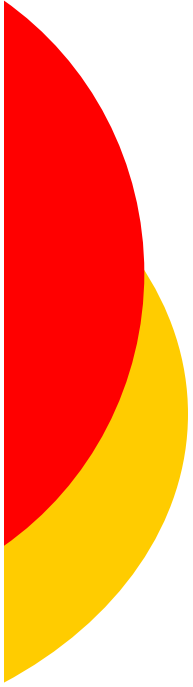




# Medical Expense Trend : Future Drivers SOA Spring Health Meeting : Session 29 Seattle, Washington

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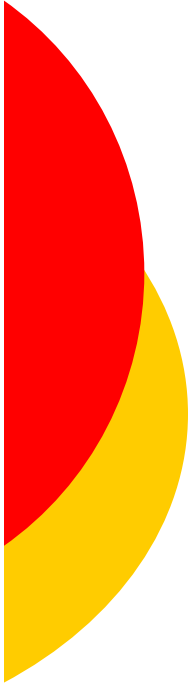
Mark Zanecki, ASA, MAAA  
IHA Consultants  
[www.ihaconsultants.com](http://www.ihaconsultants.com)  
June 13, 2007



## Desired Information from Trend Modeling and Trend Model Reports

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- What type of information would be of interest?
  - Sufficient prediction accuracy for a historical time interval
  - Overcome claim lag time impacts to trend modeling and reporting
  - Trend levels with attached probability/percentiles and/or trend range with associated range of probability/percentiles
  - Are trend levels rising or falling? How can you tell with all that noise?
  - Trend broken down by type of service
  - Trend driver Contributions: Claim Frequency and Claim Severity for each type of service
  - If possible, some sense of impact to trend and/or trend driver components due to:
    - Demographics
    - Service mix
    - Technology
    - Intensity
    - Cost-shifting
    -



## Stochastic Trend Model

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### Description

Methodology incorporates and applies in a new way advanced proven mathematical and statistical techniques healthcare insurance.

Generates historical and/or future trend level probability distributions.

We'll concern ourselves with internal data only version of the stochastic trend model oriented to reporting on trend as of December 2006 for Group – PPO line of business (LOB). In the predictive trend session, we'll use the model to predict 2007 with selected probability intervals.

### Advantages

Pure PMPM Trend percentile distribution reports generated at 1% change intervals

Once business risk rules specified for LOB, automatic generation of reports once data is available

Develop trend percentile distribution reports for pure pmpm trend, and depending on data availability/quality for claim frequency trend and claim severity trend

Provides accurate, consistent, timely and standardized trend information for use by insurer/HMO departments


Aids in improving pricing trend, valuation trend and forecast trend accuracy, consistency and timeliness

### Methodology/Results



Results from current trend modeling methodologies are “subsets (in some sense)” of stochastic trend model reports.

# Stochastic Predictive Model – Sample Results

## STOCHASTIC ACTUARIAL TOOLSET (STANDARDIZED) - Payments





Percentile	Current Measurement Date		Stochastic Monthly Pure Premiums Trend		Stochastic Monthly Pure Premiums Trend		Stochastic Monthly Pure Premiums Trend	
	Stochastic Monthly Pure Premiums May-07	Stochastic Monthly Pure Premiums Jun-07	Stochastic Monthly Pure Premiums Trend Jun-07	Stochastic Monthly Pure Premiums Jul-07	Stochastic Monthly Pure Premiums Trend Jul-07	Stochastic Monthly Pure Premiums Trend Aug-07	Stochastic Monthly Pure Premiums Trend Aug-07	
100%	\$ 156.95	\$ 160.15	11.44%	\$ 156.24	16.55%	\$ 160.63	16.08%	
90%	\$ 154.99	\$ 158.15	3.77%	\$ 154.29	4.44%	\$ 158.62	4.32%	
80%	\$ 150.92	\$ 154.00	2.31%	\$ 150.24	2.72%	\$ 154.46	2.65%	
70%	\$ 143.08	\$ 146.00	1.30%	\$ 142.44	1.62%	\$ 146.44	1.56%	
65%	\$ 136.59	\$ 139.38	0.87%	\$ 135.98	1.10%	\$ 139.80	1.06%	
60%	\$ 134.14	\$ 136.88	0.44%	\$ 133.54	0.65%	\$ 137.29	0.59%	
55%	\$ 132.79	\$ 135.50	0.21%	\$ 132.20	0.37%	\$ 135.91	0.31%	
50%	\$ 132.34	\$ 135.04	0.07%	\$ 131.75	0.18%	\$ 135.45	0.13%	
45%	\$ 130.62	\$ 133.29	-0.02%	\$ 130.04	0.08%	\$ 133.69	0.04%	

 business rule for trend  
 business rule for pmpm's

# Stochastic Predictive Model Claim Frequency Distributions-Sample Results

## STOCHASTIC ACTUARIAL TOOLSET (STANDARDIZED) - Claim Frequency



Percentile	Current Measurement Date		Stochastic Monthly Claim Count/enc Trend		Stochastic Monthly Claim Count/enc Trend		Stochastic Monthly Claim Count/enc Trend	
	Stochastic Monthly Claim Count/enc May-07	Stochastic Monthly Claim Count/enc Jun-07	Stochastic Monthly Claim Count/enc Trend Jun-07	Stochastic Monthly Claim Count/enc Jul-07	Stochastic Monthly Claim Count/enc Trend Jul-07	Stochastic Monthly Claim Count/enc Aug-07	Stochastic Monthly Claim Count/enc Trend Aug-07	
100%	0.0314	0.0320	11.32%	0.0312	16.39%	0.0321	15.92%	
90%	0.0310	0.0316	3.66%	0.0309	4.31%	0.0317	4.19%	
80%	0.0302	0.0308	2.33%	0.0300	2.75%	0.0309	2.68%	
70%	0.0286	0.0292	1.30%	0.0285	1.62%	0.0293	1.56%	
65%	0.0273	0.0279	0.85%	0.0272	1.08%	0.0280	1.04%	
60%	0.0268	0.0274	0.42%	0.0267	0.63%	0.0275	0.57%	
55%	0.0266	0.0271	0.21%	0.0264	0.37%	0.0272	0.32%	
50%	0.0265	0.0270	0.07%	0.0263	0.19%	0.0271	0.14%	
45%	0.0261	0.0267	-0.02%	0.0260	0.08%	0.0267	0.04%	

 business rule for trend  
 business rule for claim count

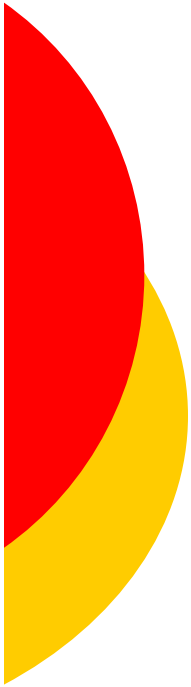
# Stochastic Predictive Model Claim Severity Analysis – Sample Results

