

HSCRC Estimate of the Marginal Additional Charge of PPCs in Maryland for Rate Year 2015

Objective: Estimate the marginal hospital charge increase when a patient develops a PPC during a hospital stay (i.e., acquired post admission) in Maryland.

Data Source: Maryland inpatient acute care all payer statewide hospital data from July 2011 through June 2012 containing 704,457 discharges were used as the basis for the estimates. After excluding those in hospice and with PPC's greater than 6, this number was reduced to 696,245. Further, discharges that died or were transferred to another acute care facility were excluded. Discharges from two inpatient rehab hospitals were excluded. Additionally, discharges with charge values below \$200 or above \$2,000,000 were excluded. The resultant analysis file contained 672,709 discharges.

Individual case level charges were standardized based on the ratio of the statewide average charge to hospital average charge. The steps to standardize the charges as follows:

1. Calculate the mean statewide charge by DRG, C_i for DRG i .
2. Calculate the mean hospital charge H_j for hospital j .
3. Calculate the mean charge the hospital would have if each discharge had the statewide mean charge for the admission DRG assigned to the discharge, S_j .
4. The standardizing factor to apply to the hospital charges is then H_j / S_j .

Since the charge values in the regression file used standardized charges, the additional per case charge value for each PPC needs to be converted back to a hospital specific value for hospital rankings.

Method: Since the marginal charge impact of a PPC, will vary depending on a patient's reason for admission and severity of illness at the time of admission, it was necessary to adjust for these factors in order to determine the marginal charges of a PPC. 3M All Patient Refined Diagnosis Related Groups (APR-DRGs) classify discharges to one of 314 reasons for admission and one of four severity of illness levels (1,256 unique patient categories). Each discharge in the analysis database was assigned to an APR DRG v30.0. Since patients who develop a post admission complication often develop multiple associated complications, it was necessary to adjust for the presence of multiple complications in order to determine the marginal charge of an individual PPC. 3M Potentially Preventable Complications (PPCs) v90 identify 66 different types of post admission complications analyzing 1,450 ICD-9-CM diagnosis codes and a select set of procedure codes. All PPCs present on each discharge (potentially preventable or not) were identified and used in the regression analysis.

A simple linear regression was specified of the form:

$$\text{Charge}_i = \alpha + \beta_j \text{PPC}_{j,i} + \gamma_k \text{APR-DRG}_{k,i} + \epsilon_i$$

Where:

Charge ϵ_i is the total charge standardized for discharge i

APR DRG $k_{,i}$ is a binary variable (0,1) indicating which of the 1,256 APR DRGs was assigned to the i^{th} discharge

PPC $j_{,i}$ is a binary variable (0,1) indicating which of the j PPCs were present for the i^{th} discharge

α is a constant value applied to each discharge in the model. α is the average baseline charge for a reference APR DRG.

γ_k is the coefficient associated with APR-DRG k and measures the marginal additional charge above α that is due to the patient's reason for admission and severity of illness level at the time of admission.

β_j is the coefficient associated with PPC j and measures the marginal additional charge above α that is due to the presence of PPC j

ϵ_i is the residual error of the model for discharge i

The coefficient β_j for each PPC is a measure of the marginal additional charges due to the occurrence of the PPC taking into account the patient's reason for admission, severity of illness and the presence of any other post admission complications (PPCs).

Cases in low volume APR-DRGs were omitted from the regression (less than 20 cases in each APR-DRG SOI combination). No effort was made to identify and exclude outlier cases. The final analysis file contained 670,598 discharges.

Results: Table 1 below provides coefficients (additional per case charges) and t-values for each of the PPC categories based on the regression model calculated.

The results of the regression are used for computing the dollar impact for each of the 66 PPCs. The dollar impact is used to create an index of either additional, or averted, resource use based on a hospital's rate of a PPC summed across all PPCs. Fifteen (15) PPCs with less predictive t-values (under 1.96) or with coding or clinical issues were excluded from the quality based payment adjustment PPC policy in FY2011. The PPC's excluded for RY2015 are the same as those for RY2014 (no changes).

Table 1. PPC Charge Regression Estimates

PPC #	PPC Description	Rate Year 2015 (Based on FY2012 Q1234 Data)				% Change from Previous Base Period	
		Adm \$	Adm T	Cases	Notes	Marginal Charge s (β_j)	Cases
			T Value<1.96		Exclusion Reason/Changes	Adm\$	Cases
1	Stroke & Intracranial Hemorrhage	\$13,527.00	34.48	825		-7.3%	-13.5%
2	Extreme CNS Complications	\$14,228.00	25.38	415		-4.9%	-6.7%
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	\$9,808.00	57.56	4635		6.0%	-8.1%
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	\$32,783.00	80.64	780		2.0%	-7.0%
5	Pneumonia & Other Lung Infections	\$20,888.00	102.53	3174		5.6%	-9.9%
6	Aspiration Pneumonia	\$16,628.00	55.74	1423		6.2%	-6.1%
7	Pulmonary Embolism	\$15,051.00	32.59	583		-5.1%	-5.2%
8	Other Pulmonary Complications	\$9,405.00	49.36	3659		-10.7%	-1.5%
9	Shock	\$19,321.00	65.17	1506		6.6%	-7.9%
10	Congestive Heart Failure	\$6,375.00	19.93	1235		-2.1%	-12.6%
11	Acute Myocardial Infarction	\$8,294.00	23.2	985		0.5%	-8.8%
12	Cardiac Arrhythmias & Conduction Disturbances	\$2,586.00	6.22	977		-28.5%	-2.3%
13	Other Cardiac Complications	\$5,664.00	7.34	207		25.2%	-23.9%
14	Ventricular Fibrillation/Cardiac Arrest	\$20,204.00	47.42	706		5.8%	-7.1%
15	Peripheral Vascular Complications Except Venous Thrombosis	\$16,972.00	21.58	202		34.0%	-14.0%
16	Venous Thrombosis	\$17,730.00	50.87	1047		2.5%	-26.2%
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding	\$15,508.00	35.18	639		-3.3%	-12.8%
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	\$20,802.00	29.6	250		5.0%	-8.4%
19	Major Liver Complications	\$21,822.00	35.52	333		-1.8%	-13.3%
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding	\$14,443.00	25.43	388		-7.6%	-4.4%
21	Clostridium Difficile Colitis	\$17,412.00	60.61	1524	Clinical	1.4%	-1.3%
22	Urinary Tract Infection	\$0.00	.	0			
23	GU Complications Except UTI	\$7,016.00	12.72	407		-23.6%	-4.7%
24	Renal Failure without Dialysis	\$8,248.00	59.86	6925		-0.7%	-6.6%
25	Renal Failure with Dialysis	\$41,311.00	49.57	179		-14.3%	-7.7%
26	Diabetic Ketoacidosis & Coma	\$8,617.00	5.22	45		-2.2%	-13.5%

