

WCIRB Actuarial Committee Meeting

June 14, 2019

Agenda

1. Actuarial Research Working Group Meeting Summary
2. AC16-06-05: Update on Medical Severity Trends by Component
3. AC17-12-04: Earthquake Study
4. AC18-06-03: Classification Payroll Limitations
5. AC19-06-01: 3/31/2019 Experience – Review of Methodologies
6. AC19-06-02: 1/1/2020 Regulatory Filing – Experience Rating Plan Values
7. AC19-06-03: Impact of Pharmaceutical Cost Reductions on Loss Development

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01

Actuarial Research Working Group Meeting Summary



Retrospective Rating – Paid Loss Simulation

Current Model

- The current model simulates incurred loss development.
 - Simulation starting database is typically three policy years of USR data at report levels 3, 4 and 5.
 - Claims are simulated until they close, never to reopen.
 - Each claim is simulated 100 times.
- Age-to-age incurred loss development factors and claim closing rates are modeled using empirically derived distributions.
 - These distributions are conditioned on maturity and claim size, measured by total incurred losses.
- Additional modeling constraints are implemented including:
 - Closing rates increase with maturity.
 - Minimum and maximum age-to-age development factors, conditional on claim size.
 - Error out thresholds ensure that no individual claim simulation develops beyond reasonable levels.

Retrospective Rating – Paid Loss Simulation Model Basics

- Paid loss simulation is incorporated into the current incurred loss model.
 - Paid and incurred losses are simulated jointly for each claim simulation.
- Paid losses are simulated by modeling incremental paid losses as a share of the claim's reserve.
 - To incorporate simulated changes in incurred losses, the reserve is determined after accounting for incurred loss development.
 - This structure allows modeling of a variable constrained between 0% and 100%.
 - The model uses empirically derived distributions which are conditional on the maturity, size as measured by total incurred losses, and the reserve share of total incurred losses.
- The basic modeling structure was tested by comparing empirical distributions of the payment share over time.
 - Claims were first divided into rough bins by claim size and reserve share.
 - The shapes of the distributions as well as the relative differences between bins were fairly stable over time.

Retrospective Rating – Paid Loss Simulation Table Development

- For simulation, an empirical distribution is compiled for each desired level of refinement.
 - In the incurred loss model, distributions are built for each maturity and each of 21 size bins.
 - For this paid loss model, the claim reserve share creates an additional dimension.

Size Bin	Reserve Share of Total Incurred				
	0%	1%	...	99%	100%
1					
2					
3					
4					
...					
19					
20					
21					

- An empirical distribution needs to be compiled for each cell in this table, at each maturity.
 - The available bottom of data is insufficient for many cells.
 - Adjacent cells could be collapsed together, but this would cause large sections of the grid to be collapsed.
- Instead, each cell is populated using the N closest observations, where N is the selected minimum volume of claims.

Retrospective Rating – Paid Loss Simulation

Determining Distance

- In order to select the “closest” claims to populate each cell, an appropriate definition of distance is necessary.
 - The goal of the distance formula is to assign a low distance to groups of claims that have similar paid development patterns.
- Each calendar year’s observations were divided into size and reserve share bins to test for differences in paid loss development.
 - Claim size is computed on a log scale, otherwise the difference between \$0 and \$5M claim would be the same as the difference between a \$10M and \$15M claim.
- Differences in paid development were tested pairwise for each group of claims using the Kruskal-Wallis rank test.
 - The p-value of the test was used as a proxy for distance.
 - Differences in both claim size and in reserve share were significant predictors of the p-value using standard Pearson correlation, Spearman rank correlation, and standard regression for all calendar years.
 - In all cases, differences in reserve share were more predictive.

Retrospective Rating – Paid Loss Simulation

Determining Distance

- If changes claim size and reserve share had been equally important in predicting changes in significance, standard L2 distance would be appropriate.

$$d = \sqrt{s^2 + r^2}$$

- Instead, an elliptical formula is used to reflect the unequal impact of differences in the variables.

$$d = \sqrt{\left(\frac{s}{A}\right)^2 + \left(\frac{r}{B}\right)^2}$$

- Values of A and B were tested, each ranging from 1 to 10.
- They were evaluated by testing how well each permutation predicted the Kruskal-Wallis p-values.
- The combination of A = 1 and B = 3 consistently performed best across calendar years.

Retrospective Rating – Paid Loss Simulation Model Validation

- This model was tested using 33,244 LTLDS claims that were open during calendar years 2010 through 2013.
 - Claims that remained open were used to eliminate any distortion from closing claims.
 - Known incurred loss values were used to remove any impact of incurred loss simulation.
 - Each claim was simulated 100 times.
- These simulation results were biased within calendar years and volatile across calendar years.
- Further examination showed that claims needed to be further differentiated based on their incurred loss development.
 - Claims were further binned based on upward, downward, or no incurred loss development.
 - Claims with extreme incurred loss development were handled separately.
 - Claims were considered extreme if absolute development exceeded \$100,000 and age-to-age development factors were less than 0.5 or greater than 2.0.
 - This is analogous to how catastrophic development is handled in the incurred loss model.
- With these refinements, volatility and bias were greatly reduced.

Retrospective Rating – Paid Loss Simulation

Model Validation

Calendar Year	Incremental Paid Losses (\$M)								
	Simulated Values								
	Empirical	Agg.	p5	p10	p25	p50	p75	p90	p95
2010	444.99	423.16	407.86	412.20	415.57	422.94	428.02	435.38	441.99
2011	402.55	409.73	395.78	397.06	403.19	409.26	415.33	420.59	424.15
2012	429.30	424.13	409.85	412.52	418.37	422.84	429.39	434.45	440.23
2013	570.39	570.59	547.48	553.46	561.49	568.75	578.00	588.37	597.36

Percent Differences from Empirical									
2010		-4.90%	-8.34%	-7.37%	-6.61%	-4.95%	-3.81%	-2.16%	-0.67%
2011		1.78%	-1.68%	-1.36%	0.16%	1.67%	3.17%	4.48%	5.36%
2012		-1.20%	-4.53%	-3.91%	-2.55%	-1.51%	0.02%	1.20%	2.54%
2013		0.03%	-4.02%	-2.97%	-1.56%	-0.29%	1.33%	3.15%	4.73%

Cumulative		-1.06%	-2.90%	-2.50%	-2.03%	-1.12%	-0.28%	0.55%	0.83%
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Retrospective Rating – Paid Loss Simulation Data Products

- The modeling approach will create a complete paid and incurred loss path for the life of each claim simulation.
- Data artifacts envisioned to be included with the updated Retrospective Rating Plan include:
 - Tables of open and closed claim counts by claim age, retro hazard group, and paid loss layer.
 - Analogous to current tables by incurred loss layer.
 - Tables of open and closed claim counts by paid loss layer, incurred loss layer, claim age, and RHG.
 - Tables of claim reserves by claim age, RHG, and incurred loss layer.
 - Other requested artifacts are potentially available.

02

Update on Medical Severity Trends by Component



Review of Medical Severity Trends – Based on 12/31/2018 Experience Summary

- Methodology of analyzing medical severity trends
- Share of medical payments by service type
- Medical severity trends by medical service type, including additional breakdown:
 - Pharmaceuticals: opioids and non-opioids
 - Outpatient: Ambulatory Surgical Center (ASC) and hospital outpatient department
 - Medical Legal: ML102 & ML104
- Cumulative share change in medical cost severity by selected component of physician services

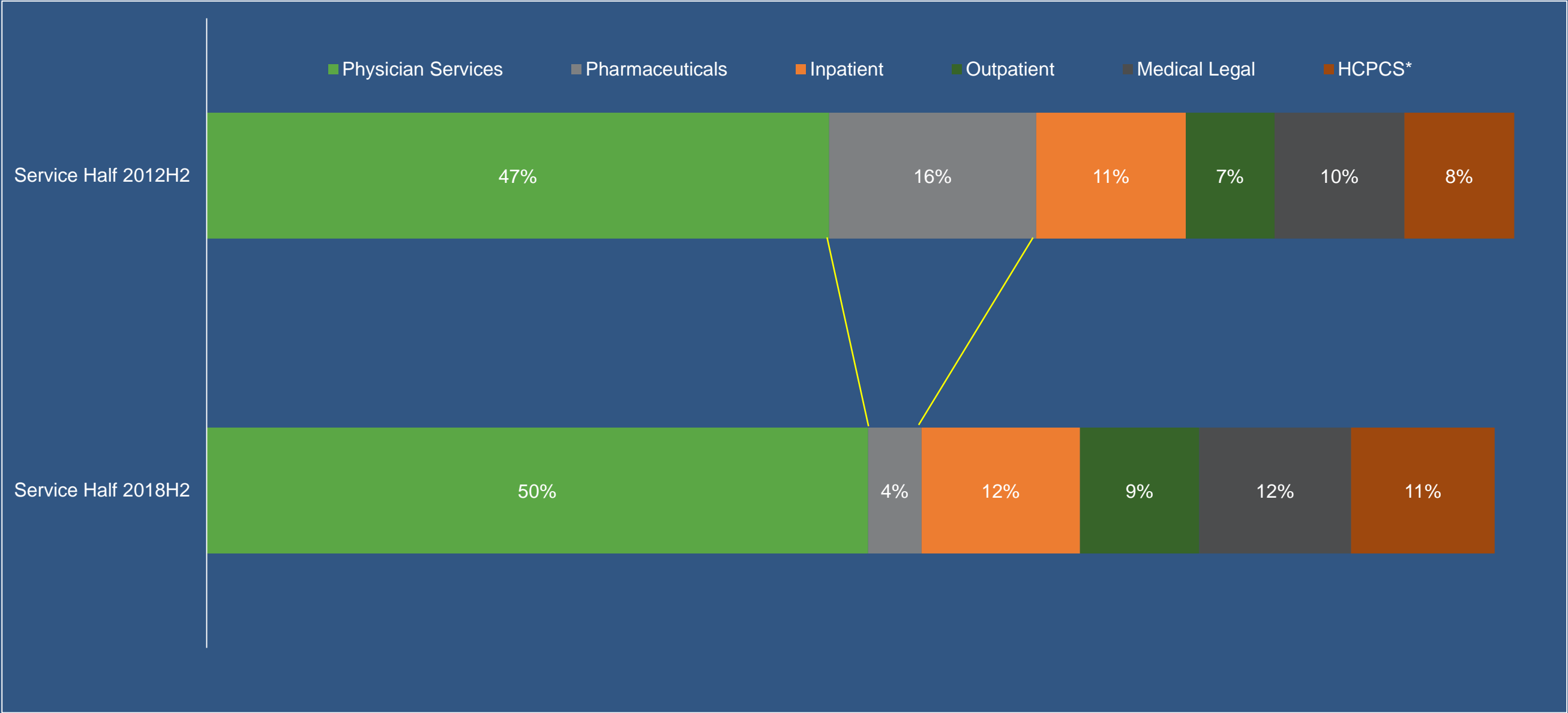
Methodology

Analyzed WCIRB's medical transaction data

- Service dates between 7/1/2012 and 12/31/2018, controlled for transactional maturity
- Includes insurers active since 7/1/2012
- Excludes medical liens
- Pathology and Laboratory testing transactions and payments were included in Physician Services

Share of Total Medical Payments by Service Type

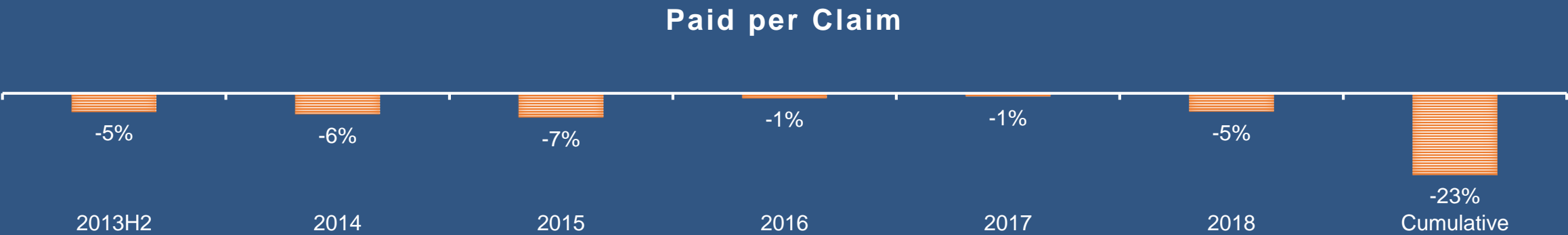
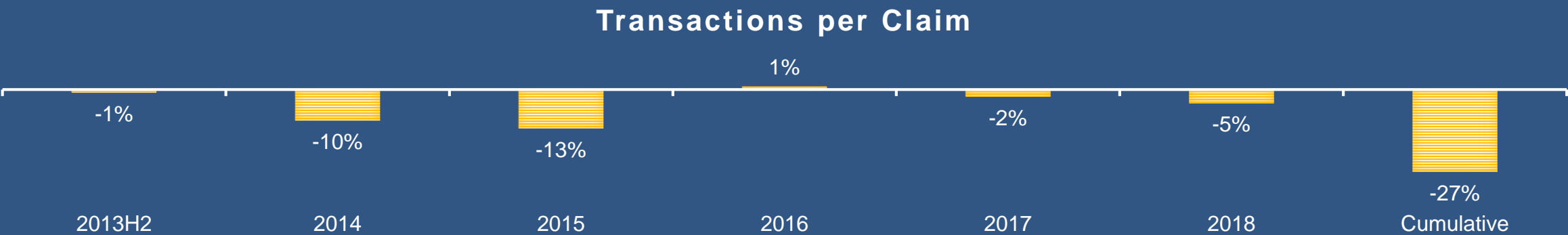
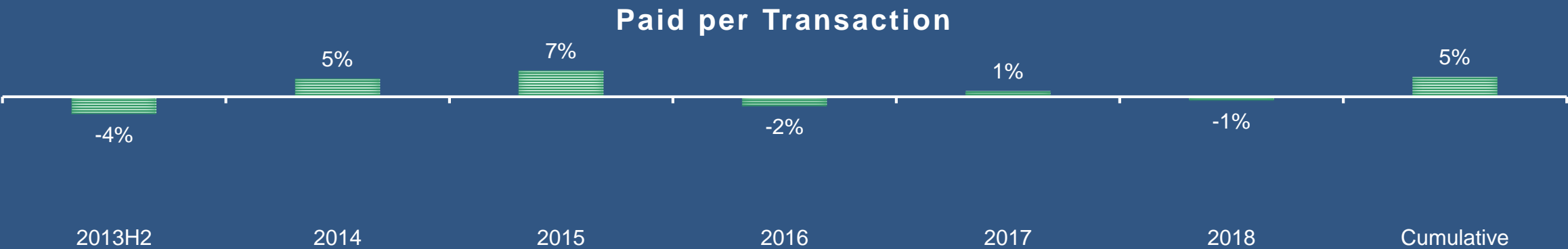
As of April 7, 2019



Source: WCIRB medical transaction data collected beginning in the third quarter of 2012.
* HCPCS stands for Health Care Procedure Coding System. HCPCS codes primarily include ambulance services, durable medical equipment, prosthetics, orthotics, and supplies used outside a physician's office, home health services, and interpreter services.

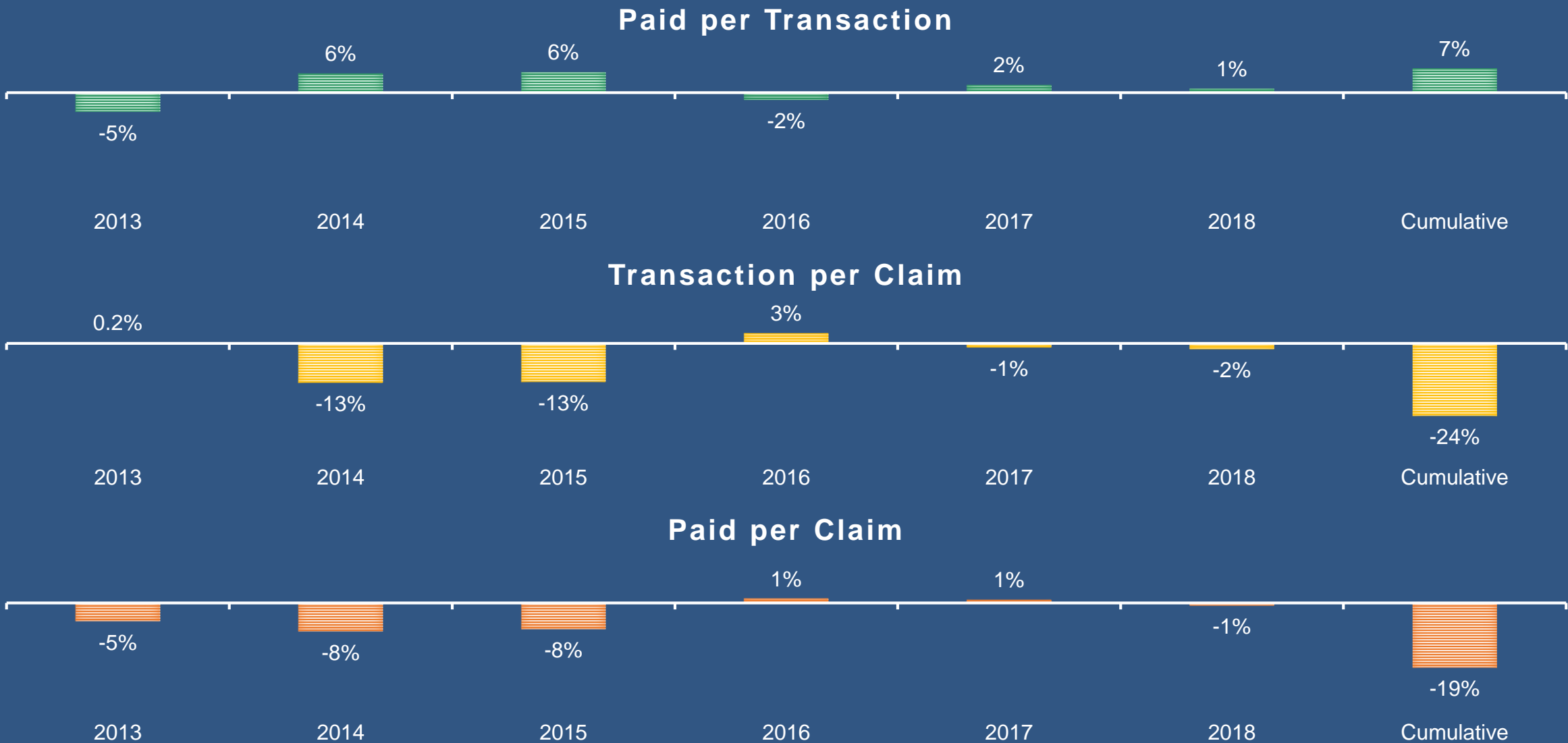
% Change in *All Medical Services* Cost per Claim