## STOCHASTIC ACTUARIAL TOOLSET (STANDARDIZED) - Claim Severity

Percentile	Current Measurement Date		Stochastic Monthly Claim Severity Trend Jun-07	Stochastic Monthly Claim Severity Jul-07	Stochastic Monthly Claim Severity Trend Jul-07	Stochastic Monthly Claim Severity Aug-07	Stochastic Monthly Claim Severity Trend Aug-07
	Stochastic Monthly Claim Severity May-07	Stochastic Monthly Claim Severity Jun-07					
100%	\$ 7,350.00	\$ 7,500.00	10.76%	\$ 7,317.07	15.57%	\$ 7,522.50	15.13%
90%	\$ 6,860.00	\$ 7,000.00	3.58%	\$ 6,829.27	4.22%	\$ 7,021.00	4.11%
80%	\$ 6,076.00	\$ 6,200.00	2.38%	\$ 6,048.78	2.80%	\$ 6,218.60	2.73%
70%	\$ 5,880.00	\$ 6,000.00	1.31%	\$ 5,853.66	1.63%	\$ 6,018.00	1.57%
65%	\$ 5,096.00	\$ 5,200.00	0.82%	\$ 5,073.17	1.04%	\$ 5,215.60	1.00%
60%	\$ 5,047.00	\$ 5,150.00	0.40%	\$ 5,024.39	0.59%	\$ 5,165.45	0.54%
55%	\$ 4,900.00	\$ 5,000.00	0.22%	\$ 4,878.05	0.38%	\$ 5,015.00	0.32%
50%	\$ 4,851.00	\$ 4,950.00	0.07%	\$ 4,829.27	0.20%	\$ 4,964.85	0.15%
45%	\$ 4,826.50	\$ 4,925.00	-0.02%	\$ 4,804.88	0.09%	\$ 4,939.78	0.04%

 business rule for trend  
 business rule for claim count

# Stochastic Predictive Model Summary Forecast -



**Forecast Statement of Income**  
**For Jun 2007 thru December 2007**  
 as of Jun 2007  
 (dollars in thousands)

	Jun-07	Jul-07
<b>Membership:</b>	225,501	230,000
<b>Revenues (as filed):</b>	\$ 30,443	\$ 33,200
<b>Net Investment Income</b>	\$ 105.00	\$ 98.00
<b>Total Revenues</b>	\$ 30,548	\$ 33,298
	<b>Claim Probability</b>	
<b>Claims and Medical Expenses</b>	65% \$ 28,100	\$ 27,538
	60% \$ 22,500	\$ 21,600
	55% \$ 18,900	\$ 18,711
<b>Administrative Expenses</b>	\$ 640	\$ 625
<b>Total Expenses</b>	65% \$ 28,740	\$ 28,163
	60% \$ 23,140	\$ 22,225
	55% \$ 19,540	\$ 19,336
<b>Income Before Taxes EBIDT</b>	65% \$ 1,808	\$ 5,135
	60% \$ 7,408	\$ 11,073
	55% \$ 11,008	\$ 13,962

**Stochastic Forecast**  
 (one-step)

**Details for July 2007**

**Pricing Drivers (All Claim Type of Srrvices)**

Membership	65%	232,500	
	60%	230,000	← Bus Rule
	55%	222,000	
PMPM Dist	65%	\$ 119.73	
	60%	\$ 93.91	← Bus Rule
	55%	\$ 81.35	
Claim Severity	65%	\$ 166.29	
	60%	\$ 144.48	← Bus Rule
	55%	\$ 140.26	
Claim Freq	65%	0.72	
	60%	0.65	
	55%	0.58	← Bus Rule

**Forecast Drivers (All Claim Type of Srrvices)**

Membership	same as above		
PMPM Dist	65%	\$ 119.73	
	60%	\$ 93.91	← Bus Rule
	55%	\$ 81.35	
Claim Severity	65%	\$ 166.29	
	60%	\$ 144.48	← Bus Rule
	55%	\$ 140.26	
Claim Freq	65%	\$ 0.72	
	60%	\$ 0.65	
	55%	\$ 0.58	← Bus Rule

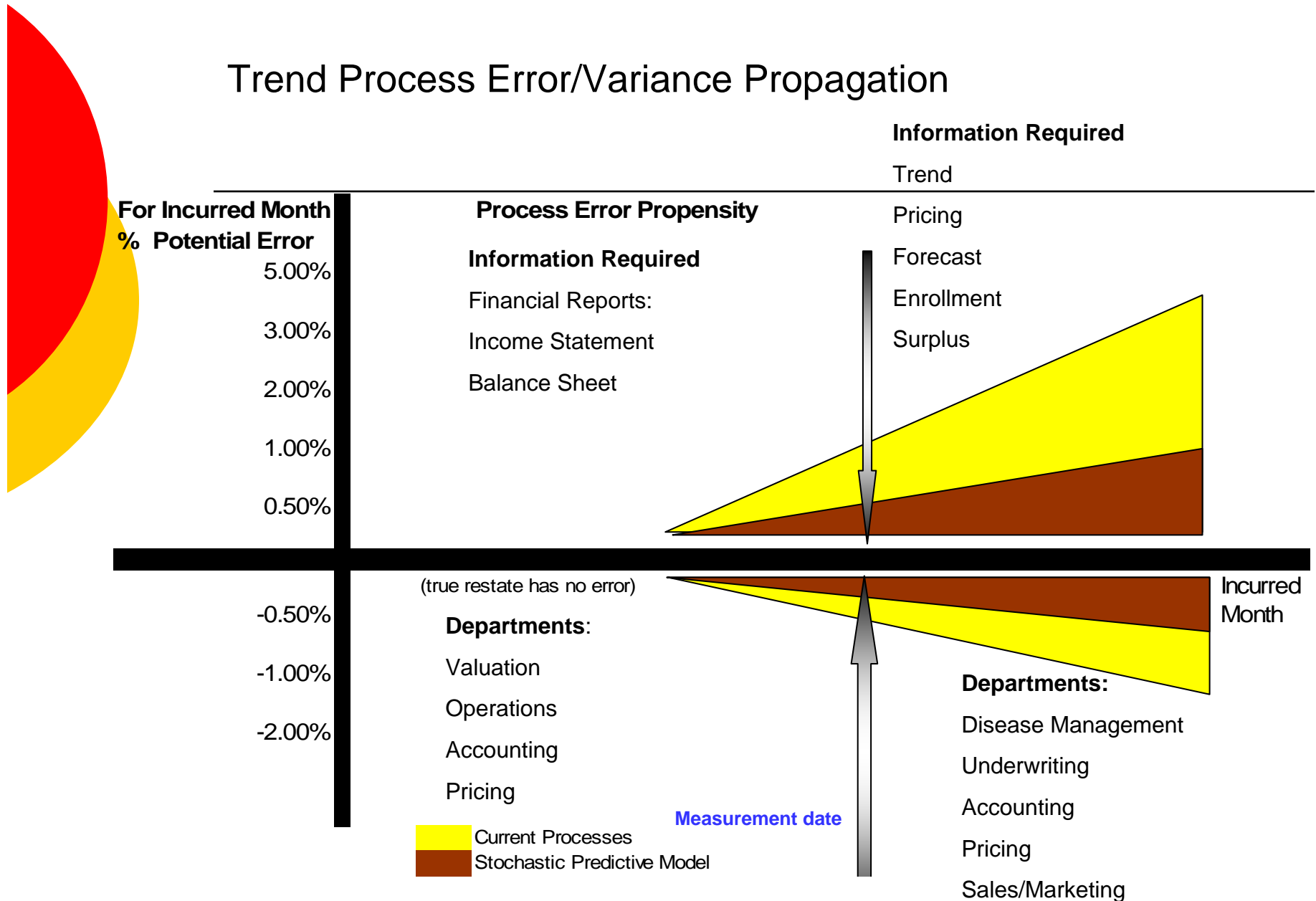


## Projected Trend Distribution Statistics and Comparisons

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- Statistics
  - Range
  - Average
  - Median
  - Std Deviation
  - Skew
  - Kurtosis
  - Percentile Distribution Report
  
- Compare selected current projected trend estimates to estimates based on earlier data
  
- Compare current projected trend estimates with outside data sources

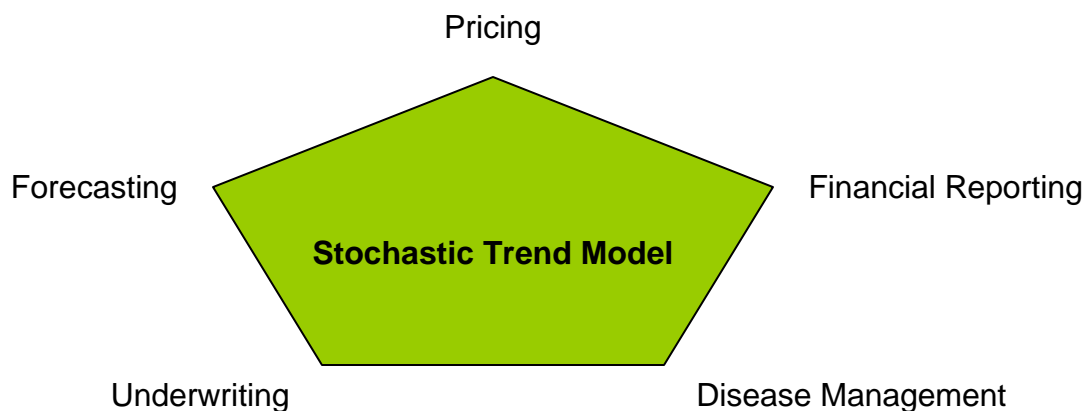
# Trend Process Error/Variance Propagation





## Stochastic Trend Model Provides Common Trend Percentile Distribution Reports to Insurance Departments that Simplify and Integrate Functions

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Common tool/framework to address trend modeling and reporting that serves various departments

Valuation – pure premium trend for reserve development purposes

Pricing – as starting point in development of pricing trends

Forecasting – as starting point on same basis as pricing and valuation for forecast development

Underwriting – as basis for renewal trend pricing component

Disease/Medical Management – as basis to measure impact of interventions or preventative policies



## Background and Preview of Coming Graphs

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### Background

This presentation is from the healthcare insurer/HMO viewpoint with respect to trend modeling business requirements and reporting.