27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	\$6,618.00	19.35	1070		-2.0%	-3.2%
28	In-Hospital Trauma and Fractures	\$8,560.00	8.9	134		54.6%	-6.9%
29	Poisonings Except from Anesthesia	\$-1,331	-1.31	119	t-value	-5.8%	-7.0%
30	Poisonings due to Anesthesia	\$14,971.00	1.34	1	t-value+case	-7.4%	-50.0%
31	Decubitus Ulcer	\$32,815.00	49.94	288		-27.9%	29.7%
32	Transfusion Incompatibility Reaction	\$21,835.00	1.97	1	t-value+case	1.7%	0.0%
33	Cellulitis	\$10,216.00	26.15	831		22.3%	-11.7%
34	Moderate Infectious	\$22,835.00	50.37	621		3.5%	-8.8%
35	Septicemia & Severe Infections	\$18,853.00	68.29	1823		-13.4%	-10.9%
36	Acute Mental Health Changes	\$3,787.00	8.76	659		6.0%	-1.5%
37	Post-Operative Infection & Deep Wound Disruption Without Procedure	\$16,777.00	46.81	1052		-9.9%	8.1%
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	\$34,433.00	29.67	93		4.1%	29.2%
39	Reopening Surgical Site	\$16,986.00	19.38	163		-6.5%	-10.9%
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Proc	\$9,819.00	41.69	2283		10.9%	-5.1%
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Proc	\$13,367.00	15.73	171		9.8%	-12.8%
42	Accidental Puncture/Laceration During Invasive Procedure	\$6,503.00	19.09	1087		1.5%	-4.5%
43	Accidental Cut or Hemorrhage During Other Medical Care	\$259.00	0.17	54	t-value	-92.0%	-5.3%
44	Other Surgical Complication - Mod	\$14,852.00	22.46	284		28.4%	-6.3%
45	Post-procedure Foreign Bodies	\$1,762.00	0.8	27	t-value	224.4%	3.8%
46	Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	\$-8,577	-1.05	2	t-value+case	109.0%	-33.3%
47	Encephalopathy	\$11,772.00	36.2	1194		1.2%	-9.8%
48	Other Complications of Medical Care	\$18,559.00	42	640		-0.3%	-15.6%
49	Iatrogenic Pneumothrax	\$9,534.00	23.58	782		-1.2%	-10.1%
50	Mechanical Complication of Device, Implant & Graft	\$16,993.00	34	495		-0.6%	-9.5%
51	Gastrointestinal Ostomy Complications	\$26,871.00	40.61	284		8.5%	-3.4%
52	Inflammation & Other Complications of Devices, Implants or Grafts Except Vascular Infection	\$11,290.00	30.89	954		-7.7%	-7.9%
53	Infection, Inflammation & Clotting Complications of Peripheral Vascular Catheters & Infusions	\$14,455.00	20.57	250		8.8%	0.0%
54	Infections due to Central Venous Catheters	\$29,152.00	45.6	315		-16.6%	8.2%
55	Obstetrical Hemorrhage without Transfusion	\$406.00	1.39	1494	Clinical	9.8%	-67.3%
56	Obstetrical Hemorrhage with Transfusion	\$3,723.00	8.09	605		-1.1%	0.5%
57	Obstetric Lacerations & Other	\$436.00	1.33	1160	t-value	28.4%	-2.1%

	Trauma Without Instrumentation						
58	Obstetric Lacerations & Other Trauma With Instrumentation	\$609.00	1.11	409	t-value	-10.1%	-6.0%
59	Medical & Anesthesia Obstetric Complications	\$1,239.00	2.8	646		2.5%	-13.2%
60	Major Puerperal Infection and Other Major Obstetric Complications	-\$625	-0.58	107	t-value	5.8%	-14.4%
61	Other Complications of Obstetrical Surgical & Perineal Wounds	\$1,276.00	1.54	181	t-value	-13.0%	-5.7%
62	Delivery with Placental Complications	\$688.00	1.03	281	t-value	-37.4%	1.1%
63	Post-Operative Respiratory Failure with Tracheostomy	\$103,152.00	62.65	46	Clinical	-17.3%	-4.2%
64	Other In-Hospital Adverse Events	\$5,354.00	10.89	509	Clinical	25.0%	-3.2%
65	Urinary Tract Infection without Catheter	\$14,313.00	77.79	3794		-1.6%	-5.7%
66	Catheter-Related Urinary Tract Infection	\$11,718.00	10.18	93		-24.6%	9.4%
	<i>Note: Shaded PPCs are excluded</i>						