As of April 7, 2019



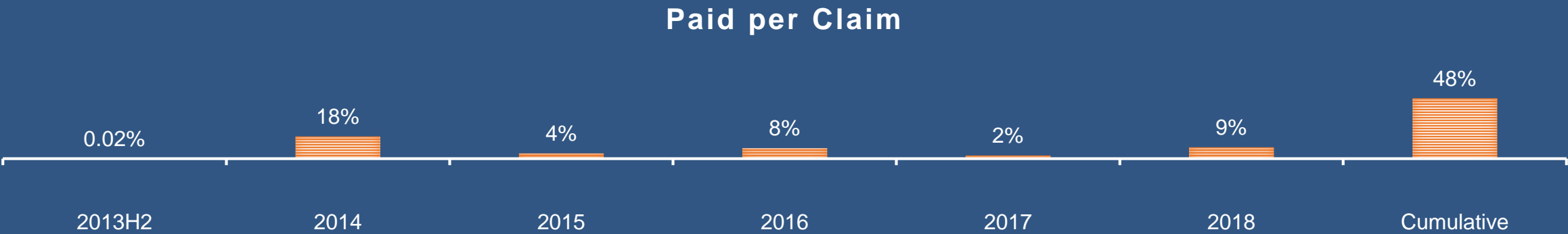
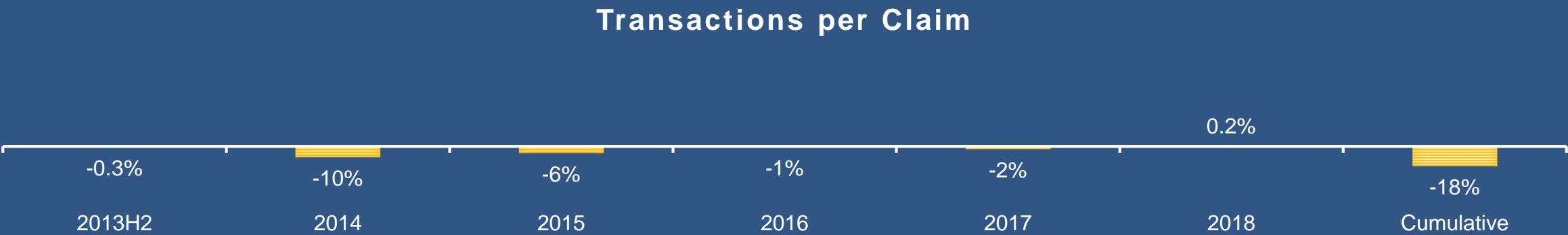
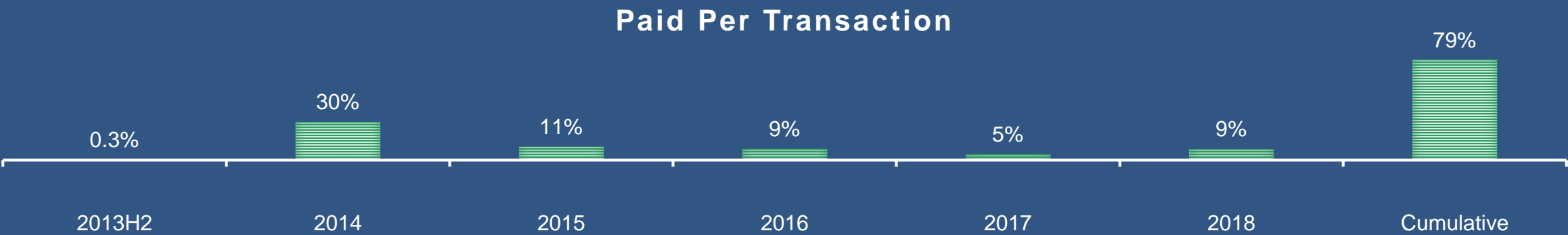
% Change in *Physician Services* Cost per Claim

As of April 7, 2019



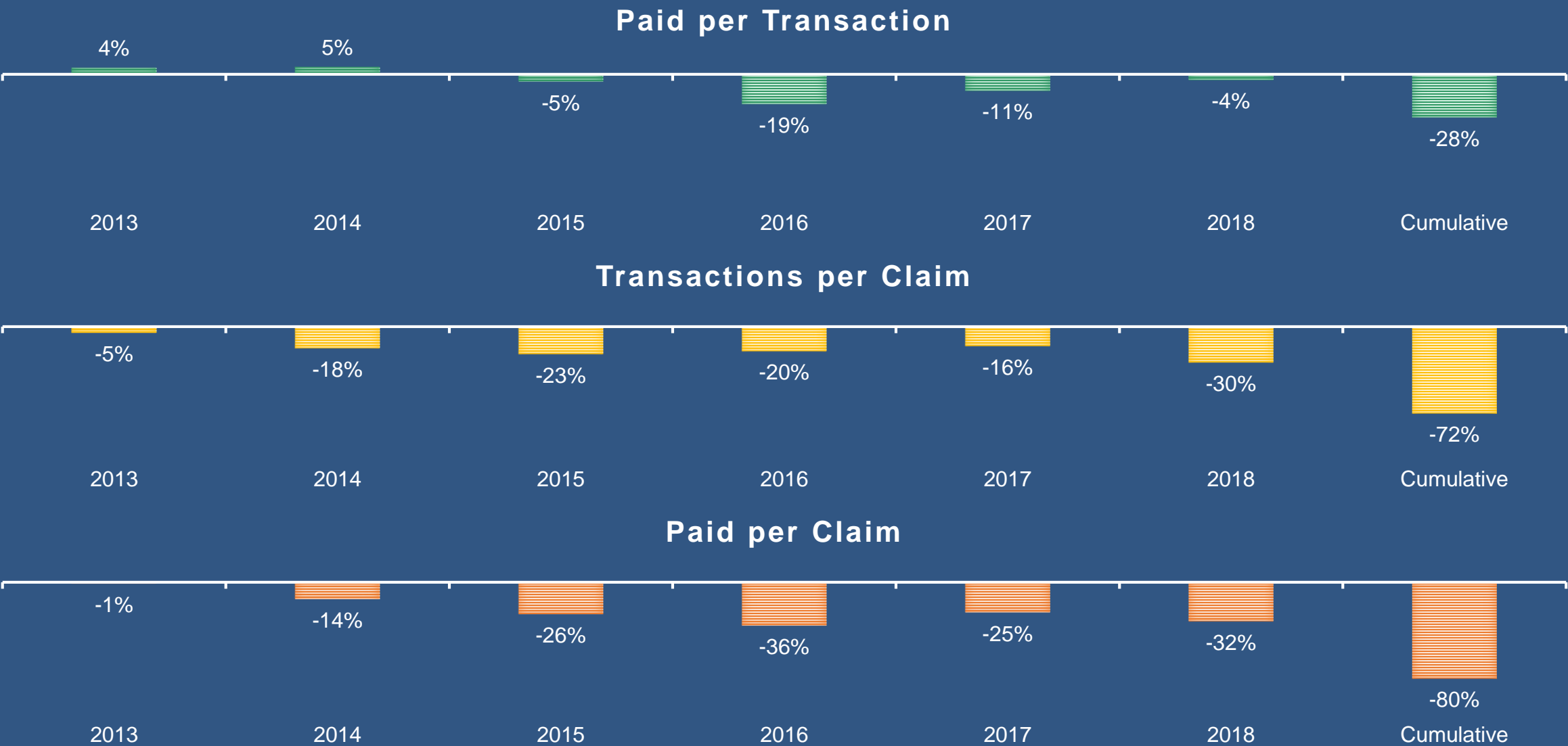
% Change in *Physical Therapy* Cost per Claim

As of April 7, 2019



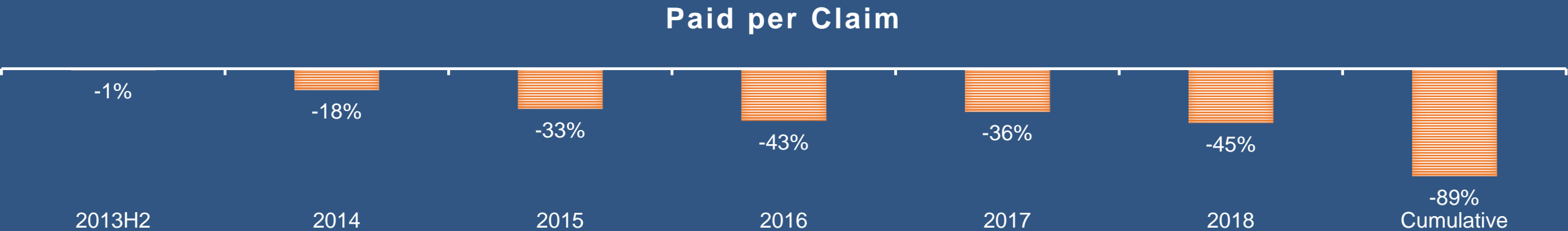
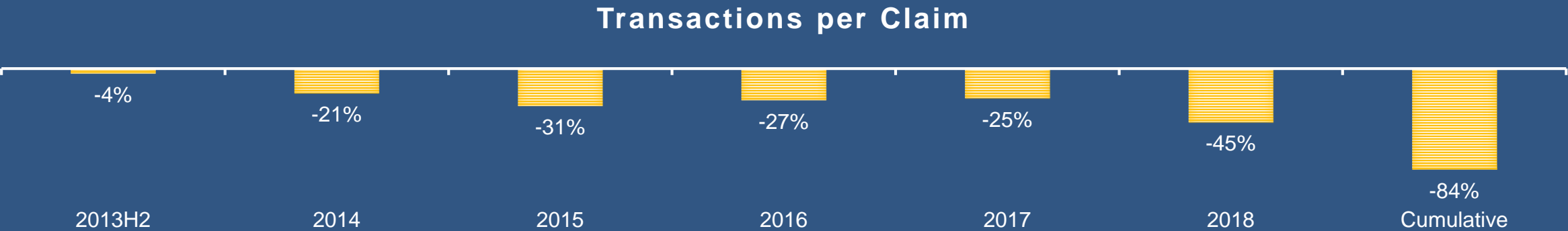
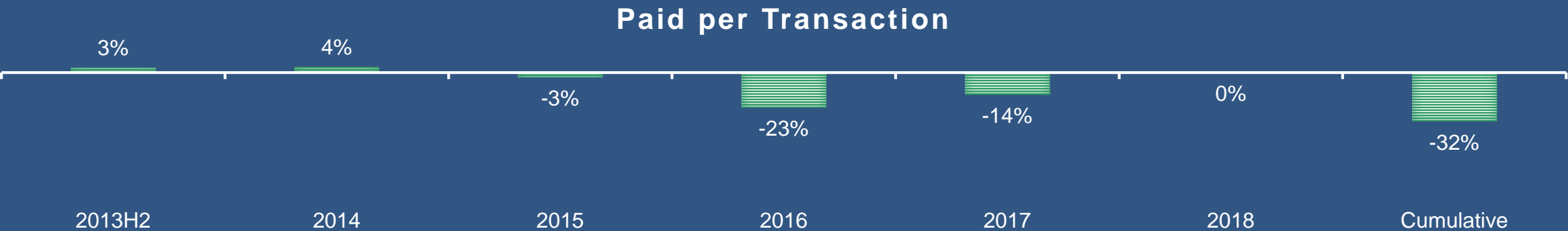
% Change in *Pharmaceutical* Cost per Claim

As of April 7, 2019



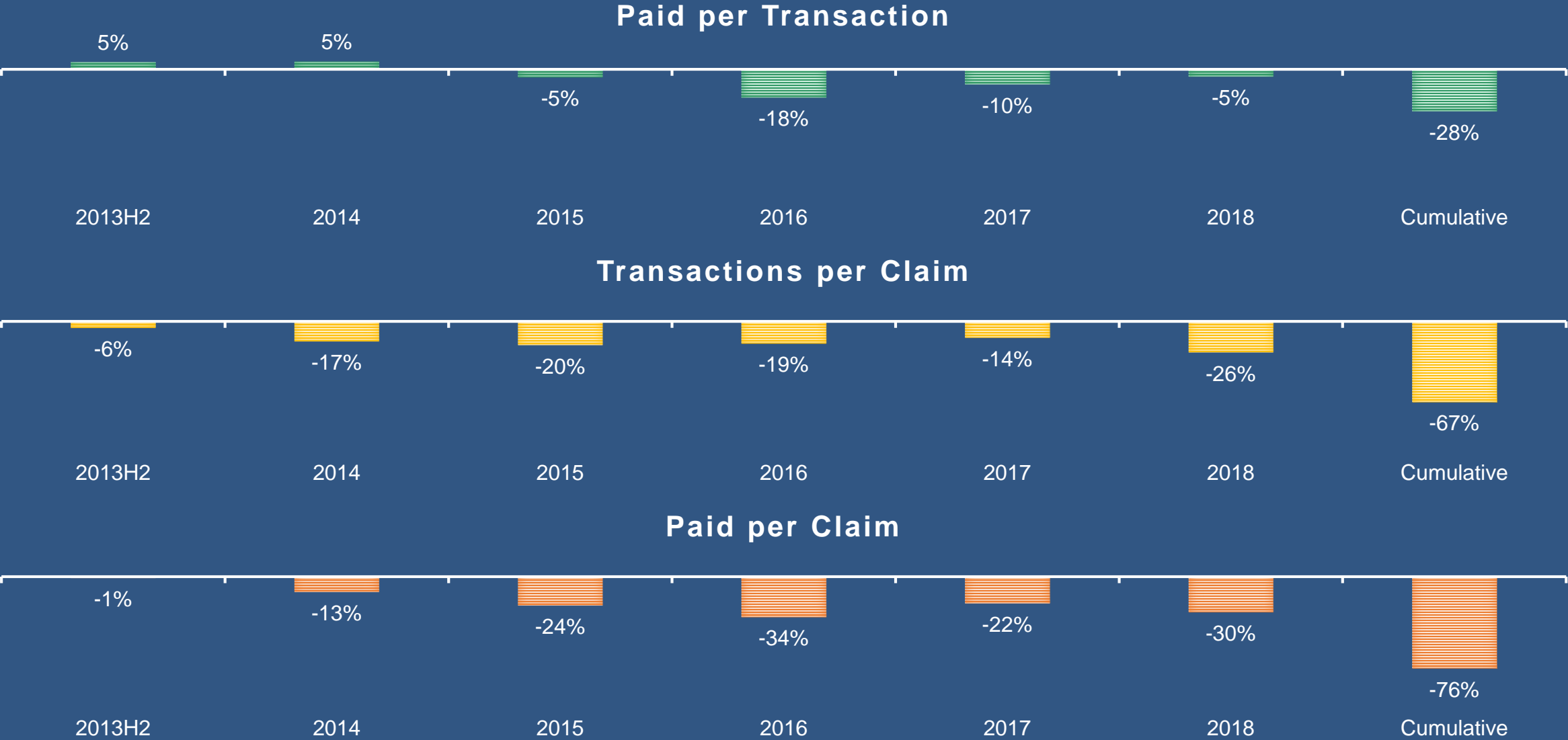
% Change in *Opioid* Cost per Claim

As of April 7, 2019



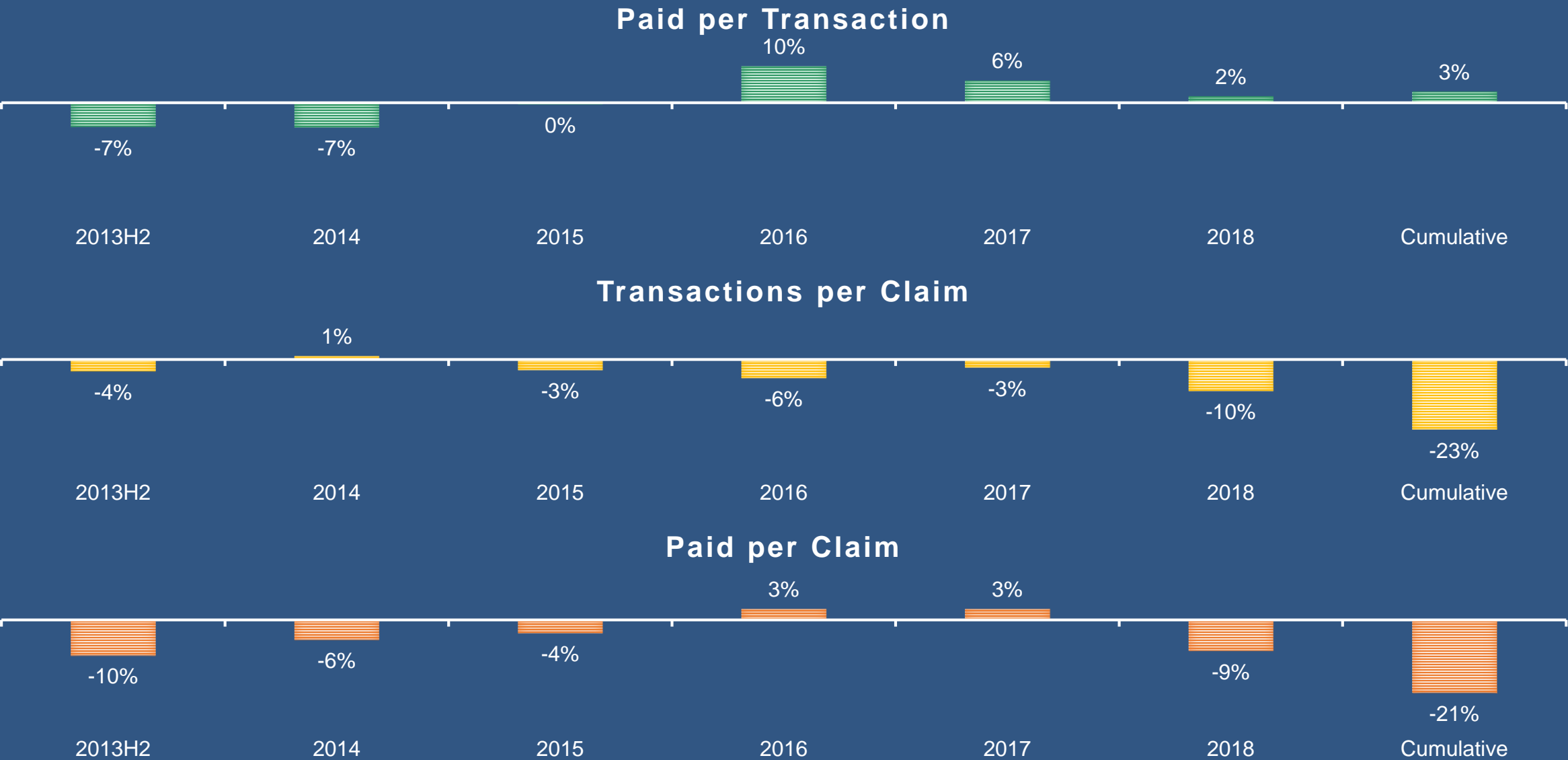
% Change in *Non-Opioid* Cost per Claim

As of April 7, 2019



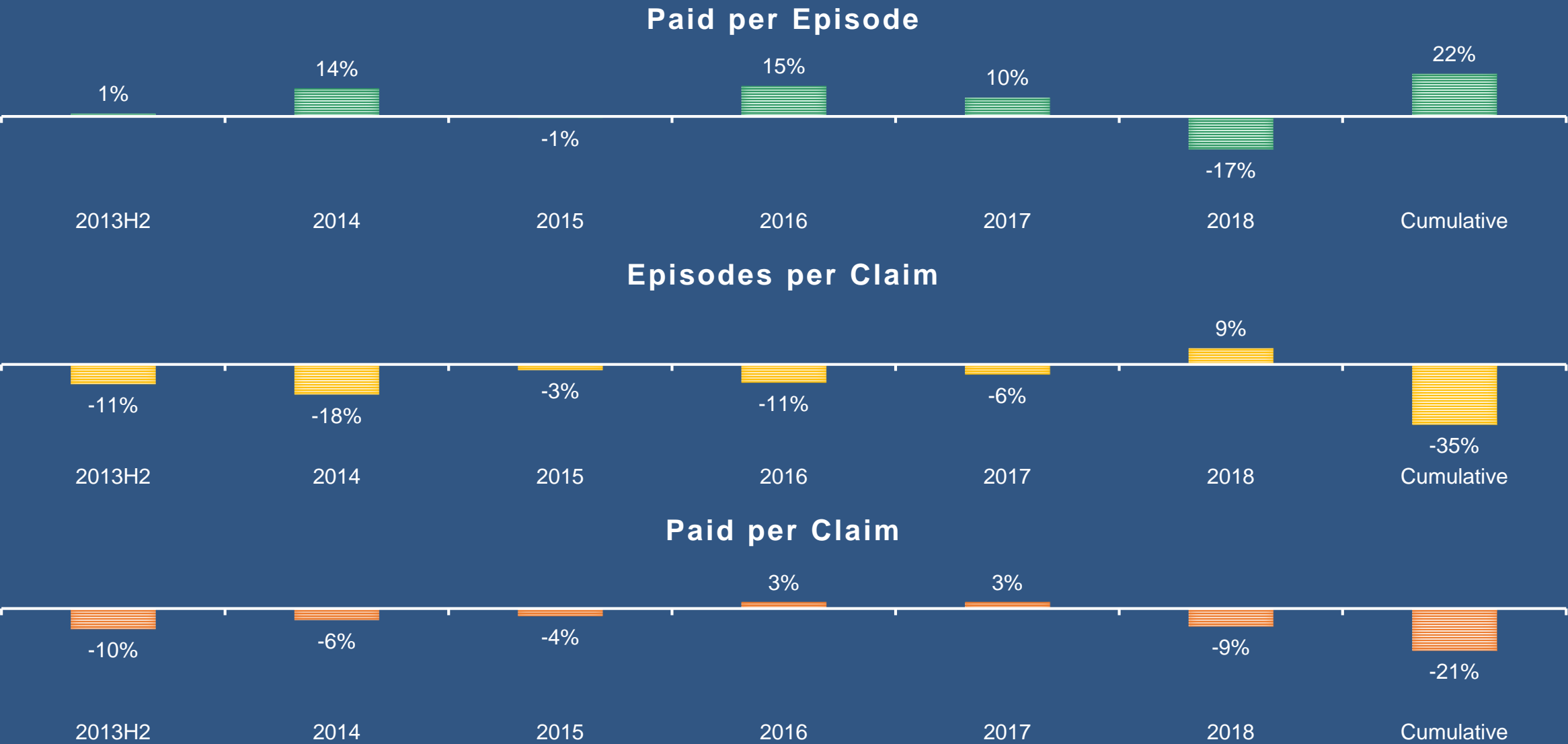
% Change in *Inpatient* Cost per Claim (transaction-based)