We'll focus at the line of business level, specifically underwritten Group – PPO.

Trend report and graphs is based on incurred and paid data through December 2006.

### Trend Graphs and Trend Driver Contribution

- Aggregate Pure Premium (PMPM) Trend at Selected Percentiles
  
- PMPM Trend by Type of Service at Selected Percentiles for
  - Hospital Inpatient
  - Hospital Outpatient
  - Professional
  - Pharmacy
  
- Trend Driver Components: Claim Frequency and Claim Severity at Selected Percentiles for
  - Hospital Inpatient
  - Hospital Outpatient
  - Professional
  - Pharmacy



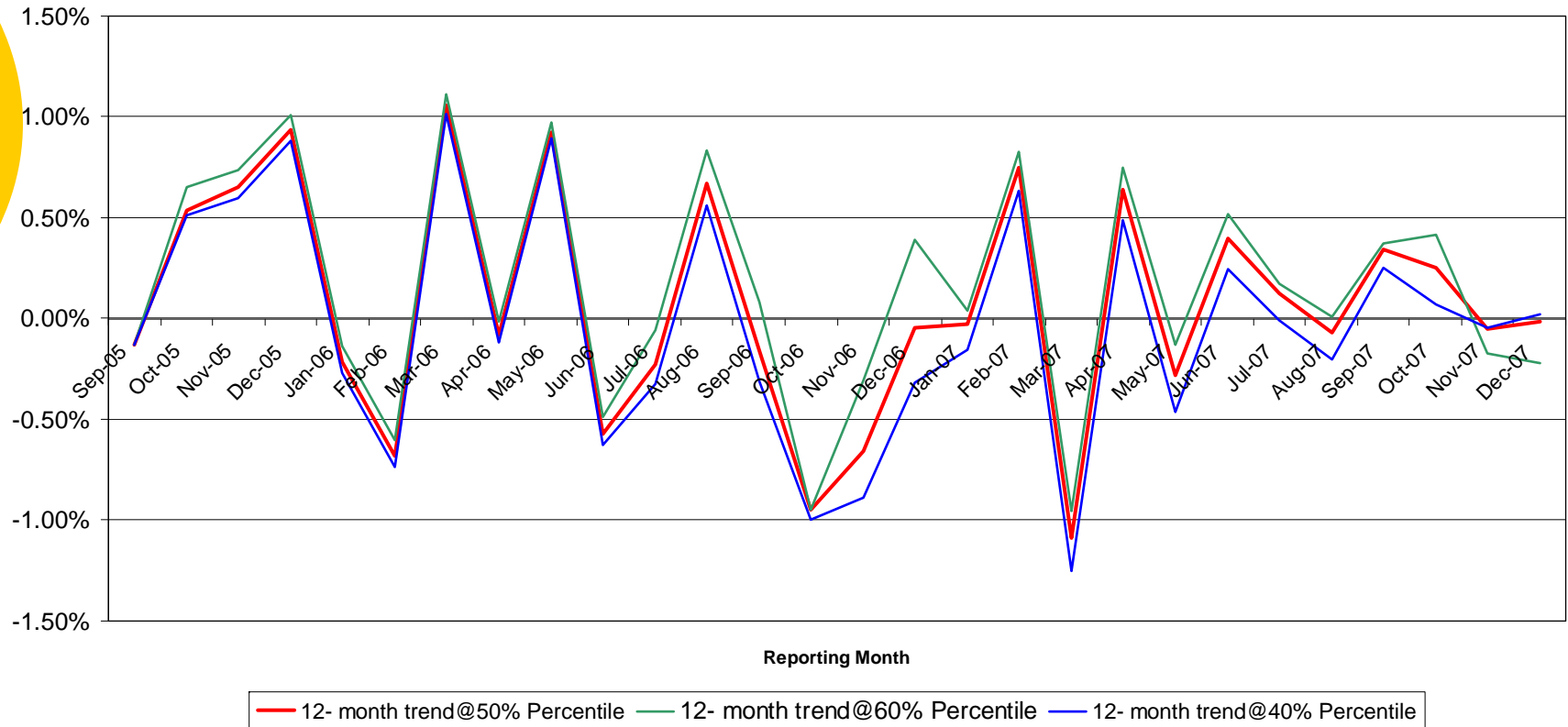
## 2007 Projected Pure PMPM Trends by Type of Service with Upper and Lower Percentile Boundaries

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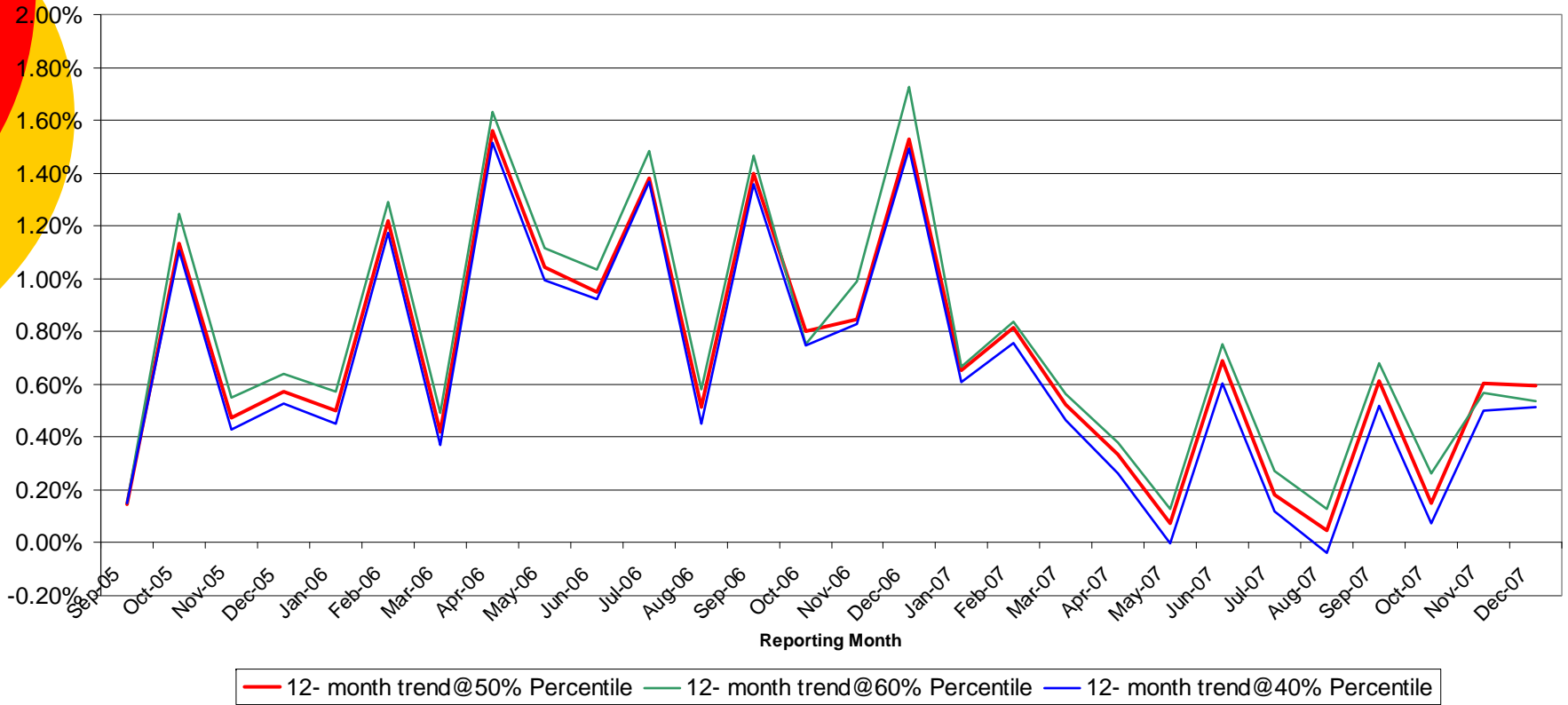
- Hospital Inpatient
- Hospital Outpatient
- Professional
- Pharmacy



