0.93	1.20
.8-<.9	1.01	0.86	1.17
.9-<1	0.98	0.85	1.15
1.0-<1.1	0.96	0.84	1.15
1.1-<1.2	0.95	0.83	1.14
1.2-<1.4	0.96	0.84	1.14
1.4-<1.6	0.99	0.86	1.15
1.6-<1.8	1.02	0.89	1.15
1.8-<2.0	1.05	0.91	1.15
2.0-<2.2	1.10	0.94	1.17
2.2-<2.4	1.10	0.95	1.16
2.4-HIGH	0.99	0.86	1.15

# Predictive Ratios New Model 2010 Low Income Aged – MA-PD vs. PDP



# Key Points

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- Factors impacting predictive ratios include:
  - Year over year changes in actual PMPM are changing at different rates within model segment
  - Effect of lag of calibration to payment year impacts predictive ratios
  - Model is calibrated using PDP data only but predicted and actual costs are calculated for MA-PDs and PDPs

## Results of 2007-2010 Part D Analysis

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- Actual plan liability for beneficiaries in different model segments are increasing at different rates from calibration year to payment year
- The analysis shows that the revised RxHCC RAM is more accurately predicting plan liability than the original RxHCC RAM

# Results of 2007-2010 Part D Analysis

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- Three ways of looking at predictive ratios
  1. Old model vs. New model
    - In most segments the new model is predicting costs more accurately than the old model for all years
    - The new model is predicting costs more accurately for MA-PDs and PDPs than the old model
  2. Old model over time
    - In most segments the old model is predicting costs less accurately over time
    - For MA-PDs and PDPs the old model is predicting costs less accurately over time
  3. New model over time
    - In most segments the new model is predicting costs more accurately over time





# Assessments

# Assessment Question 1

Which of the following statements best describes CMS' RxHCC Risk Adjustment Model?

- 1/A Predicts cost variation among subpopulations of Medicare Part D enrollees
- 2/B Predicts which Part D plan is best for each Medicare enrollee
- 3/C Determines how many Part D plans should be in a specific region
- 4/D Determines the effectiveness of Special Needs Plans
- 5/E All of the above

## Assessment Question 2

The three data sources used by CMS to measure the performance of the RxHCC Risk Adjustment Module include:

- 1/A Part D Pharmacist self-reports, Part D Claims Data, CMS Annual Reports
- 2/B CMS' Payment Reconciliation System, Part D Sponsor Bid Data & CMS's Risk Adjustment Payment System
- 3/C Part D Claims Data, Diagnosis Codes, Part D Sponsor Bid Data
- 4/D Part D Sponsor self-reports, Diagnosis Codes, Part D Claims Data
- 5/E All of the above



## Questions?

# Contact Information

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For further questions, please contact:

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## Presentation Evaluation

**Please get your ARS Response Card ready**