As of April 7, 2019



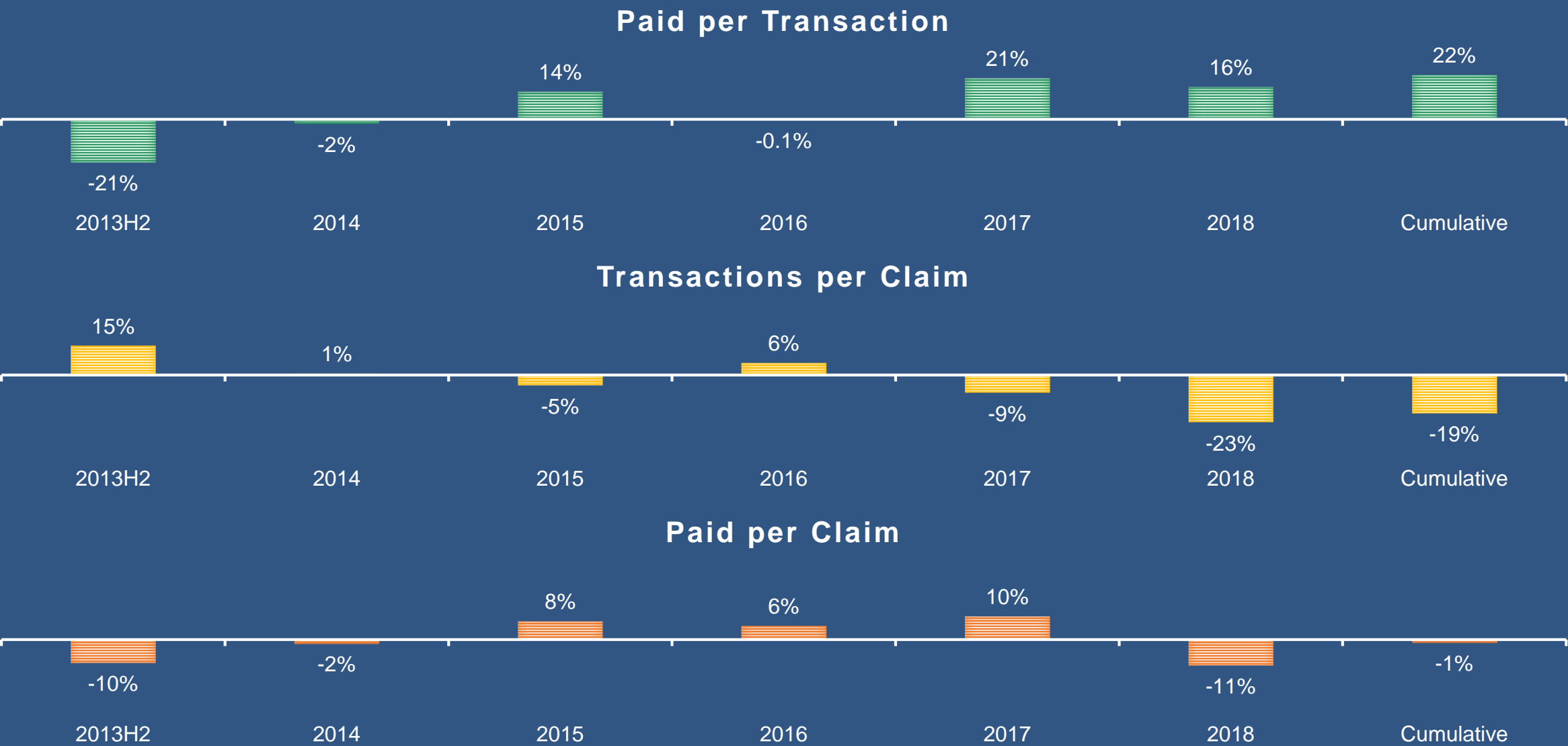
% Change in *Inpatient* Cost per Claim (episode-based)

As of April 7, 2019



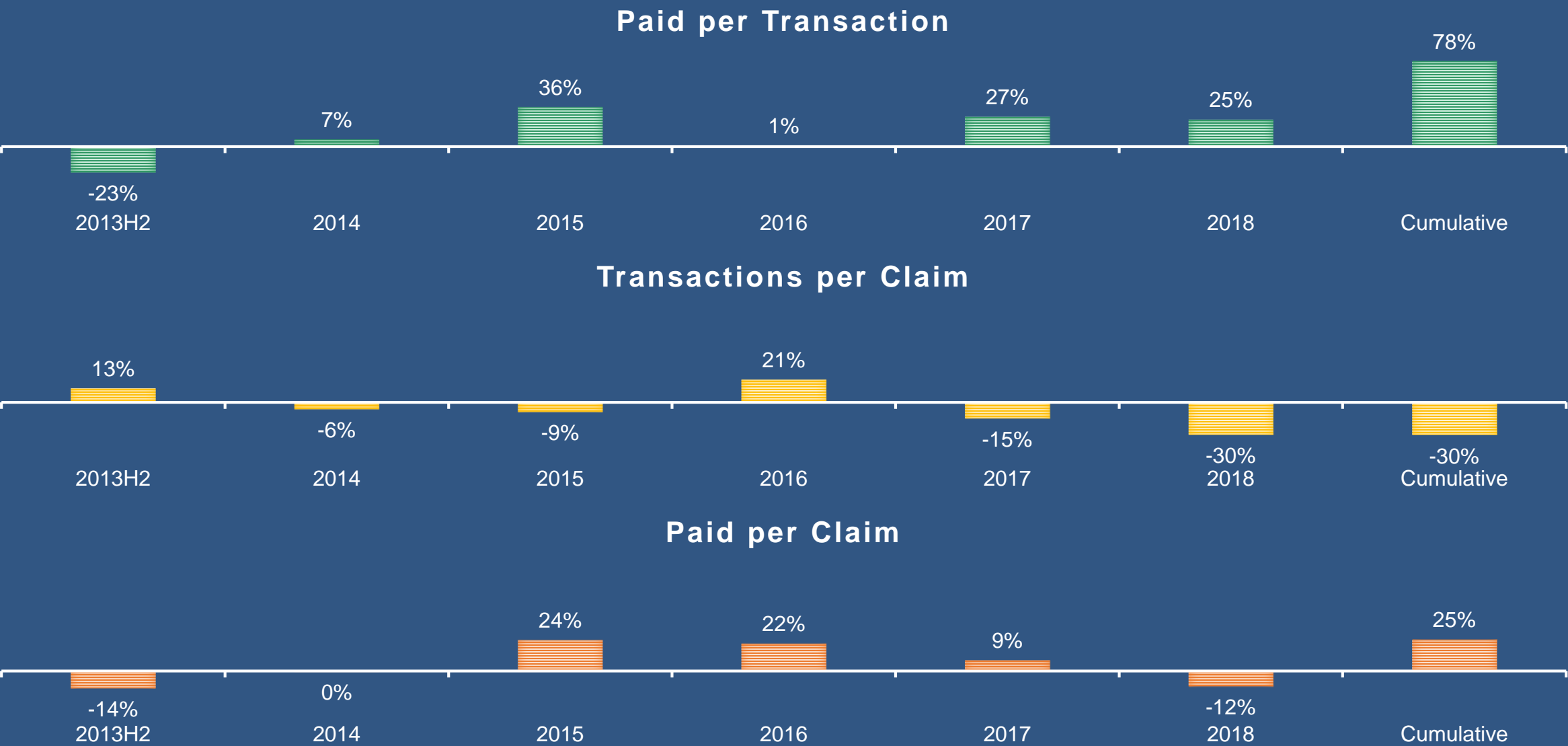
% Change in *Outpatient* Cost per Claim

As of April 7, 2019



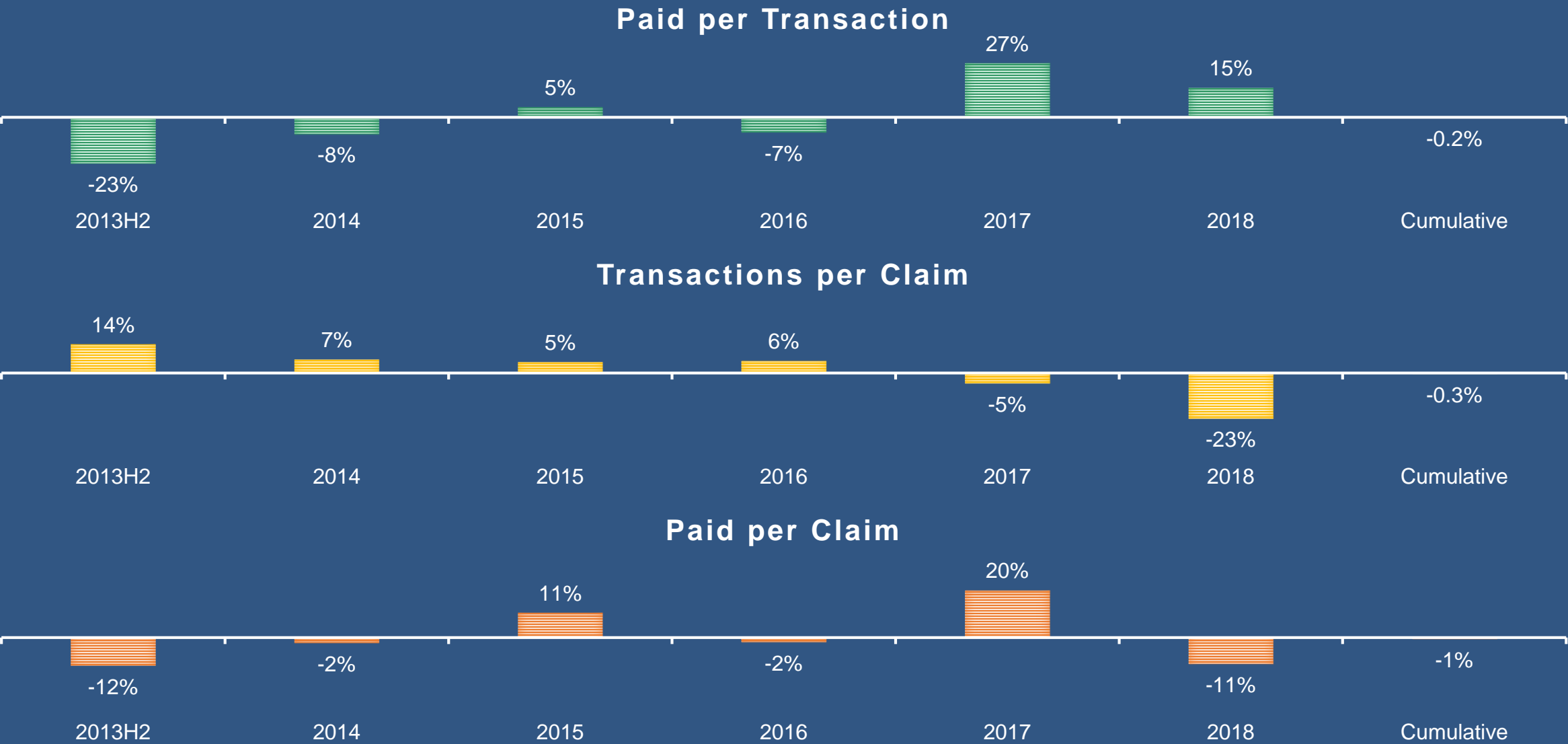
% Change in Ambulatory Surgical Center (ASC) Cost per Claim

As of April 7, 2019



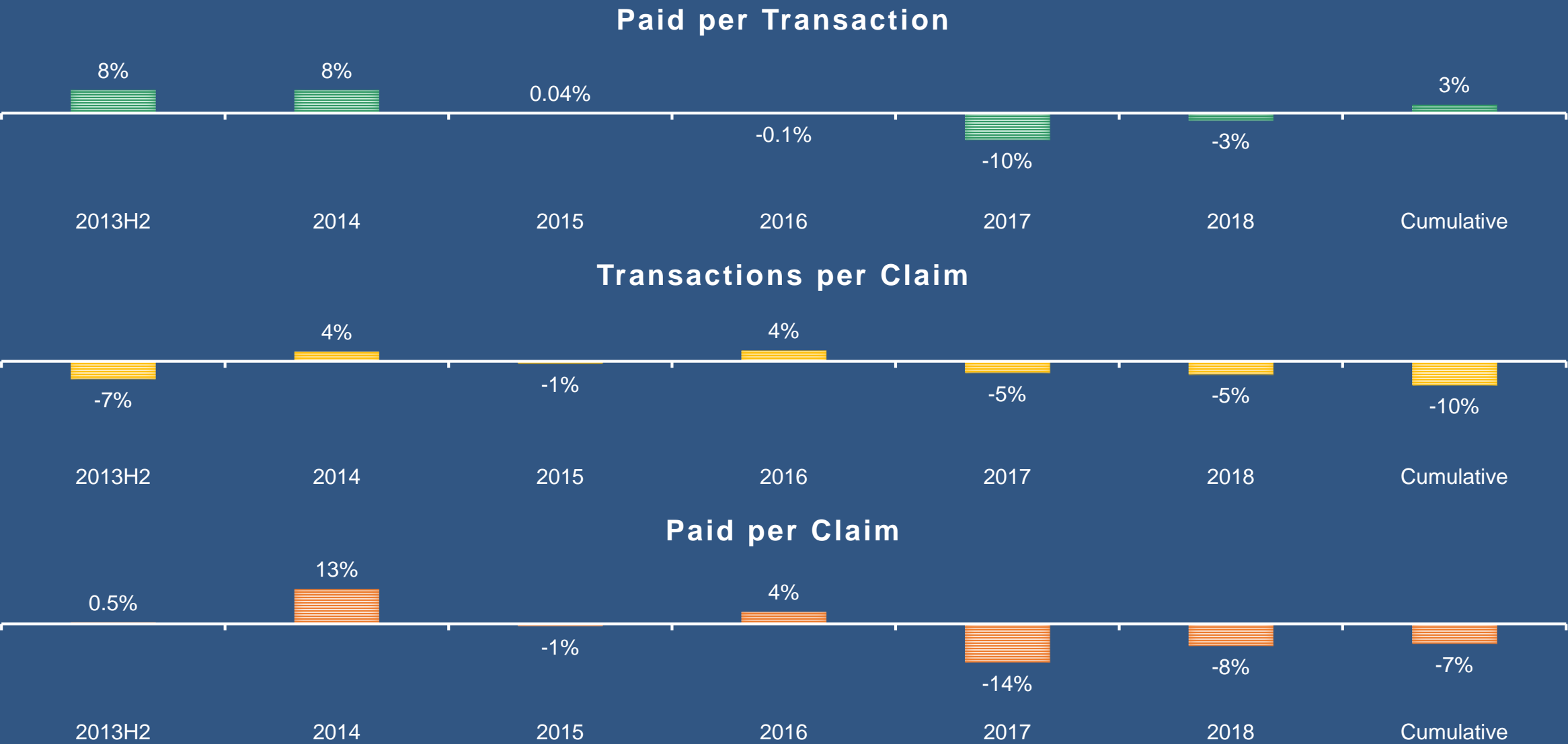
% Change in *Hospital Outpatient Department* Cost per Claim

As of April 7, 2019



% Change in *Medical Legal* Cost per Claim

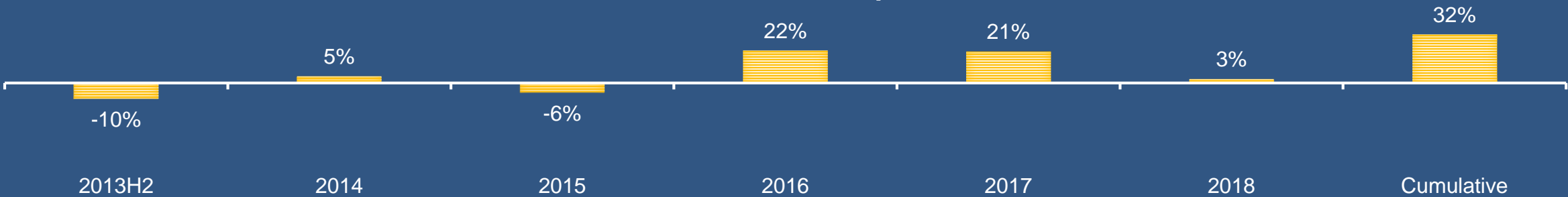
As of April 7, 2019



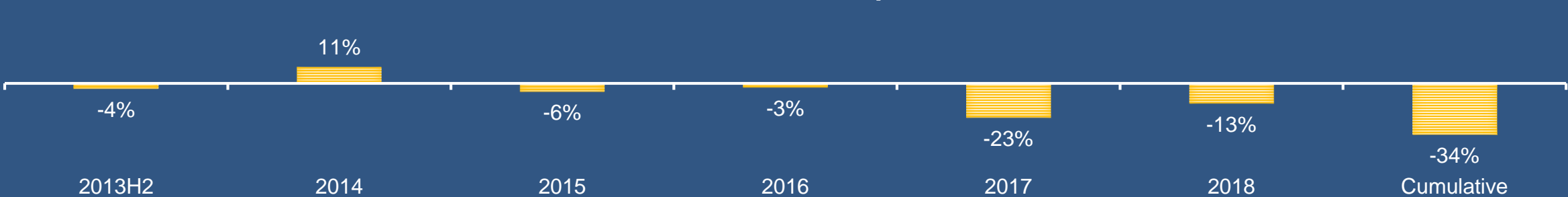
% Change in *ML102* and *ML104* Transactions per Claim