## 2007 Projected Hospital Inpatient Pure Premium Trend at Selected Percentiles

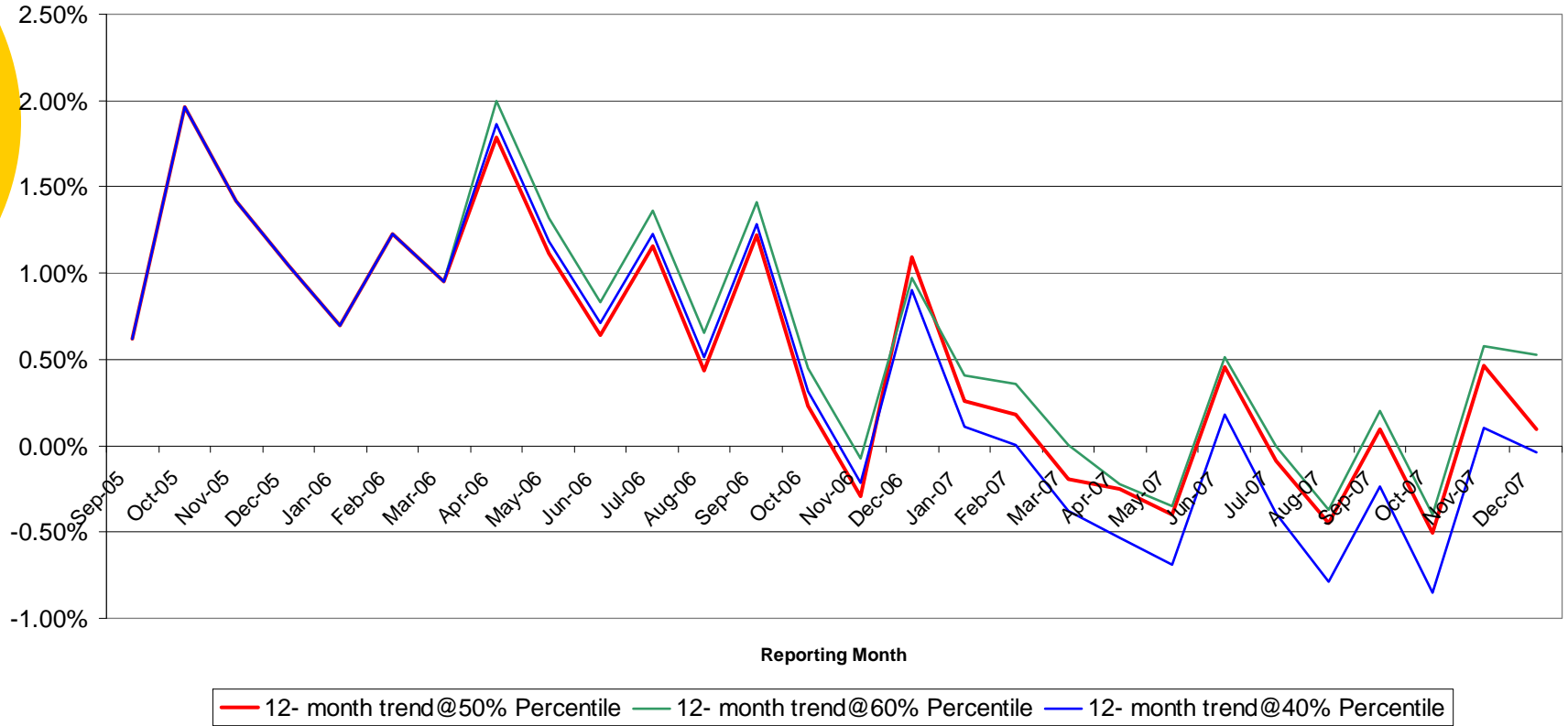


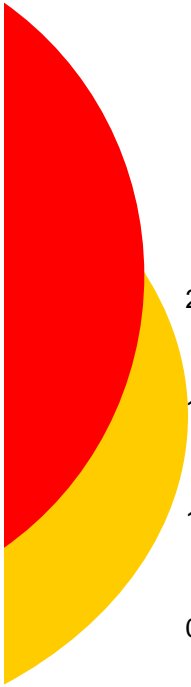
## 2007 Projected Hospital Outpatient Pure Premium Trend at Selected Percentiles



