

Rosen AB, Aizcorbe A, Ryu AJ, Nestoriak N, Cutler DM, Chernew ME. Policy makers will need a way to update bundled payments that reflects highly skewed spending growth of various care episodes. Health Aff (Millwood). 2013;32(5).

## Appendix

### Decomposition of spending growth

$$C^y = \sum_i \frac{c_i^y}{e_i^y} * \theta_i^y * \frac{E^y}{N^y}$$

Where  $C^y$  is the cost per capita in year  $y$ ,  $c_i$  is the spending on disease  $i$ ,  $e_i$  is the number of episodes of disease  $i$ ,  $E$  is the total number of episodes,  $\theta_i^y$  is the episode mix ( $e_i/E$ ), and  $N$  is the total number of patients.

Our change in spending per capita between years 1 and 2 is given by:

$$(1) C^2 - C^1 = \sum_i \frac{e_i^2 c_i^2}{N e_i^2} - \sum_i \frac{e_i^1 c_i^1}{N e_i^1}$$

or

$$\begin{aligned} C^2 - C^1 = & \sum_i \frac{e_i^1}{N^1} \left( \frac{c_i^2}{e_i^2} - \frac{c_i^1}{e_i^1} \right) + \sum_i \frac{c_i^1 E^1}{e_i^1 N^1} (\theta_i^2 - \theta_i^1) + \sum_i \frac{c_i^1}{e_i^1} \theta_i^1 \left( \frac{E^2}{N^2} - \frac{E^1}{N^1} \right) \\ & + \sum_i \frac{c_i^1}{e_i^1} (\theta_i^2 - \theta_i^1) \left( \frac{E^2}{N^2} - \frac{E^1}{N^1} \right) + \sum_i \left( \frac{c_i^2}{e_i^2} - \frac{c_i^1}{e_i^1} \right) \frac{E^1}{N^1} (\theta_i^2 - \theta_i^1) \\ & + \sum_i \left( \frac{c_i^2}{e_i^2} - \frac{c_i^1}{e_i^1} \right) \theta_i^1 \left( \frac{E^2}{N^2} - \frac{E^1}{N^1} \right) + \sum_i \left( \frac{c_i^2}{e_i^2} - \frac{c_i^1}{e_i^1} \right) (\theta_i^2 - \theta_i^1) \left( \frac{E^2}{N^2} - \frac{E^1}{N^1} \right) \end{aligned}$$

where each of the first three terms decompose the change in per capita spending into the change in cost per episode, the mix of episodes, and the number of episodes per person, holding the other terms at their base year level. The remaining terms are the cross interaction terms.

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## Sensitivity Analysis Results

Sensitivity analyses truncated the cost of outlier episodes (those in the highest 1 percentile of spending) to the same cost as the 99<sup>th</sup> percentile of spending. Tables of sensitivity analysis results are included below.

**Sensitivity Analysis Table 1:** Decomposition of spending growth by episode type, 2003-2007

Episode Type	Growth in spending per capita (\$)	Contribution to overall spending growth (%)
Well care	61.37	13.61%
Chronic episodes	184.22	40.85%
Chronic maintenance	6.57	1.46%
Chronic with acute flare	-8.11	-1.80%
Chronic non-stratified	185.76	41.19%
Acute episodes	205.42	45.55%

**Source:** Authors' analysis of MarketScan® Commercial Claims and Encounters Database, 2003 and 2007.

**Notes:** Spending on outlier episodes (those in the highest 1 percentile of spending) is set to the 99<sup>th</sup> percentile of spending. Direct adjustment was used to standardize age and gender to 2003 levels to account for spending growth attributable to demographic changes in the population.

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**Sensitivity Analysis Table 2:** Spending decomposition for diseases with largest and smallest contribution to overall spending growth, 2003-2007

	Episode Type	Growth in spending per capita (\$)	Contribution to overall spending growth (%)	Growth in Spending per Episode (%)
<b>Top 10</b>				
Encounter for Preventive Health Services	Well Care	61.37	13.61%	31.5%
Neoplasm, Malignant: Breast, Female	Chronic	25.55	5.67%	37.5%
Osteoarthritis, Lumbar Spine	Chronic	20.27	4.49%	24.8%
Diabetes Mellitus Type 2 and Hyperglycemic States Maintenance	Chronic	19.20	4.26%	5.4%
Osteoarthritis, Except Spine	Chronic	18.55	4.11%	31.0%
Delivery, Cesarean Section	Acute	14.24	3.16%	12.0%
Neoplasm, Malignant: Colon and Rectum	Chronic	13.39	2.97%	54.1%
Renal Failure	Chronic	10.63	2.36%	-26.5%
Multiple Sclerosis	Chronic	10.45	2.32%	47.8%
Dysfunctional Uterine Bleeding	Acute	8.16	1.81%	34.7%
<b>Bottom 10</b>				
Neoplasm, Benign: Uterus (Leiomyomas)	Acute	-1.09	-0.24%	4.7%
Other Fungal Infections	Acute	-1.09	-0.24%	-11.4%
Sleep Disorders	Acute	-1.66	-0.37%	-38.5%
Congestive Heart Failure	Chronic	-1.79	-0.40%	4.9%
Endometriosis	Acute	-1.89	-0.42%	7.9%
Hepatitis C	Chronic	-2.03	-0.45%	-21.1%
Sinusitis	Acute	-2.54	-0.56%	-8.8%
Depression	Acute	-3.70	-0.82%	-5.8%
Acute Myocardial Infarction	Chronic *	-7.78	-1.72%	6.7%
Angina Pectoris, Chronic Maintenance	Chronic	-23.5231	-5.22%	-9.2%

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\*Episode type considered chronic with acute exacerbation.