As of April 7, 2019

ML102 Transactions per Claim

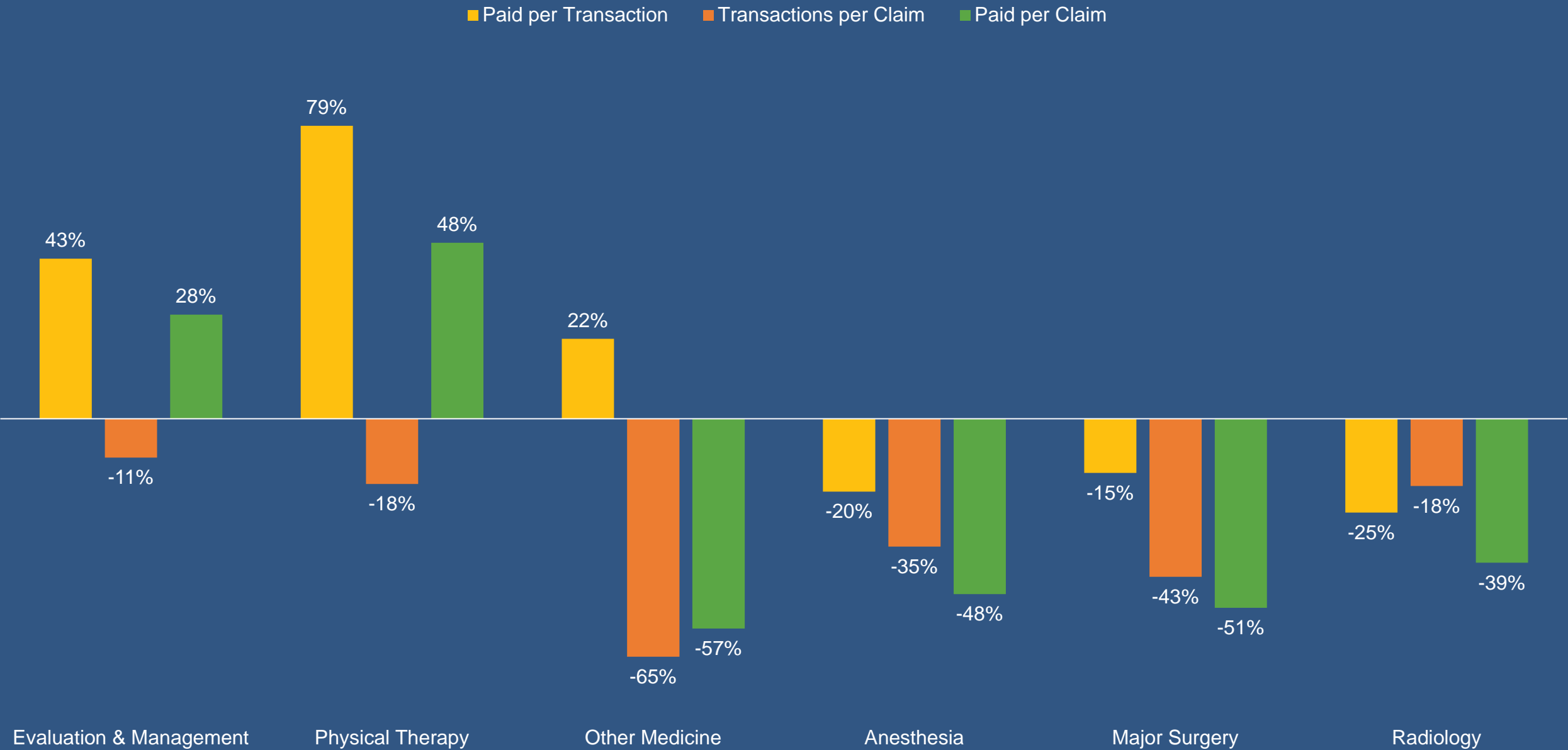


ML104 Transactions per Claim



Cumulative % Change in Selected Components of Physician Services 2012H2 through 2018H2

As of April 7, 2019



04

Classification Payroll Limitations



New Maximum Payroll Limitations

- CDI approved maximum payroll limitations to apply to five additional classifications in 2020
 - 7607, *Video Post-Production/Audio Post-Production*
 - 8743, *Mortgage Brokers*
 - 8803, *Auditing, Accounting or Management Consulting Services*
 - 8820, *Law Firms*
 - 8859, *Computer Programming or Software Development*
- Staff developed approach to adjust relativity for these classifications to reflect new payroll cap
- Methodology reviewed by Actuarial Research Working Group and Actuarial Committee in 2018
- Final adjustments reviewed by Classification & Rating Committee at 5/30/2019 meeting

Data and Classification Mapping

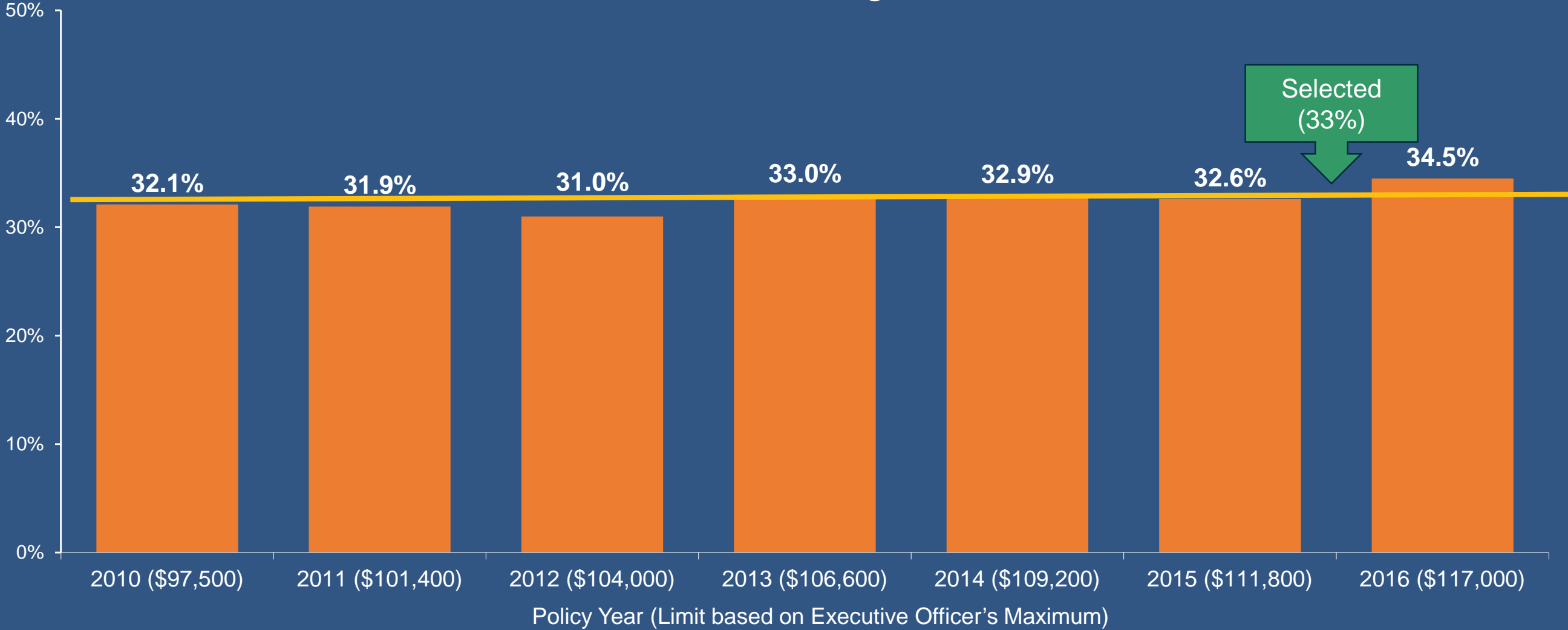
- Data is based on American Community Survey (ACS)
 - Includes annual wages by industry and occupation
 - % of payroll above certain annual wages can be observed
 - Data includes payroll cap (approx. \$500,000) to mitigate impact of very large salaries
- Calendar years 2010 to 2017 reviewed
- Subject classifications were mapped to industry and occupation by WCIRB classification analysts
- Examples (also see Exhibit 2):
 - Classification 8820, *Law Firms*
 - 100% weight to NAICS 5411 – Legal services
 - Classification 8803, *Auditing, Accounting or Management Consulting Services*
 - 71% weight to NAICS 5412 – Accounting, tax preparation, bookkeeping and payroll services
 - 29% weight to NAICS 5416 – Management, scientific and technical consulting services

Adjustment Methodology

- % payroll above specific limits reviewed in ACS data for mapped industries
- Selected limits used were USRP executive officer maximum in effect for each year
 - Executive officer maximum is what new payroll caps will be tied to
 - Executive officer maximum is already indexed for wage inflation each year
- % of payroll above selected limits was fairly consistent by year within the classification but showed some volatility
- A single adjustment factor selected based on average across years for the classification rather than by year
- Resulting factors were consistent with expectations and prior periods when payroll limits were implemented

Percent of Payroll Above Limit – Classification 8820 (Exhibit 6)

Based on NAICS 5411 – Legal Services



Selected Percent Above Limit and Adjustment Factors

Classification	2020 Payroll Maximum	% Payroll Above Maximum	Adjustment Factor
7607	\$139,100	20%	0.80
8743	\$139,100	29%	0.71
8803	\$139,100	19%	0.81
8820	\$139,100	33%	0.67
8859	\$139,100	27%	0.73

Application to Classification Ratemaking

- Each of the five classifications' payroll and expected loss to payroll ratio is adjusted by the selected payroll limit factor
- Review sheet will separately show impact of adjustment and impact of experience change
- Relativity changes will not be restricted to 25%
 - Payroll on 2020 policies will be reported on limited basis
 - Adjustment intended to be produce same total pure premium for the classification

05

3/31/2019
Experience –
Review of
Methodologies



Preliminary Summary of 3/31/2019 Experience

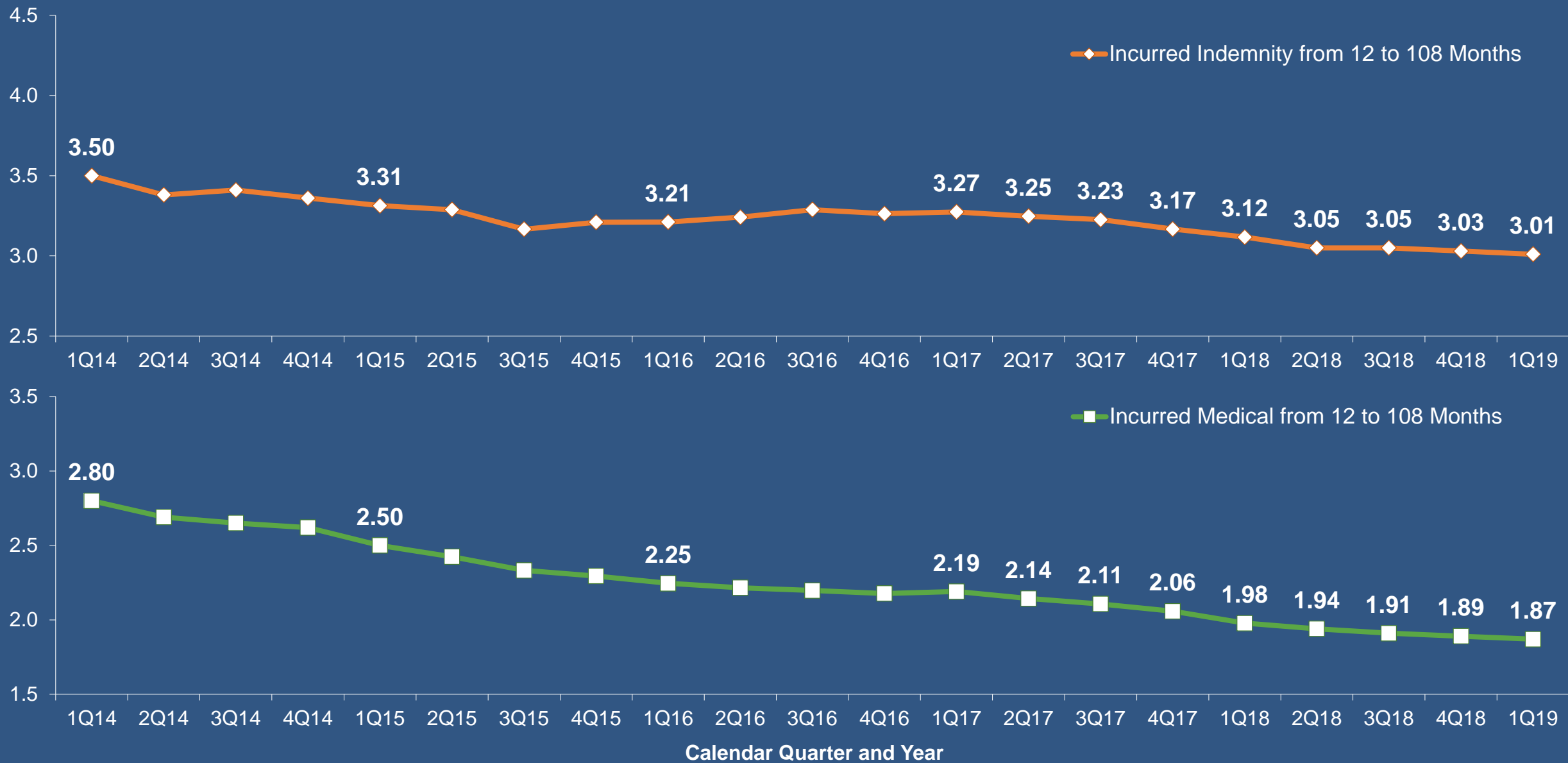
- Approximately 100% of market reflected
- Methodologies consistent with 4/2/2019 Agenda and generally consistent with 1/1/2019 Filing
- Projected loss ratio for 2020 policies: 0.549
- 1.5 point decrease from 4/2/2019 Agenda projection based on 12/31/2018 experience (0.563)
- 7.0 point decrease from 1/1/2019 Filing projection based on 3/31/2019 experience

Approximate Change in Loss Ratio Projection

Factor	Change in Percentage Points From 1/1/2019 Filing	Change in Percentage Points From 4/2/2019 Agenda
Lower Loss Development Emergence	-3.5	-0.5
Inclusion of 2018 Accident Year	-1.0	---
Updated Wage Forecast	+0.5	+0.5
Updated Frequency Trends	-0.5	---
Trend to Policy Year 2020	-2.0	-1.5
Medical Loss Development Methodology Adjustments	-0.3	---
Reflect Impact of Drug Formulary	-0.2	---
Total (to 6/14/2019 Agenda)	-7.0	-1.5

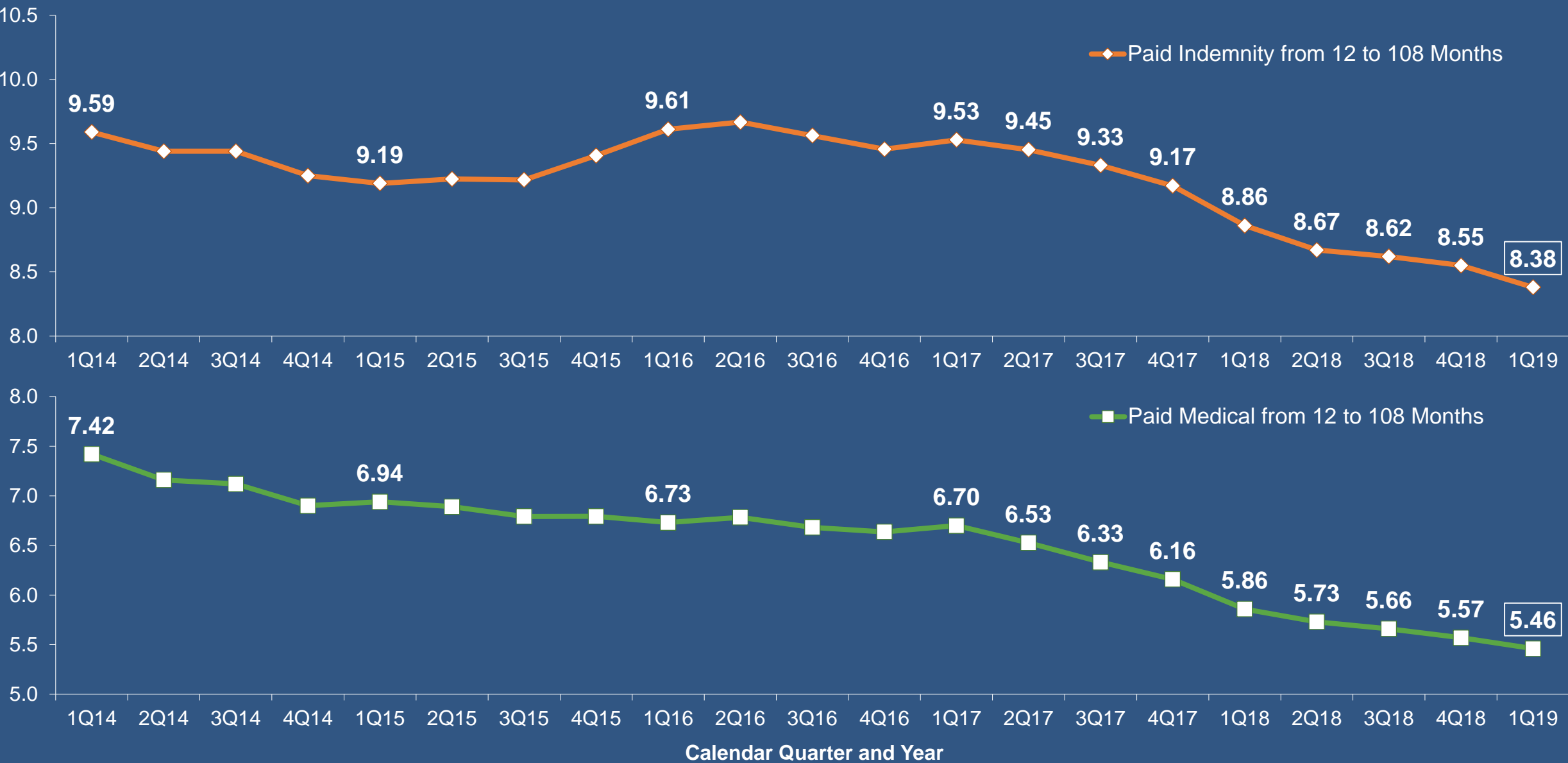
Cumulative Incurred Development from 12 to 108 Months

As of March 31, 2019



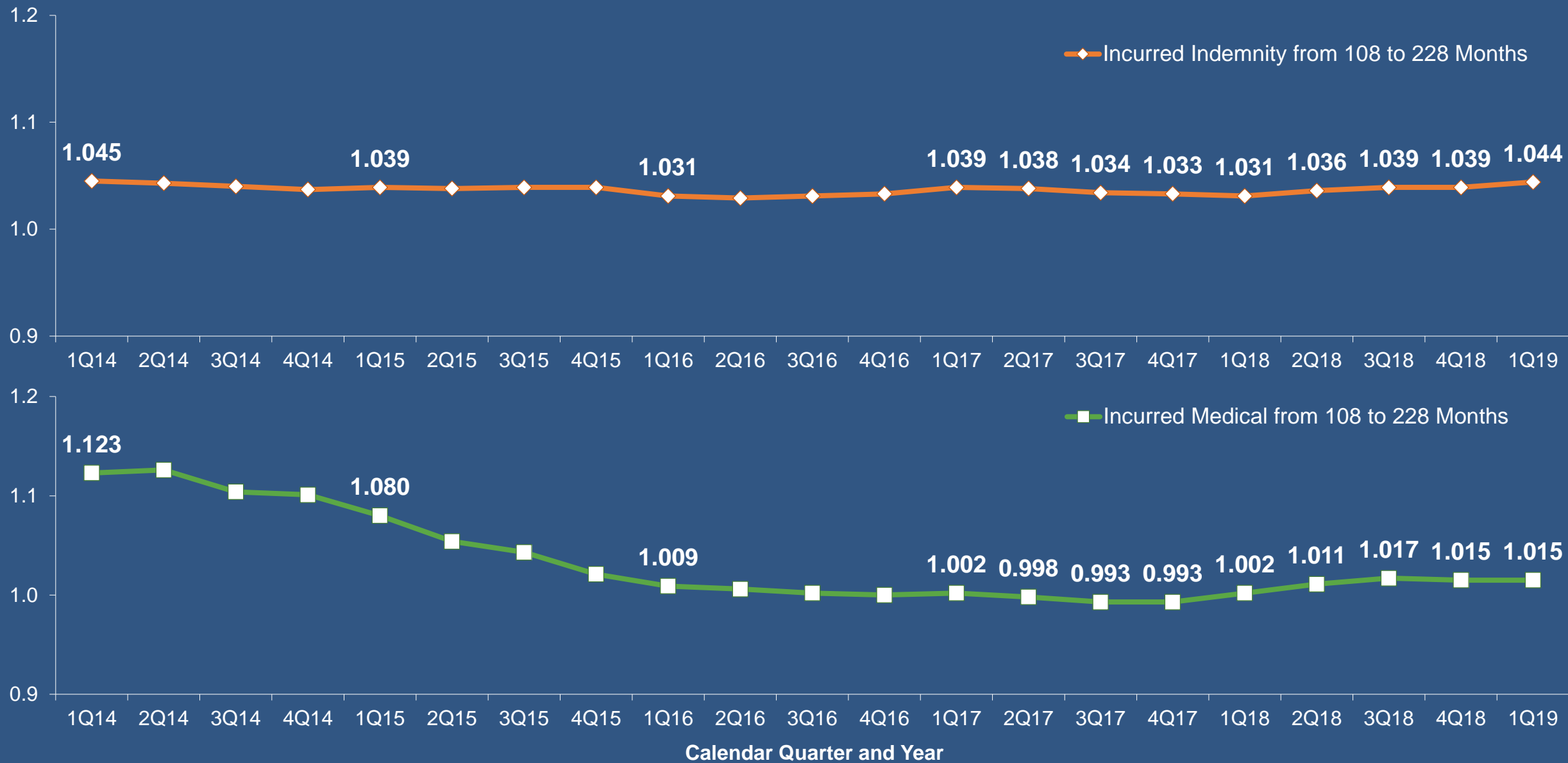
Cumulative Paid Development from 12 to 108 Months