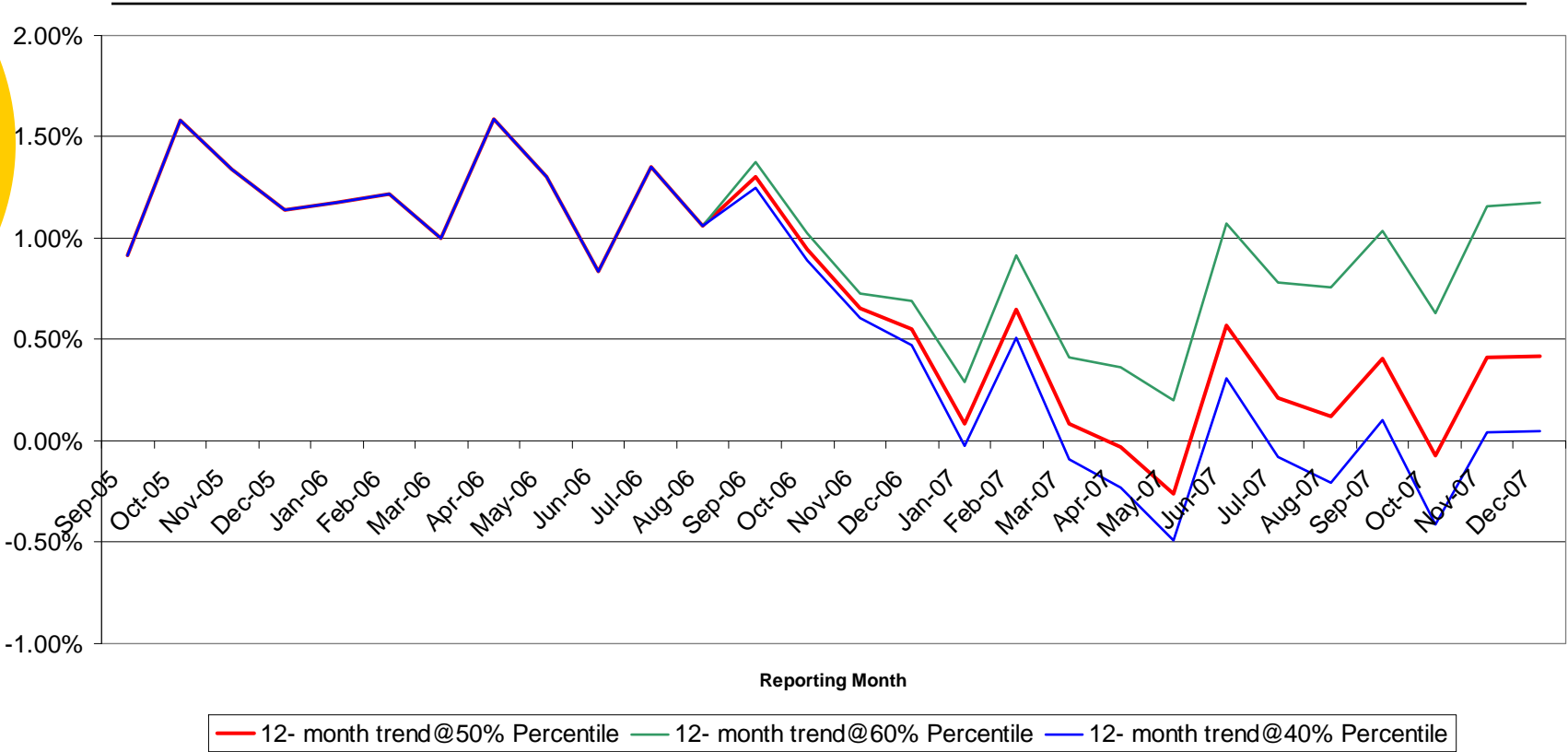


## 2007 Projected Professional Pure Premium Trend at Selected Percentiles





### 2007 Projected Pharmacy Pure Premium Trend at Selected Percentiles



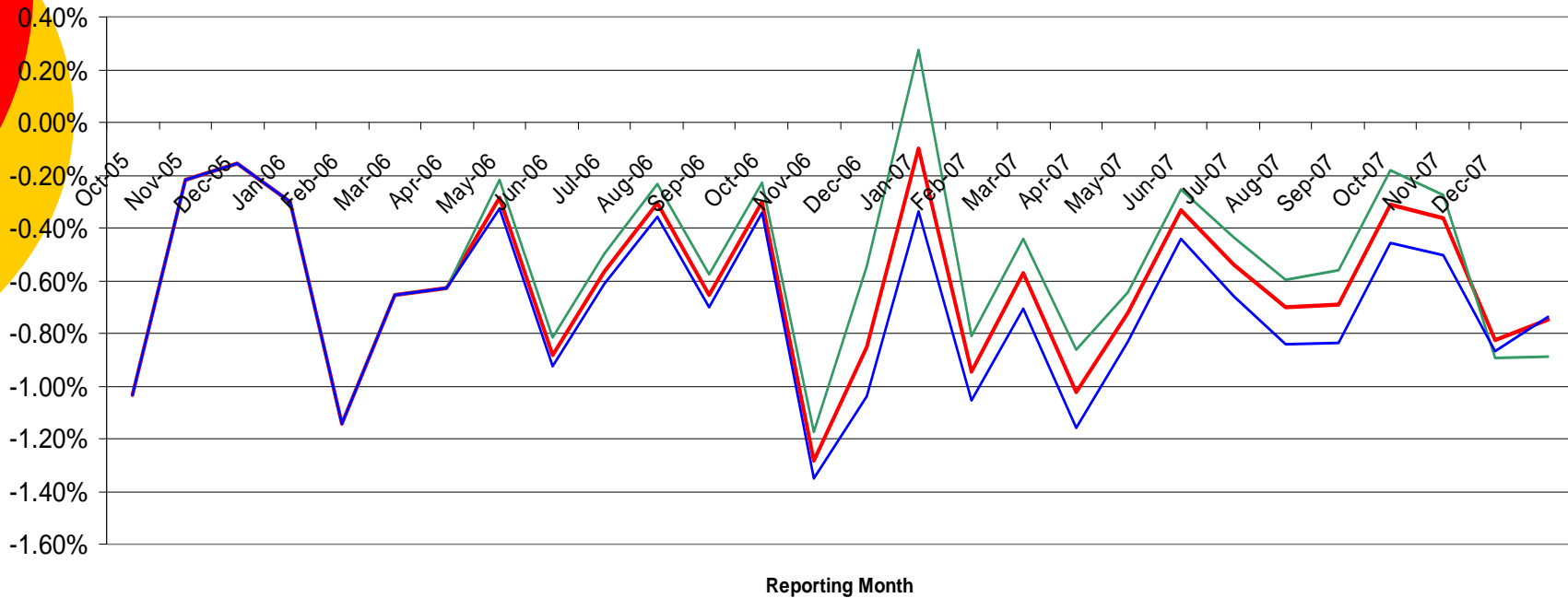


## 2007 Projected Claim Frequency Trends by Type of Service with Upper and Lower Percentile Boundaries

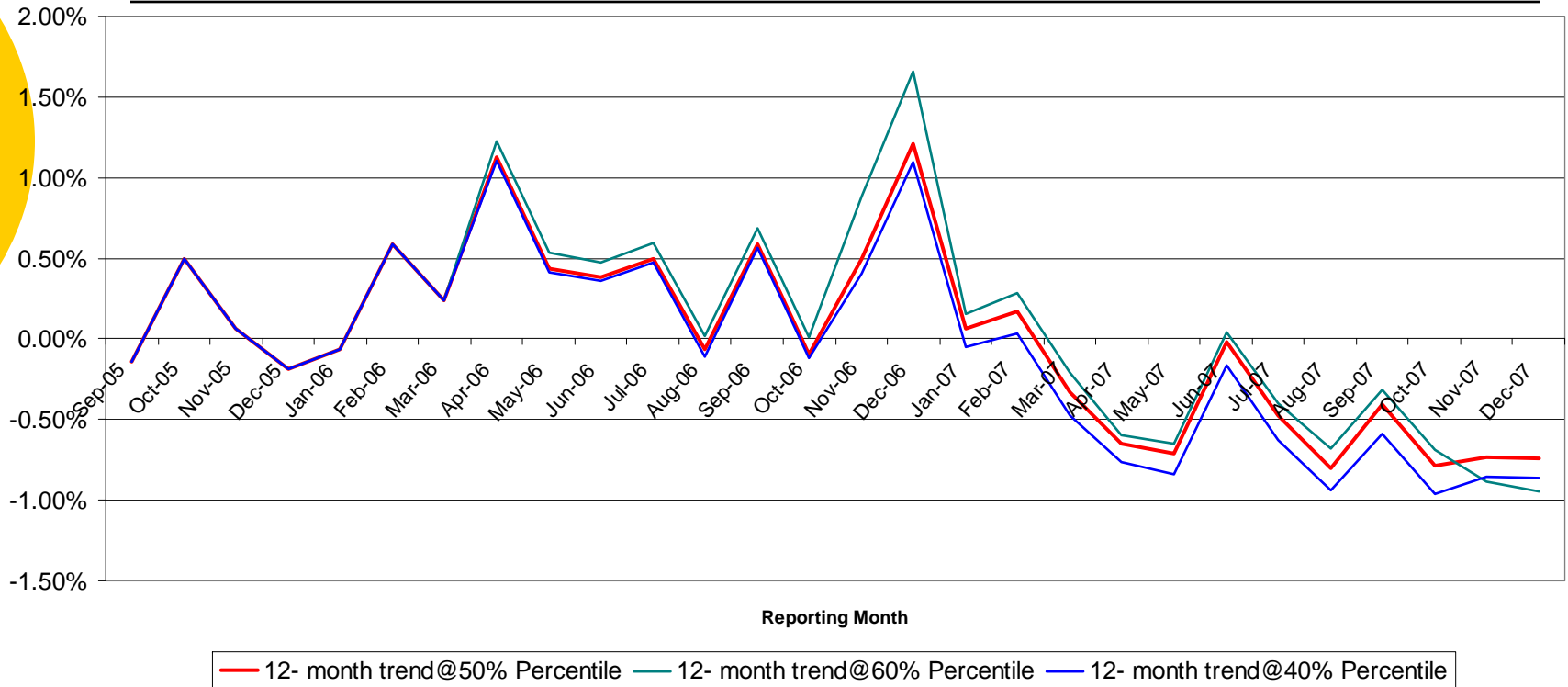
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- Hospital Inpatient
- Hospital Outpatient
- Professional
- Pharmacy

## 2007 Projected Hospital Inpatient Claim Frequency Trend at Selected Percentiles

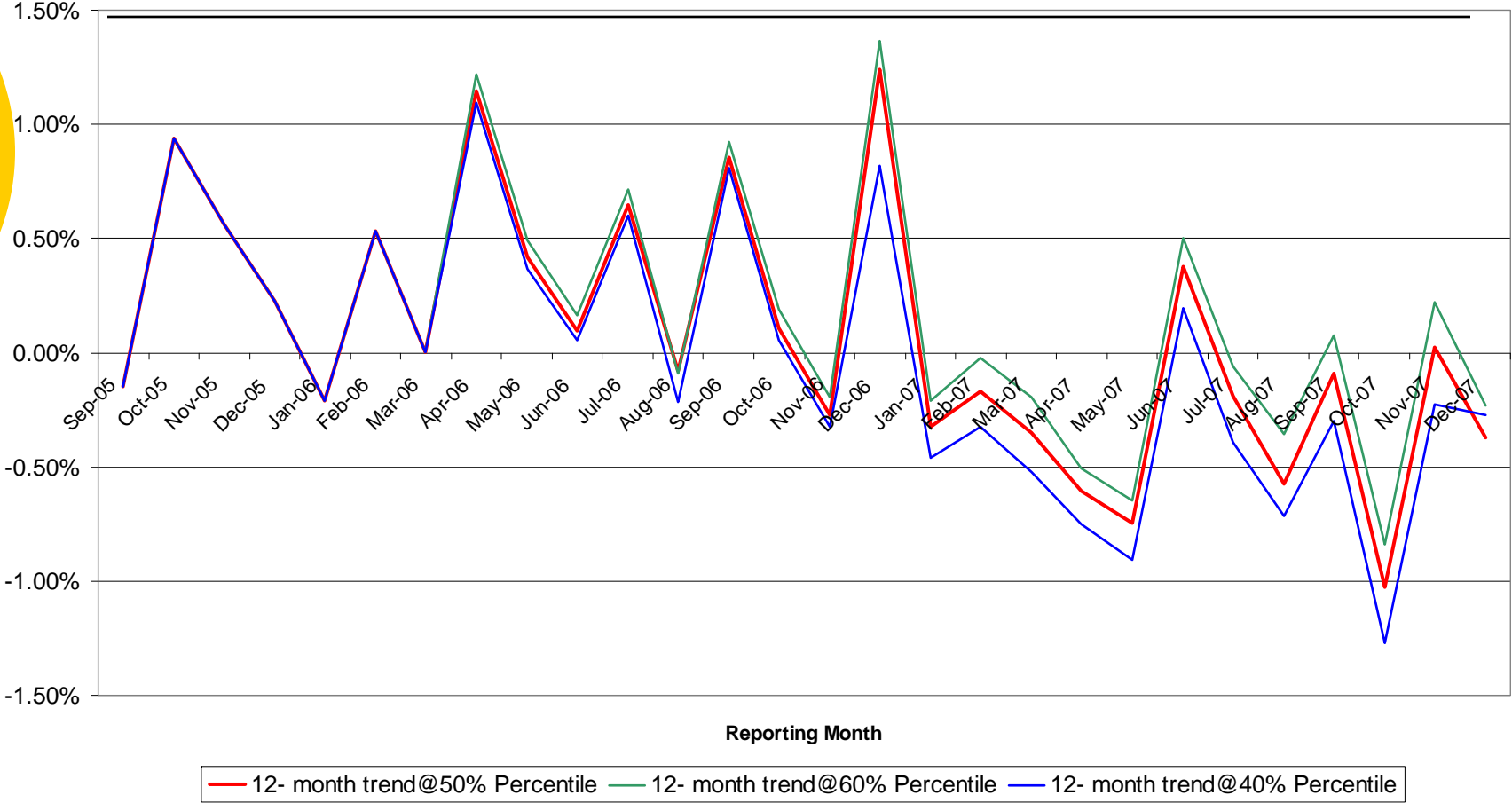


## 2007 Projected Hospital Outpatient Claim Frequency Trend at Selected Percentiles



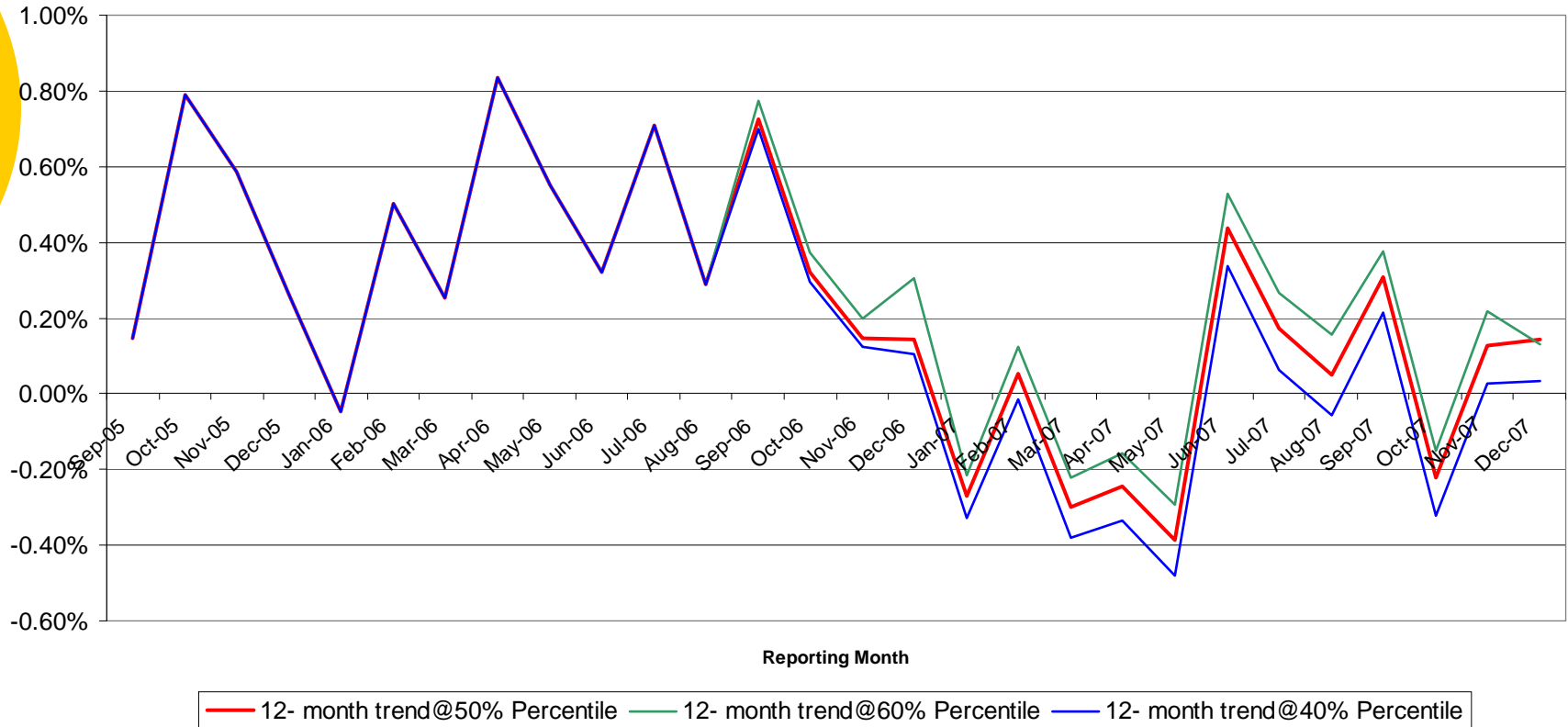


### 2007 Projected Professional Claim Frequency Trend at Selected Percentiles





## 2007 Projected Pharmacy