As of March 31, 2019



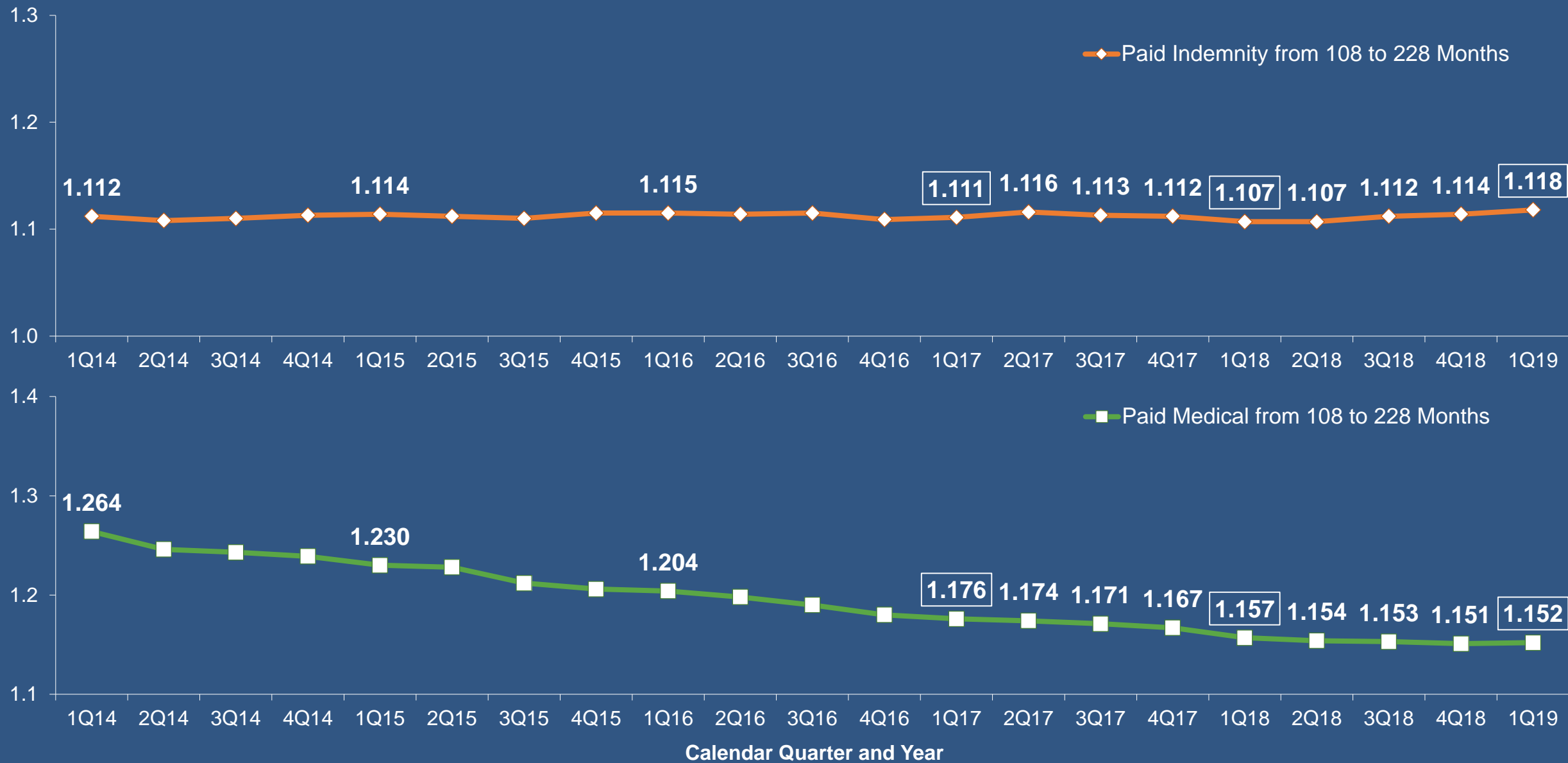
Cumulative Incurred Development from 108 to 228 Months

As of March 31, 2019



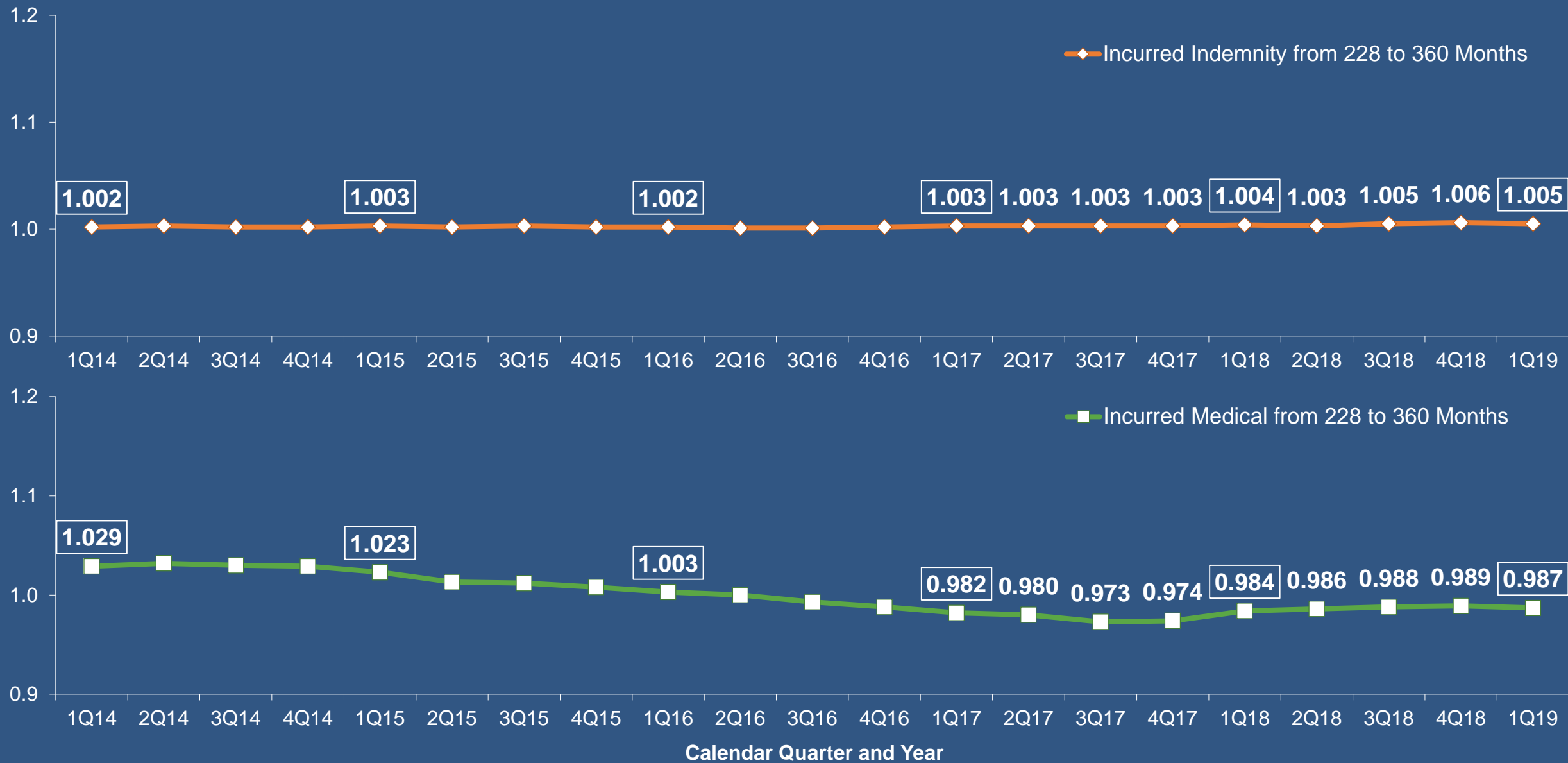
Cumulative Paid Development from 108 to 228 Months

As of March 31, 2019



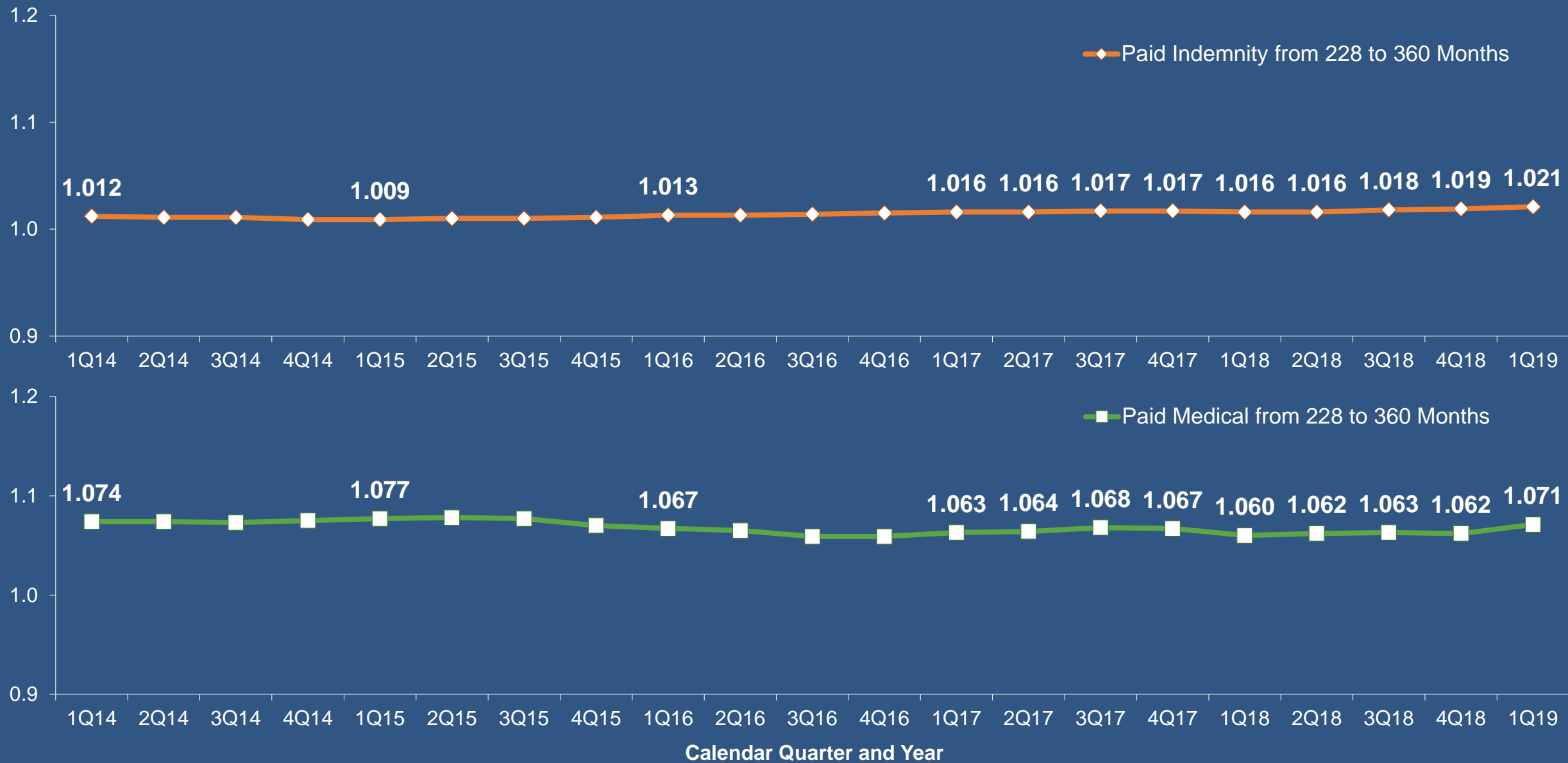
Cumulative Incurred Development from 228 to 360 Months

As of March 31, 2019



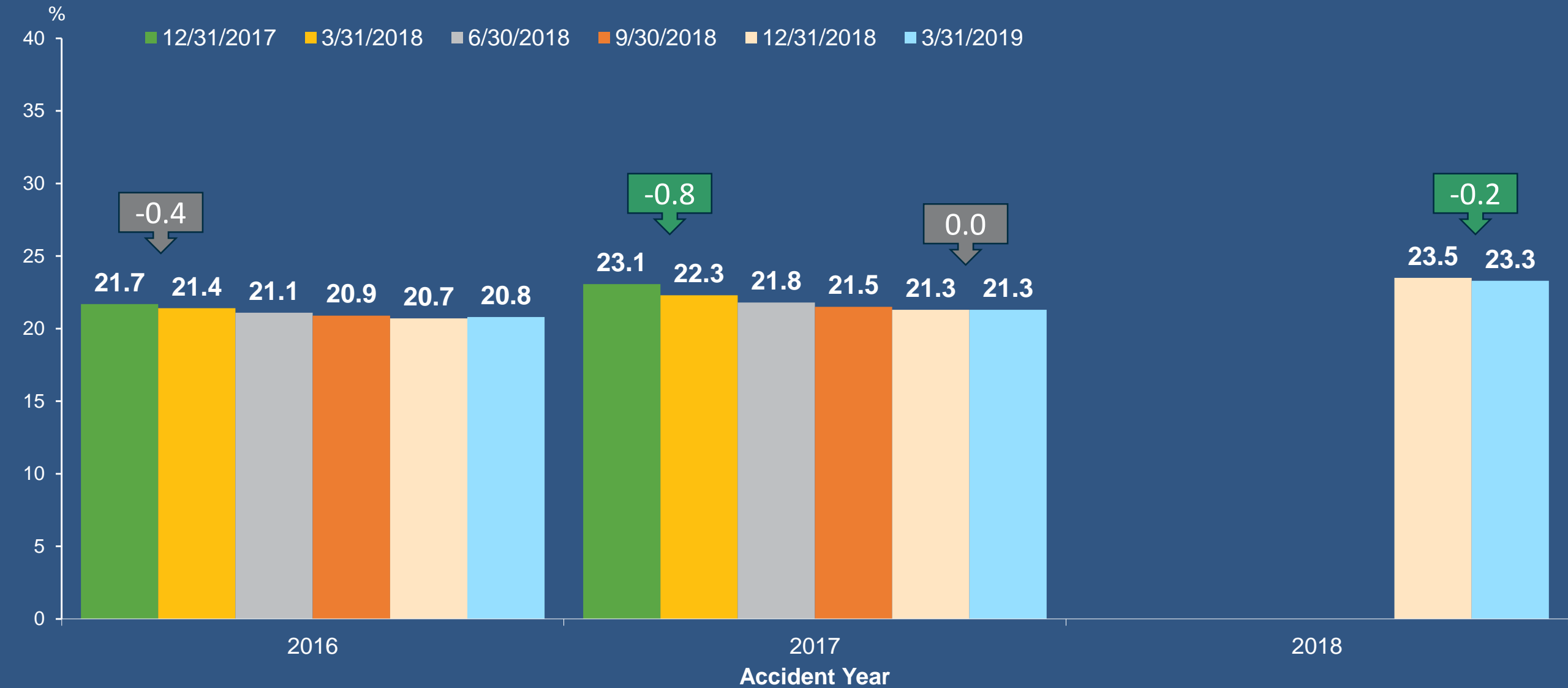
Cumulative Paid Development from 228 to 360 Months

As of March 31, 2019



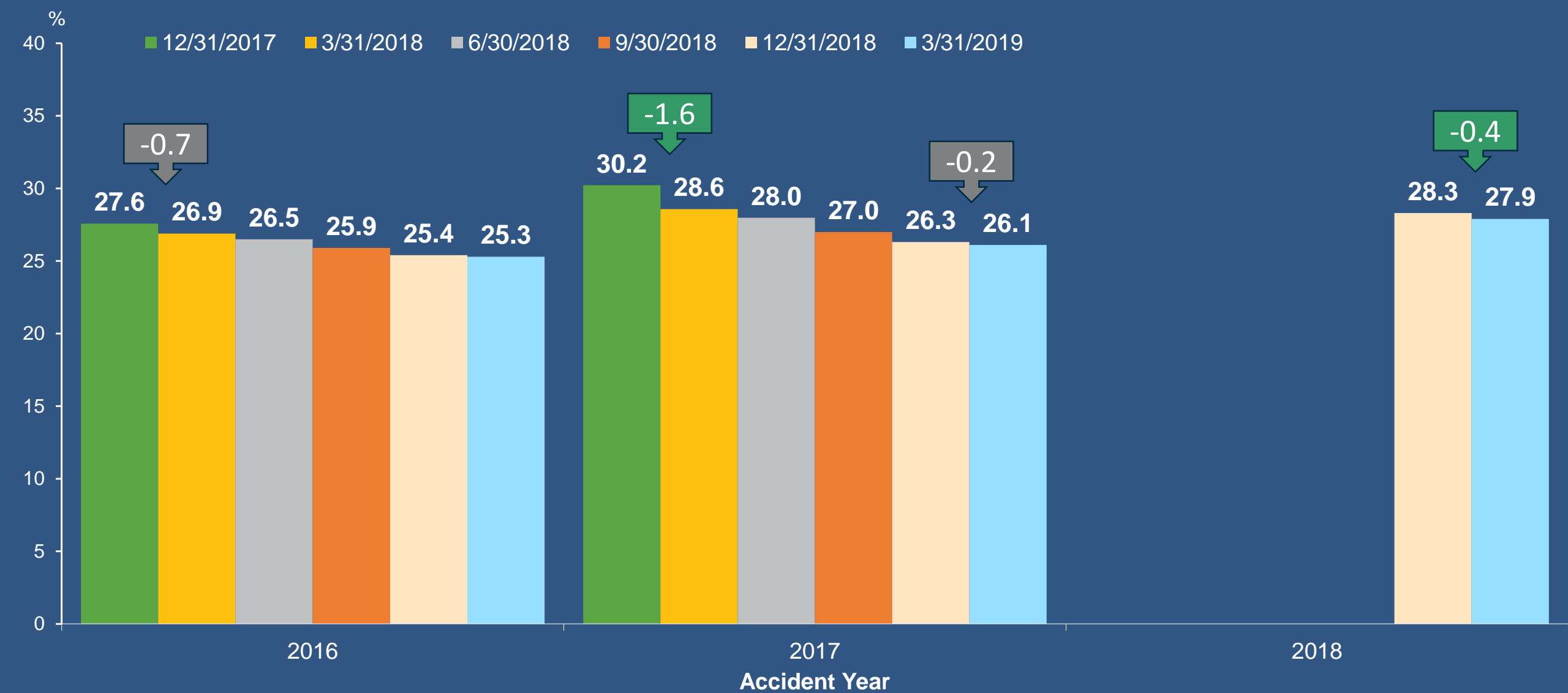
Projected Ultimate Indemnity Loss Ratios (Exhibit 3.1)

As of March 31, 2019



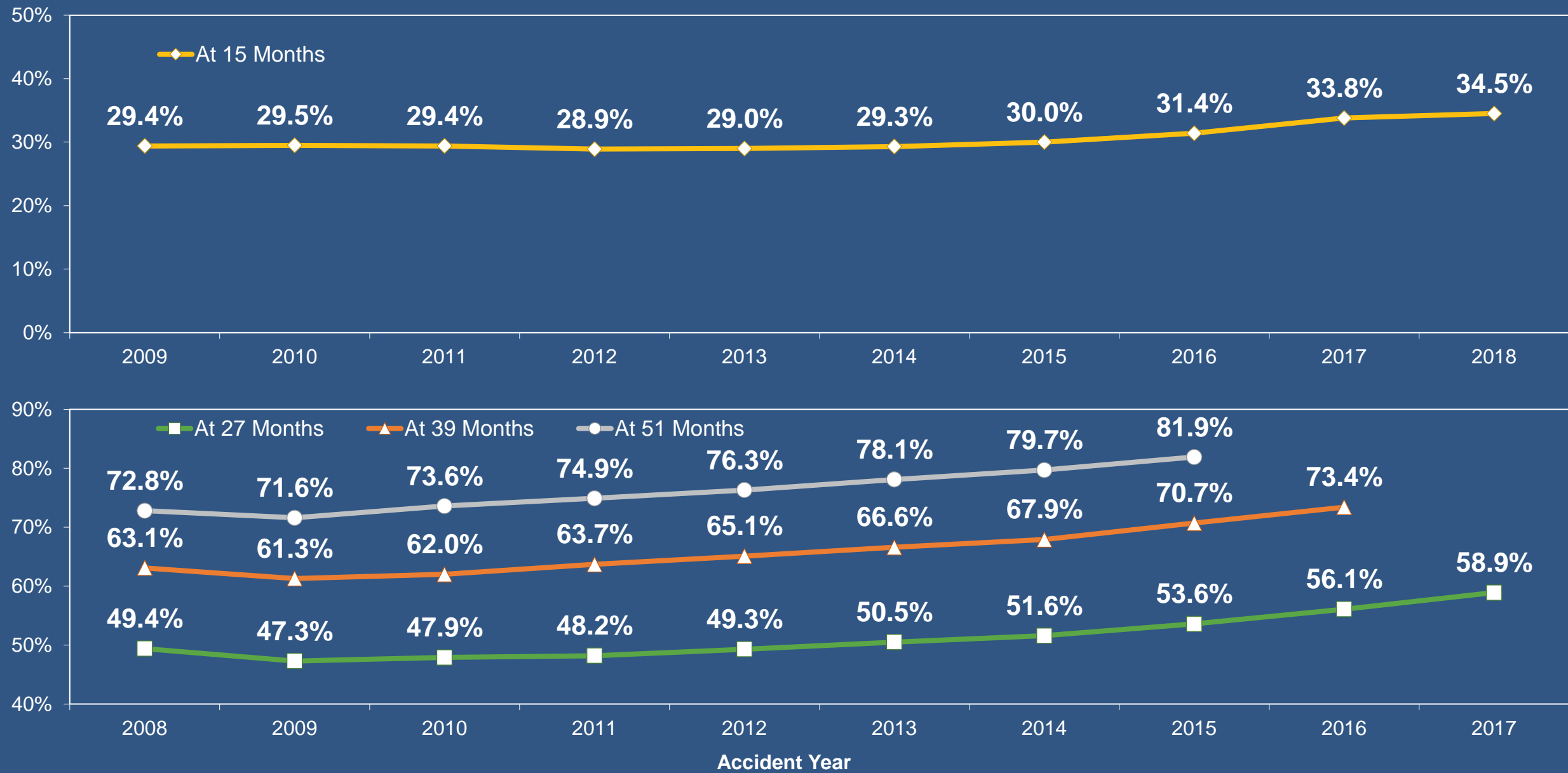
Projected Ultimate Medical Loss Ratios (Exhibit 3.2)

As of March 31, 2019



Ultimate Indemnity Claim Settlement Ratios (Exhibit 11.2)

As of March 31, 2019



Indemnity Claim Count Development (Exhibit 10.1)

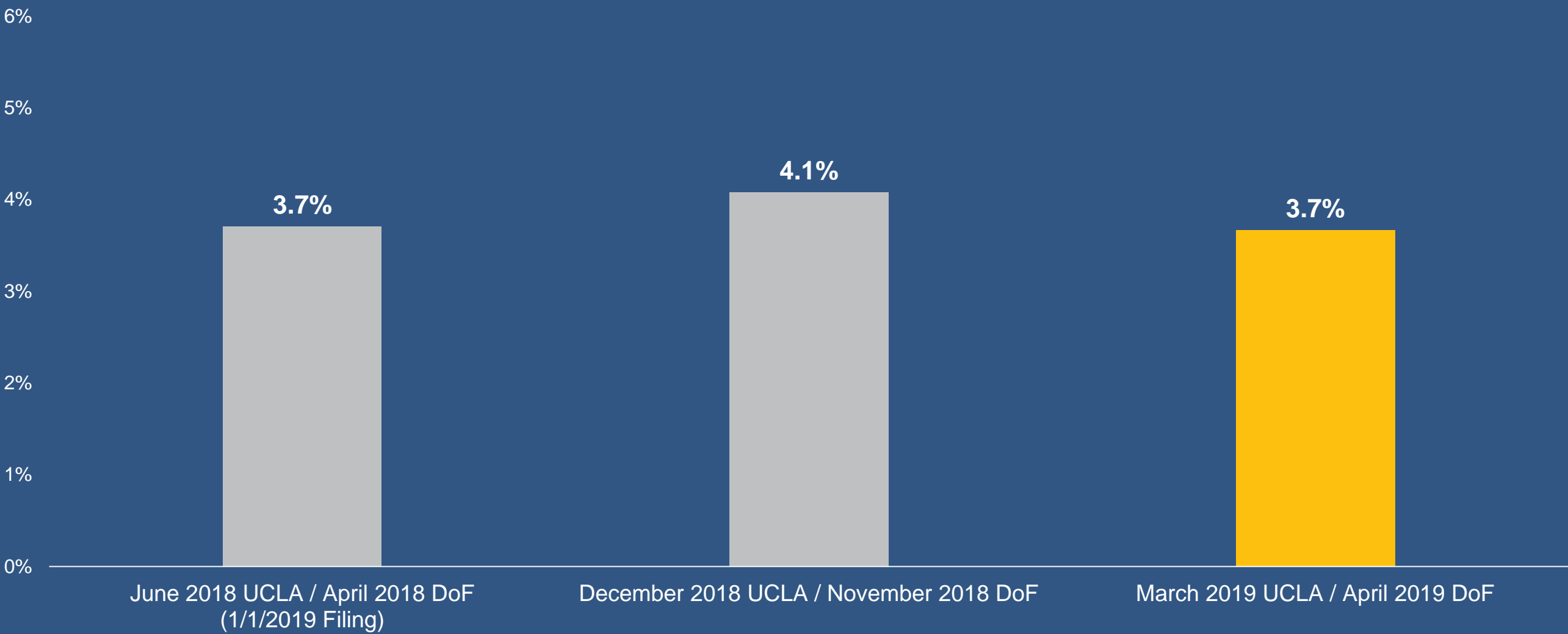
As of March 31, 2019



Average Annual Wage Level Change Forecast (Exhibit 5.1)

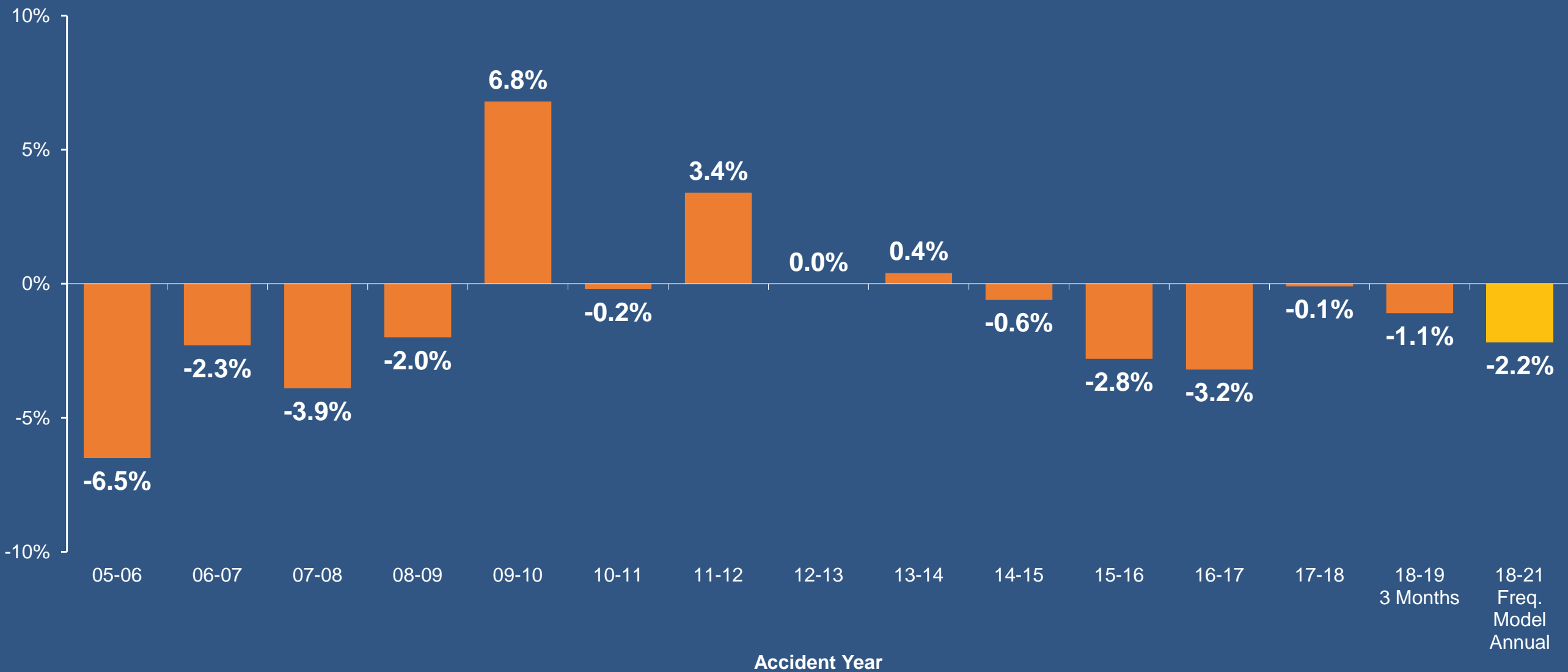
As of March/April 2019

Annualized Wage Level Change from
Average of Latest Two Accident Years to Projected Policy Period



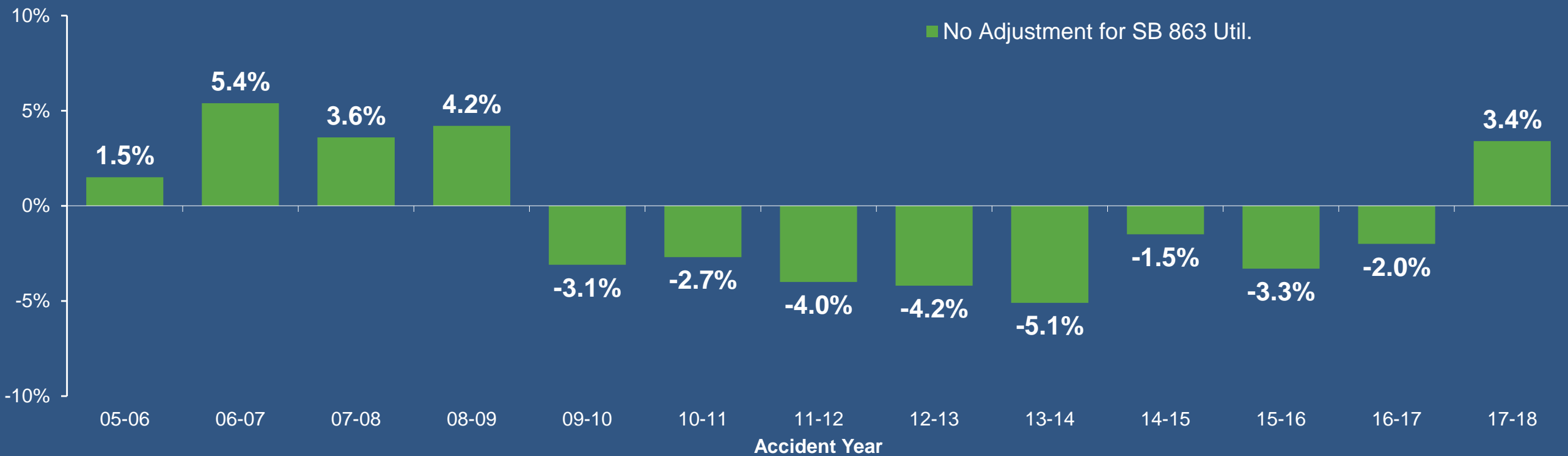
Projected Changes in Indemnity Claim Frequency (Exhibits 6.1 & 12)

As of March 31, 2019



Projected Changes in On-Level Indemnity Severity (Exhibit 6.2)

As of March 31, 2019



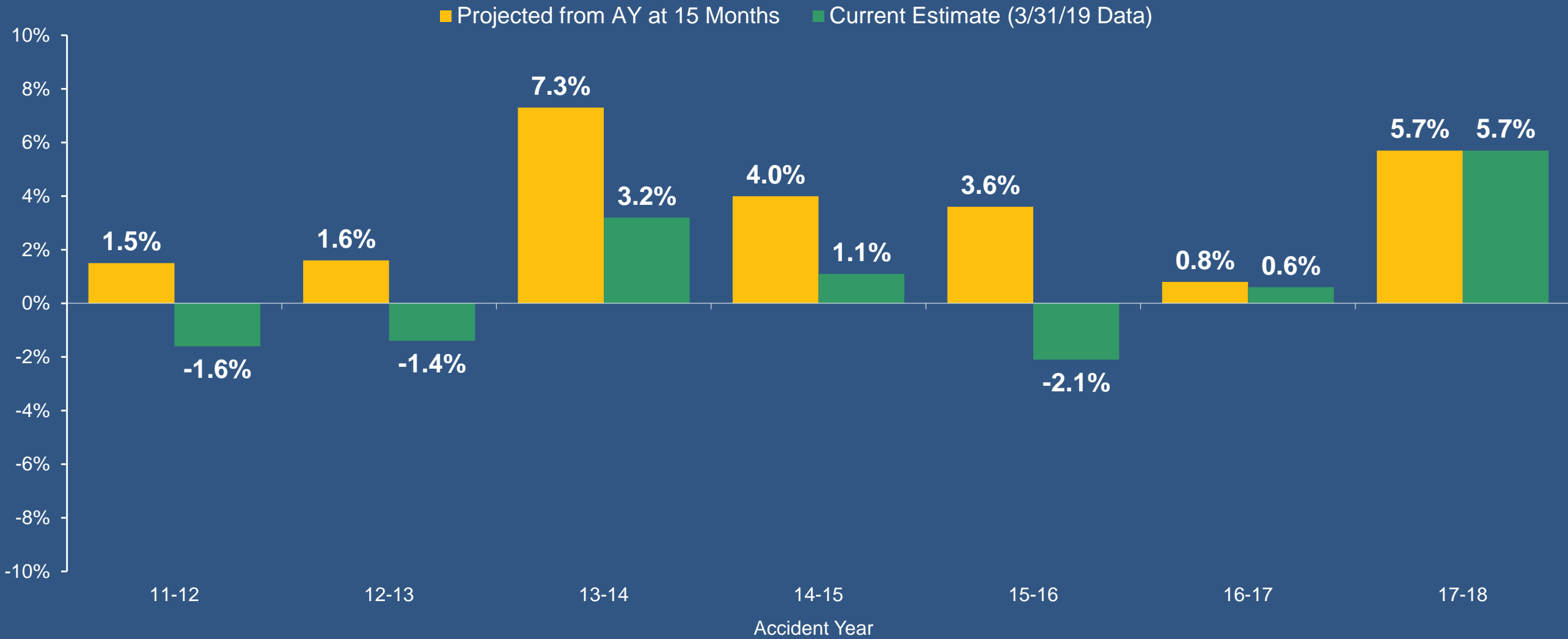
Annual Exponential Trend Based on:

- 1990 to 2018: +1.3%
- 2005 to 2018: -1.5%
- 2014 to 2018: -1.2%

Agenda Selected: -0.5%

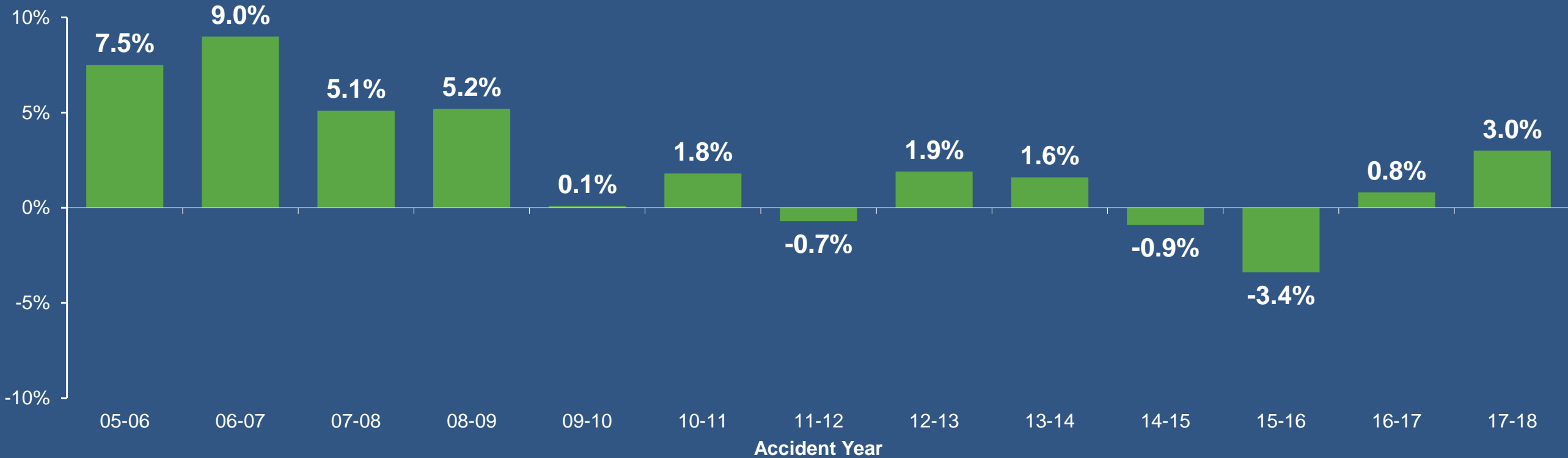
Indemnity Severity Changes Projected from 15 Months Compared to Current

As of March 31, 2019



Projected Changes in On-Level Medical Severity (Exhibit 6.4)