Claim Frequency Trend at Selected Percentiles





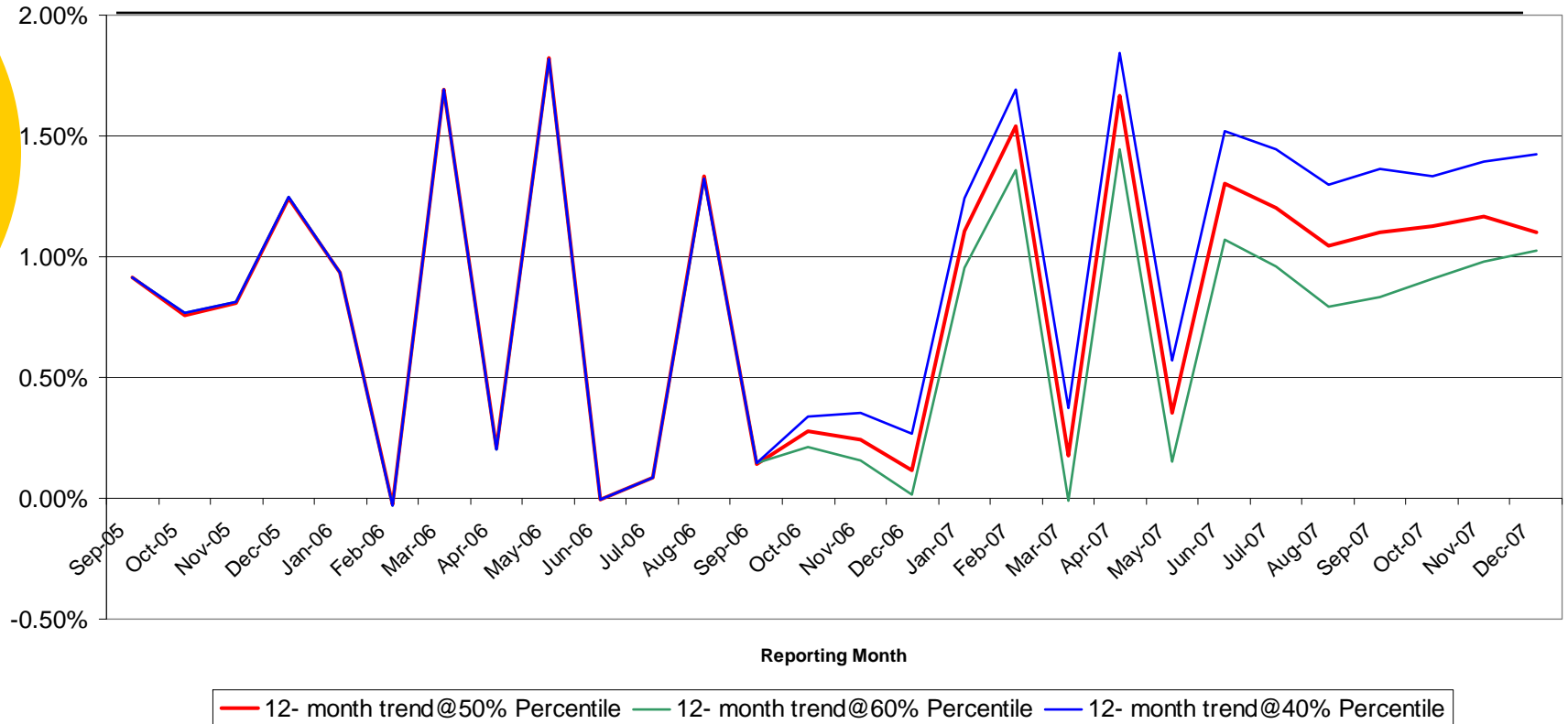
## 2007 Projected Claim Severity Trends by Type of Service with Upper and Lower Percentile Boundaries

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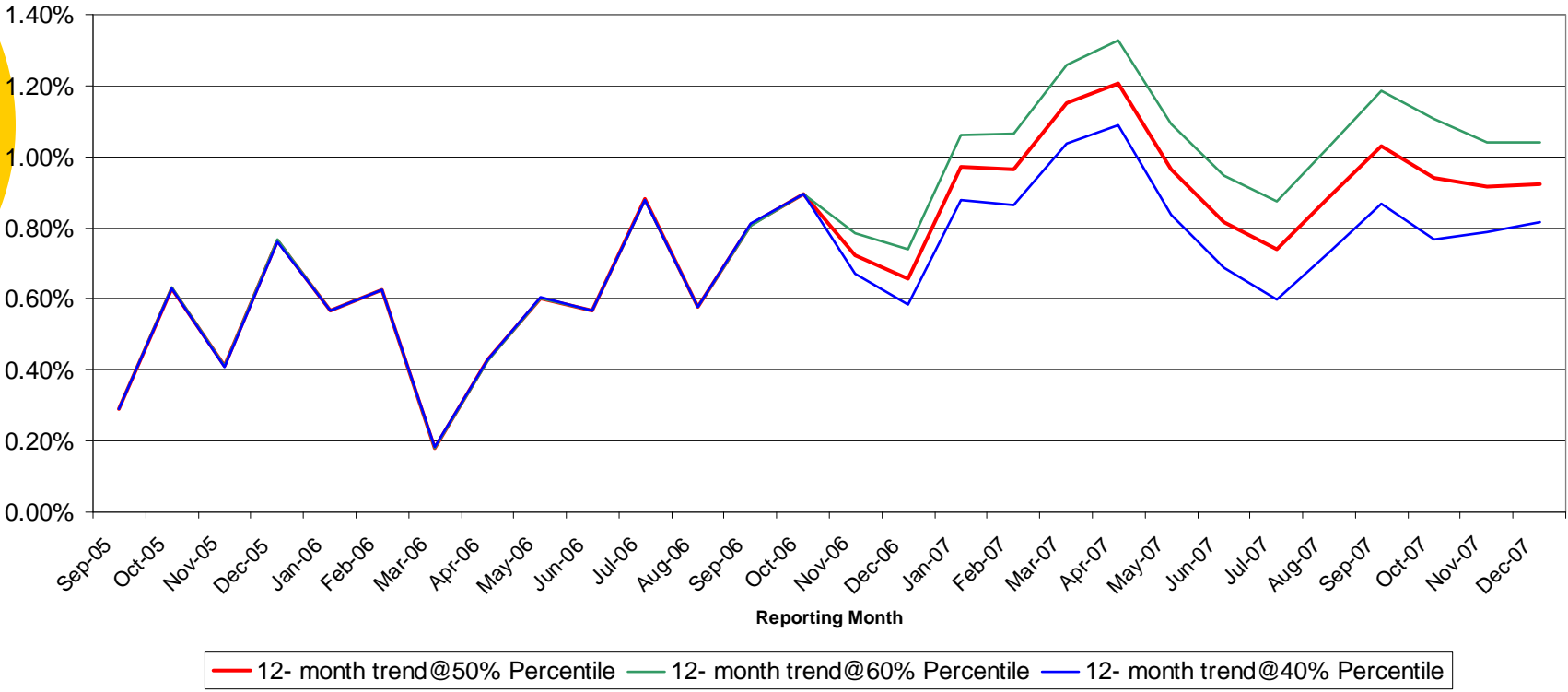
- Hospital Inpatient
- Hospital Outpatient
- Professional
- Pharmacy