As of March 31, 2019



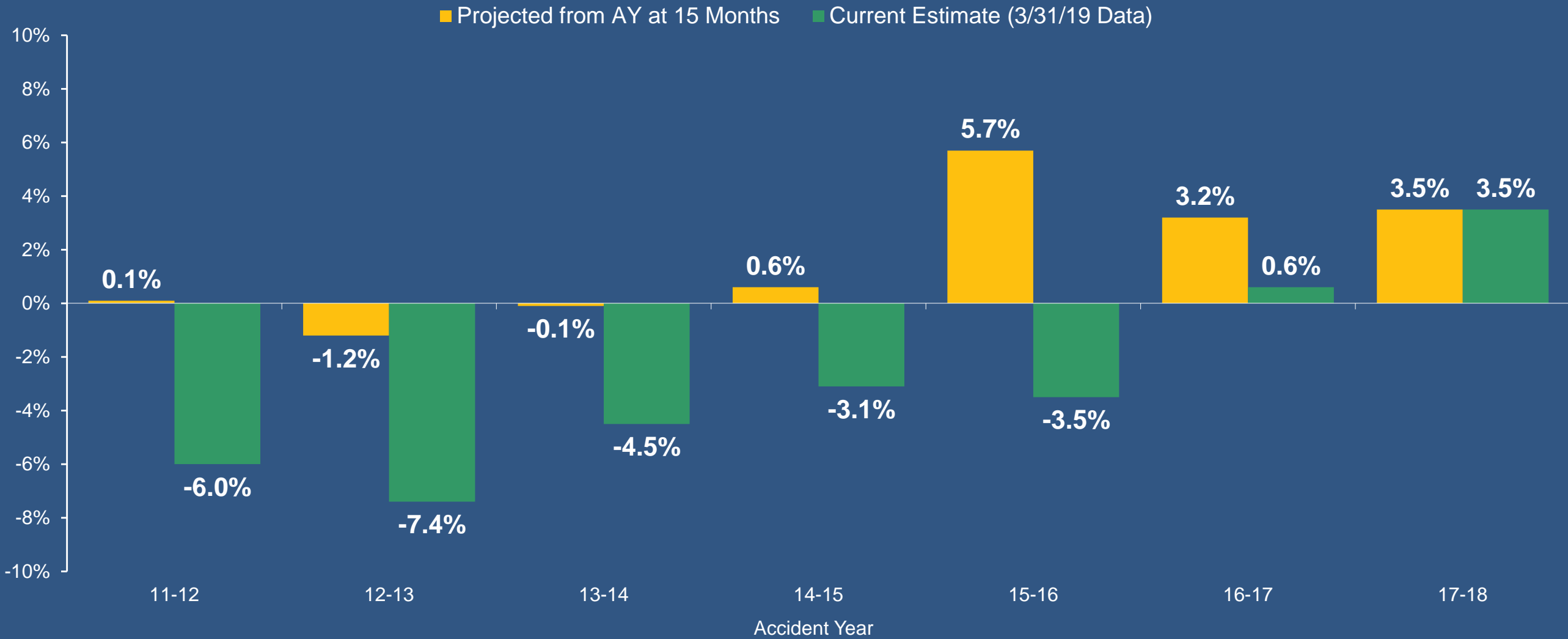
Annual Exponential Trend Based on:

- 1990 to 2018 (Incl. MCCP): +5.7%
- 2005 to 2018: +1.8%
- 2014 to 2018: -0.4%

Agenda Selected: 2.5%

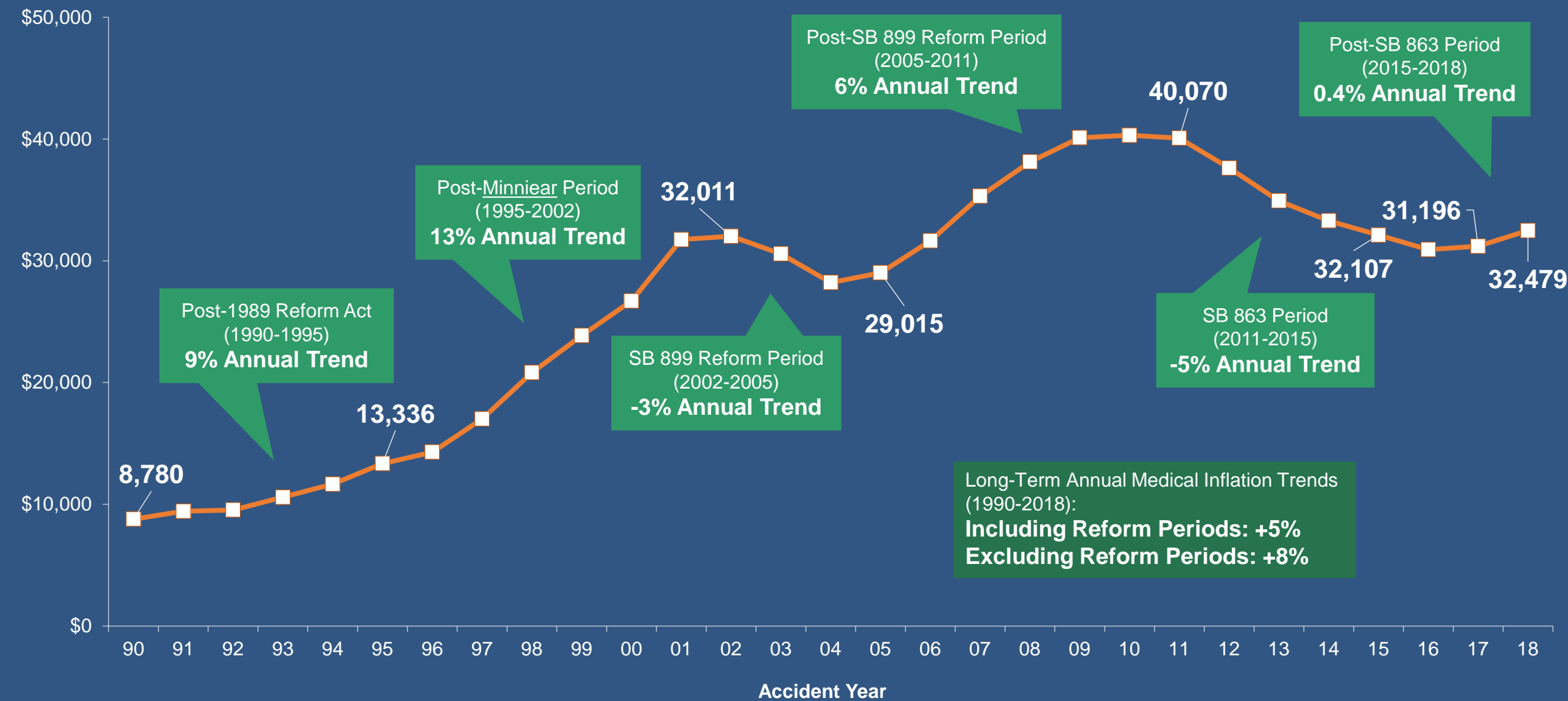
Medical Severity Changes Projected from 15 Months Compared to Current

As of March 31, 2019



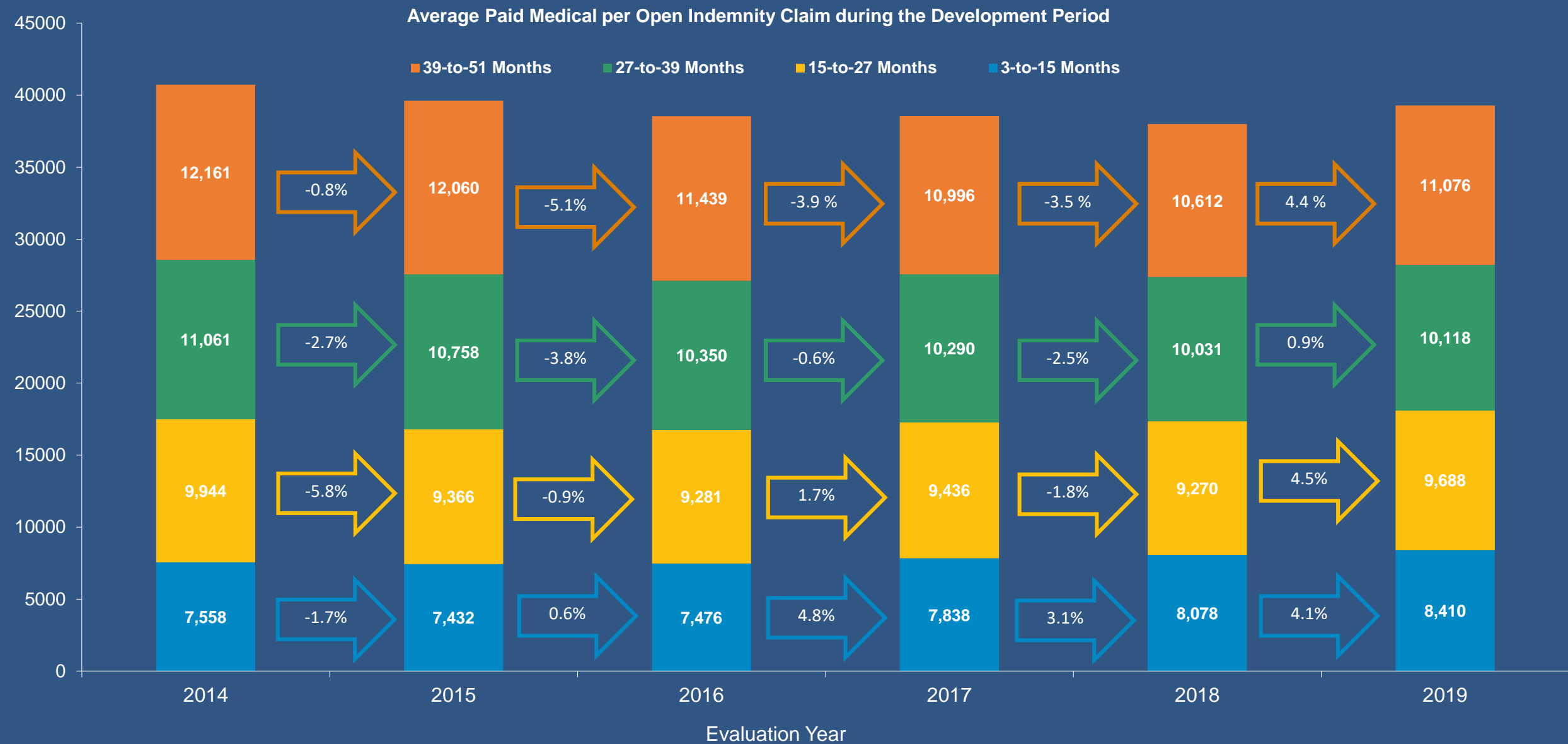
Ultimate Medical per Indemnity Claim (Exhibits 6.3 & 6.4)

As of March 31, 2019



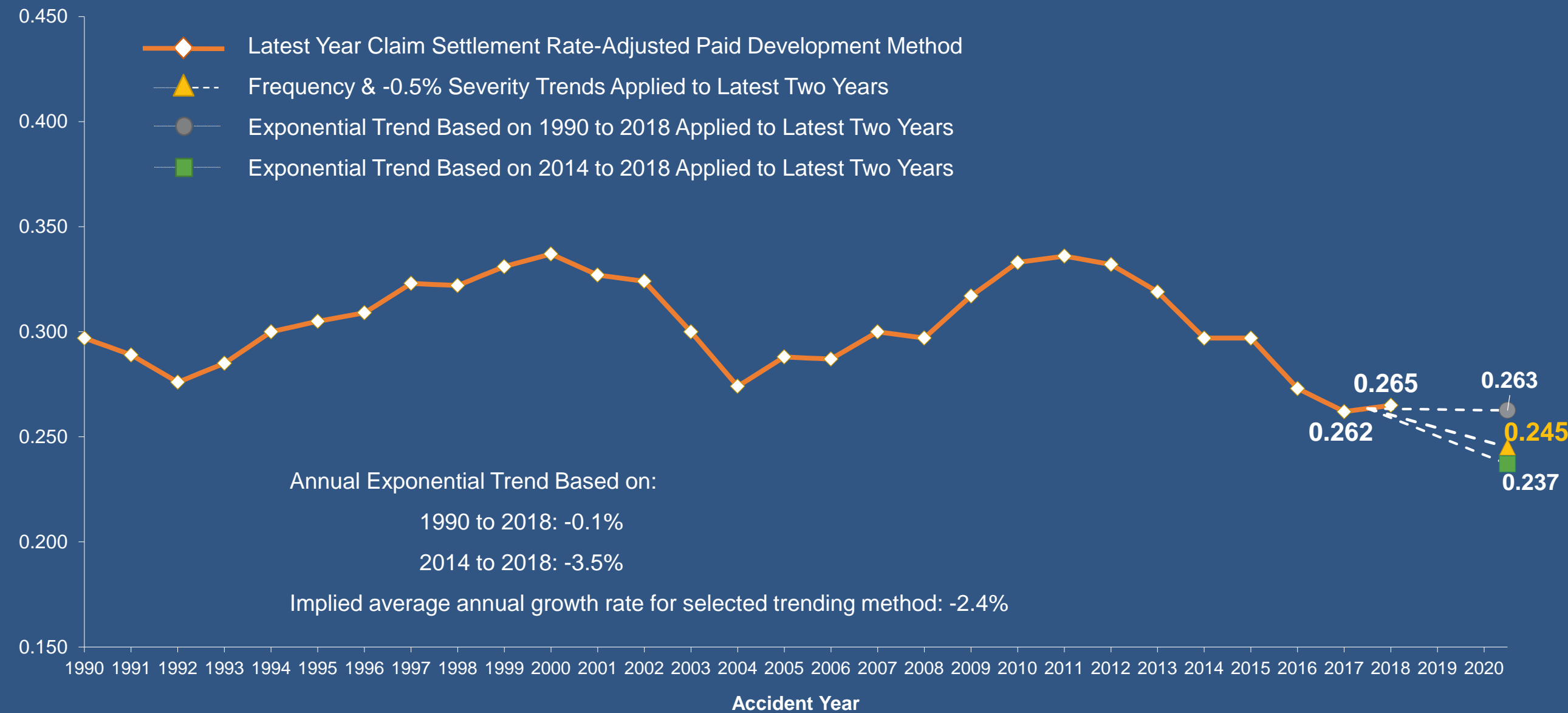
Severity – Incremental Paid Medical per Open Indemnity Claim During the Development Period

As of March 31, 2019



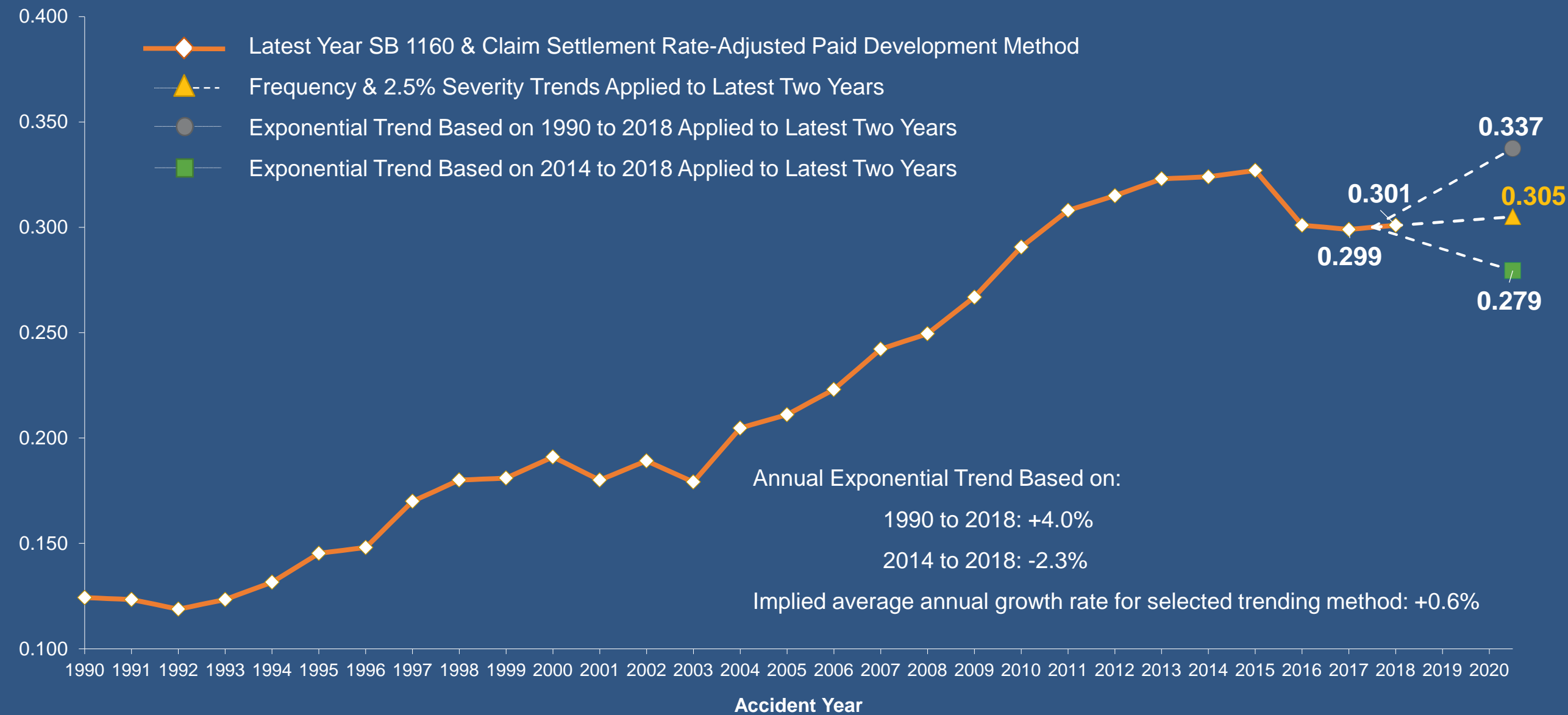
Projected On-Level Indemnity Loss Ratios (Exhibit 7.1)

As of March 31, 2019



Projected On-Level Medical Loss Ratios (Exhibit 7.3)