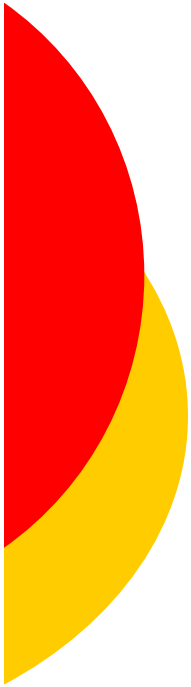


## 2007 Projected Hospital Inpatient Severity Trend st Selected Percentiles

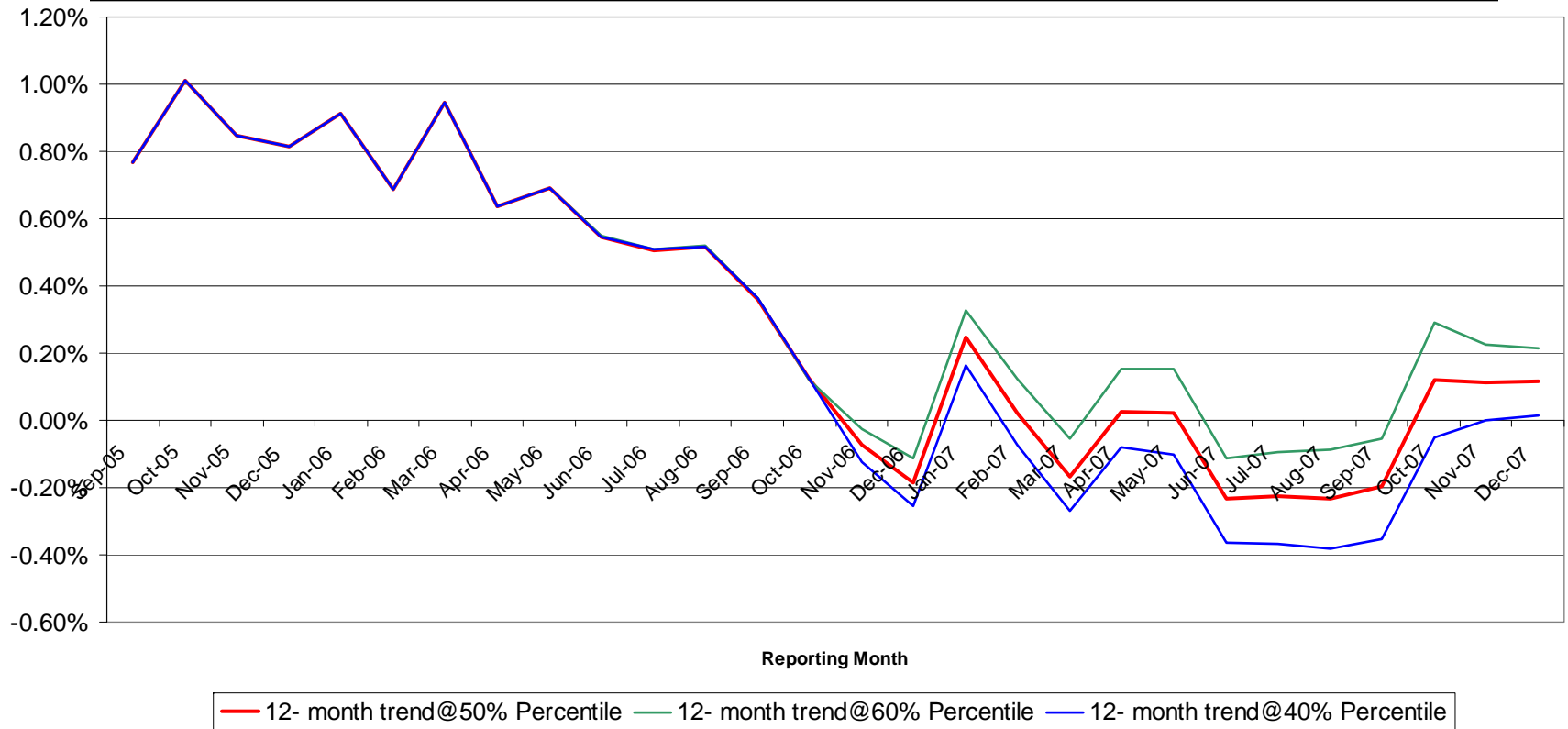


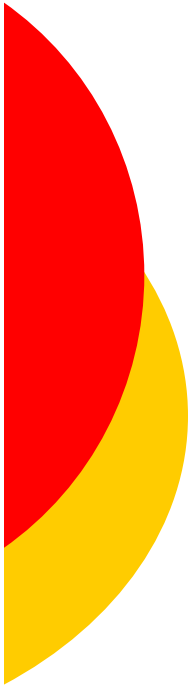
## 2007 Projected Hospital Outpatient Claim Severity Trend at Selected Percentiles



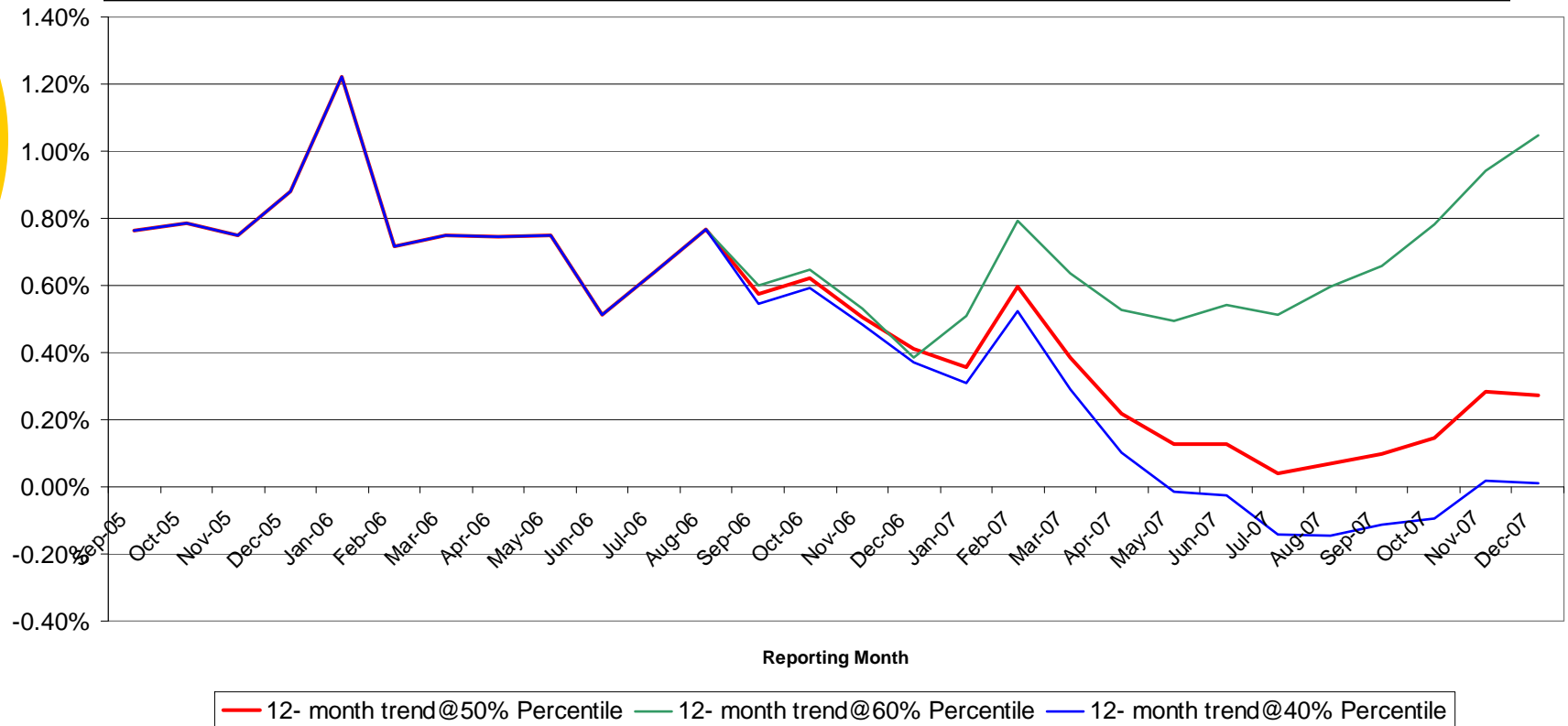


## 2007 Projected Professional Claim Severity Trend at Selected Percentiles





## 2007 Projected Pharmacy Claim Severity Trend at Selected Percentiles





## Take Home Message

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- Stochastic trend modeling and reporting solution is a reality
- Provides accurate, consistent, timely and standardized trend information for use by insurer/HMO departments
- Pure PMPM or allowed PMPM trend reports with associated probabilities provide common “backbone” framework as starting point for pricing, financial reporting, forecasting, underwriting and disease management/trend.
- Actuary’s time is significantly shifted from estimate development to analysis of business risk levels with associated probabilities from a dynamic book of business portfolio viewpoint
- Error detection and mitigation is earliest possible
- Two forms of stochastic model, one that incorporates external data and another that relies on internal data.