As of March 31, 2019

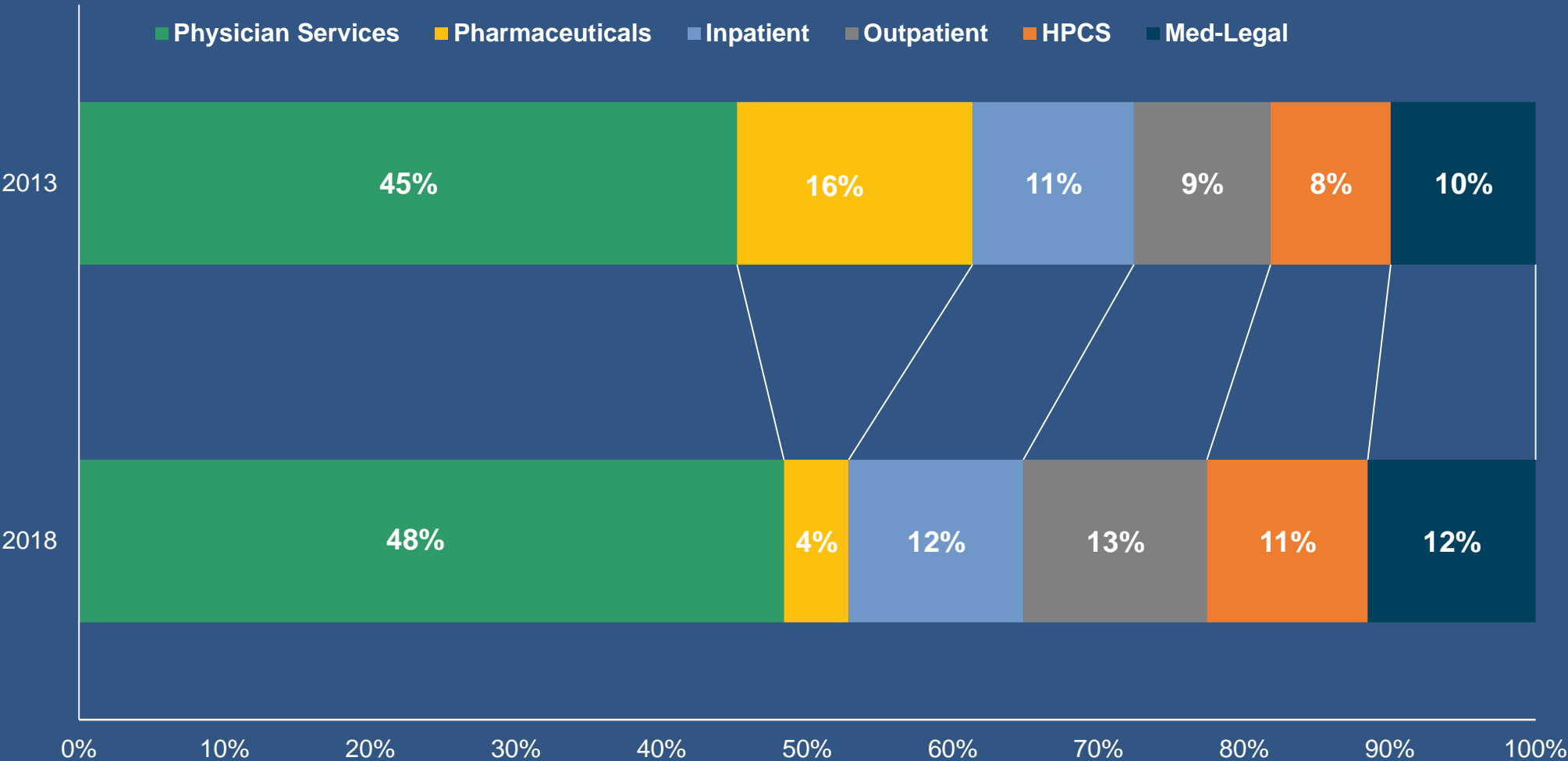


07

Impact of Pharmaceutical Cost Reductions on Loss Development

Share of Calendar Year Medical Payments by Service Type (Exhibit 1.1)

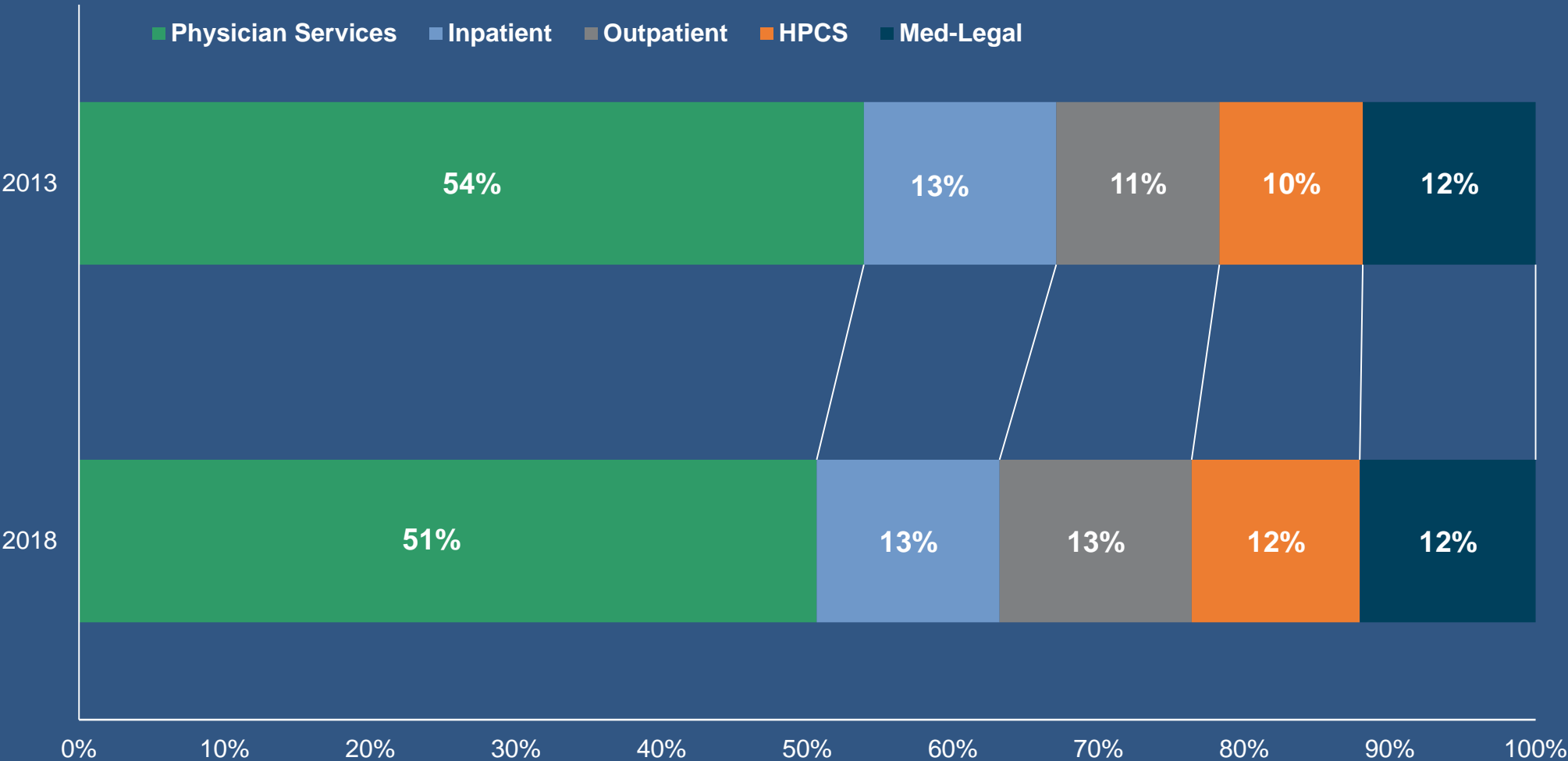
As of December 31, 2018



Share of Calendar Year Medical Payments by Service Type (Exhibit 1.2)

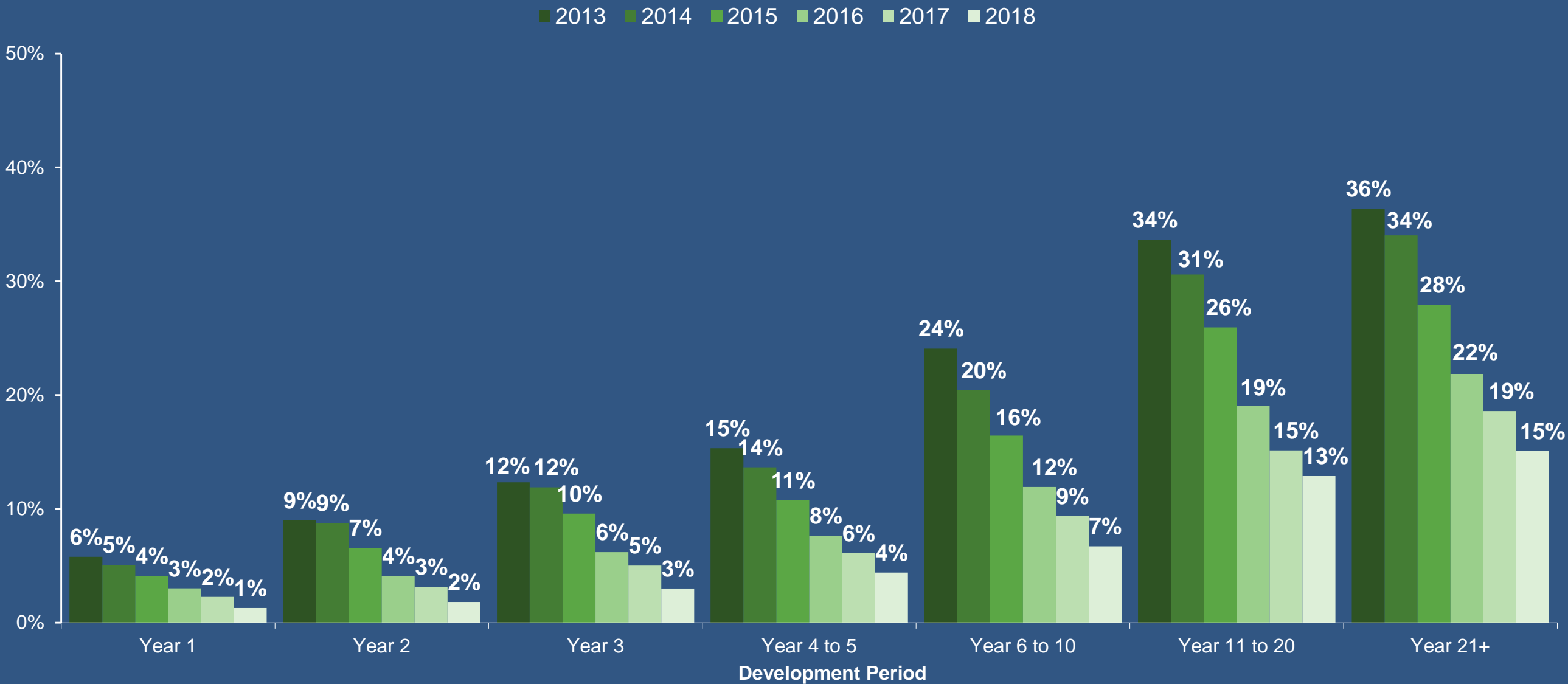
Excluding Pharmaceuticals

As of December 31, 2018



Share of Total Pharmaceutical Services Paid by Age and Service Type (Exhibit 1.1)

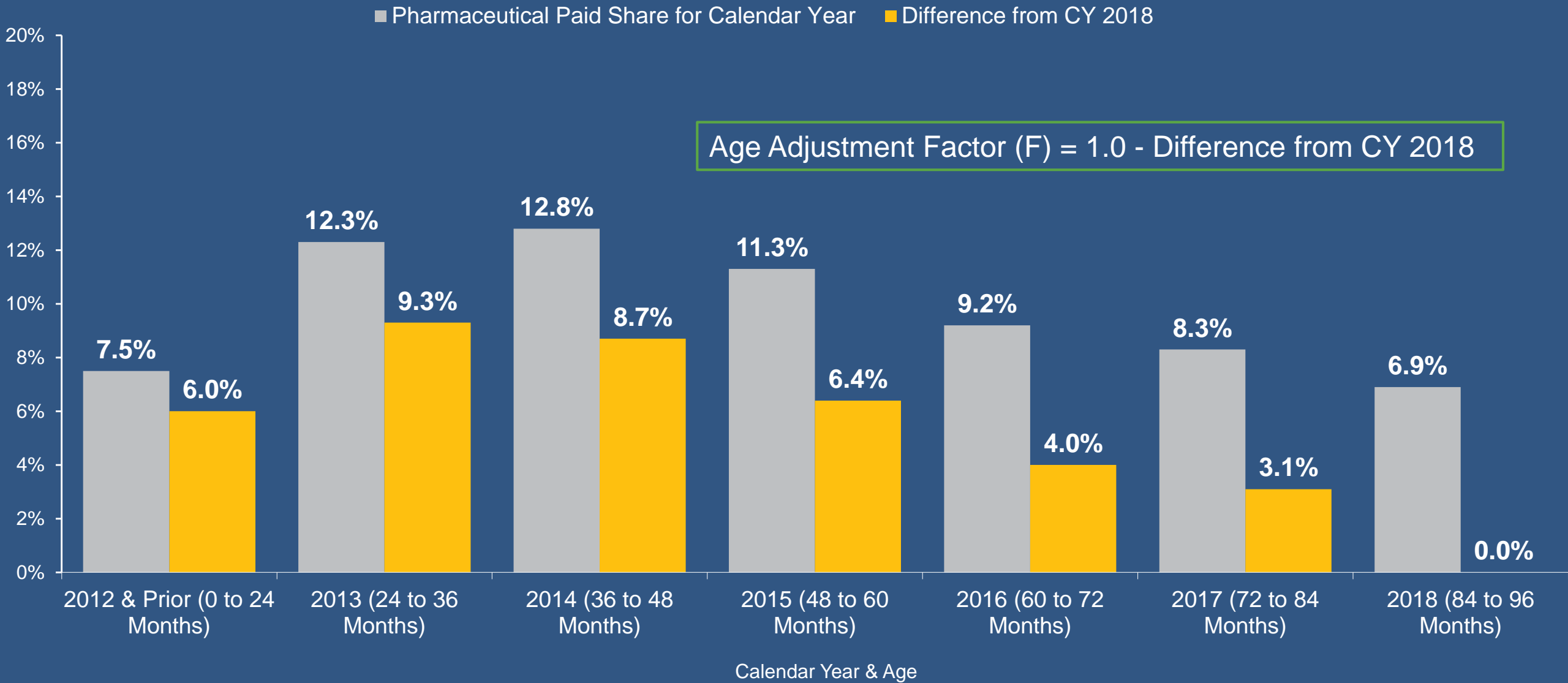
As of December 31, 2018



Adjustment for Pharmaceutical Impact to Paid Medical Development

- General approach
 - Adjust pre-2018 payments to the 2018 pharmaceutical cost level
 - Re-compute paid medical age-to-age factors on adjusted basis
- For calendar year 2013-2017 payments
 - Compute the difference from 2018 in pharma. share by CY and age (12 through 108 months)
 - A single difference factor selected for 108 months & later
 - Adjust CY payments based on $(1.0 - \text{difference in share})$
- For payments made prior to 2013
 - Medical transaction data by CY and age not available
 - CY 2013 pharma. distribution used for prior CYs
 - Cumulative share difference computed for each AY at December 31, 2012 evaluation

Computation of Adjustment for 84-to-96 Factor (AY 2011)



Computation of Adjustment for 84-to-96 Factor (AY 2011)

Adjusted Paid Medical LDF_[84-to-96]:

$$= \frac{\text{Paid}_{[0-24]} \times F_{[24]} + \text{Paid}_{[24-36]} \times F_{[36]} + \dots + \text{Paid}_{[72-84]} \times F_{[84]} + \text{Paid}_{[84-96]} \times F_{[96]}}{\text{Paid}_{[0-24]} \times F_{[24]} + \text{Paid}_{[24-36]} \times F_{[36]} + \dots + \text{Paid}_{[72-84]} \times F_{[84]}}$$

$$= \frac{\text{Paid}_{[0-24]} \times 0.940 + \text{Paid}_{[24-36]} \times 0.907 + \dots + \text{Paid}_{[72-84]} \times 0.969 + \text{Paid}_{[84-96]} \times 1.000}{\text{Paid}_{[0-24]} \times 0.940 + \text{Paid}_{[24-36]} \times 0.907 + \dots + \text{Paid}_{[72-84]} \times 0.969}$$

$$= 1.044$$

Impact of Adjustment on Paid Medical LDF (Exhibit 5)

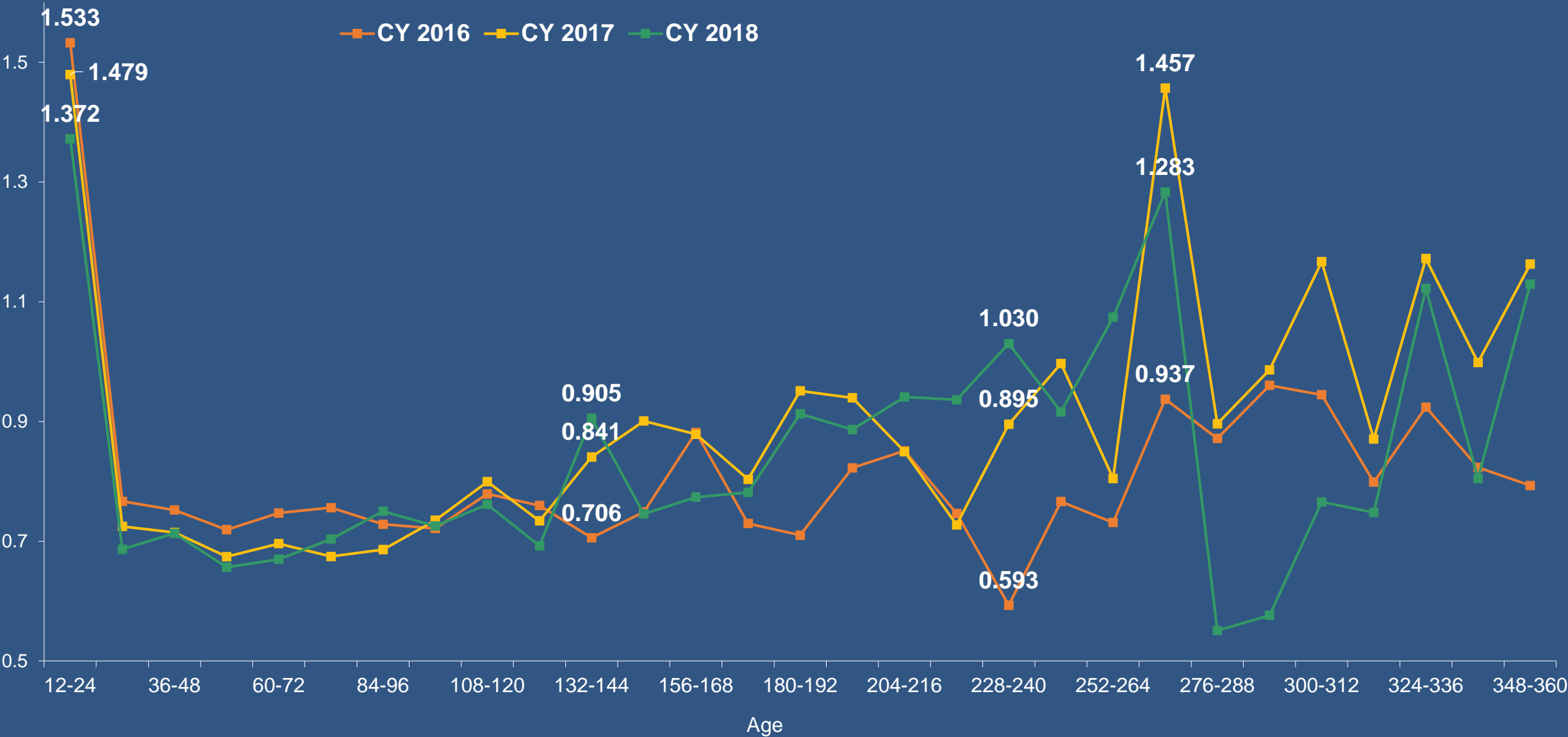
Age-to-Age	@12/31/18 Unadjusted Factor	@12/31/18 Adjusted Factor	% Change	Age-to-Ult.	@12/31/18 Unadjusted LDF	@12/31/18 Adjusted LDF	% Change
12-to-24	2.372	2.386	+0.6%	12-Ult.	6.808	7.180	+5.5%
24-to-36	1.410	1.416	+0.4%	24-Ult.	2.870	3.009	+4.9%
36-to-48	1.217	1.223	+0.4%	36-Ult.	2.036	2.125	+4.4%
48-to-60	1.121	1.125	+0.4%	48-Ult.	1.672	1.738	+4.0%
60-to-72	1.077	1.081	+0.4%	60-Ult.	1.492	1.545	+3.5%

Other Considerations

- Staff compared recommended adjustment with less refined approaches and impact on cumulative LDF was similar
- Staff reviewed incremental methods
 - Incremental methods not distorted by prior CY payments
 - Incremental factors typically vary volatile
 - Incremental method with pharma. adjustment had similar impact to chain ladder method
- Paid-to-date ratio also should be adjusted so that adjusted LDFs are comparable
- On-level factors should be reviewed to avoid double-counting of pharma. impact

Incremental Paid Medical Age-to-Age Factors

As of December 31, 2018



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