

Statistical Brief #1

Office of Quality and Patient Safety Bureau of Health Informatics

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New York State All-Payer Hospital Inpatient Potentially Preventable Complication (PPC) Rates: 2009-2012

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Introduction

This statistical brief provides a summary of crude and risk adjusted rates of 3M™ Potentially Preventable Complications (PPCs) for all-payer New York State hospital inpatient discharges for the time period 2009 through 2012.

Potentially Preventable Complications (PPCs) are harmful events (e.g. accidental laceration during a procedure, improper administration of medication) or negative outcomes (e.g. hospital-acquired pneumonia); that develop after hospital admission and may result from processes of care and treatment rather than from natural progression of the underlying illness and are therefore potentially preventable¹. The software defines 65 potentially preventable complications, which are further grouped into 8 Groups (1 - Extreme Complications; 2 - Cardiovascular-Respiratory Complications; 3 - Gastrointestinal Complications; 4 - Perioperative Complications; 5 - Infectious Complications; 6 - Malfunctions, Reactions, etc.; 7 - Obstetrical Complications; 8 - Other Medical and Surgical Complications) and 2 Levels (Major, Other).

Methods

The unit of analysis is a hospital inpatient discharge record from an Article 28 (acute care) facility in New York State submitted through the Statewide Planning and Research Cooperative System (SPARCS) for calendar years 2009 through 2012. SPARCS is a comprehensive data reporting system established in 1979 as a result of cooperation between the health care industry and government. SPARCS currently collects patient level detail on patient characteristics, diagnoses, treatments, services, and charges for every hospital discharge, ambulatory surgery patient, and emergency department admission in New York State.

Highlights

- The statewide Major PPC rate decreased over the four year period from 364.16 to 326.19 per 10,000 discharges.
- Most NYS regions had PPC rates that decreased over the four year period studied.
- Long Island's Major PPC risk adjusted rate is statistically higher than the NYS average (a low rate is desirable).
- Northeastern NY and the Northern Metropolitan area adjacent to NYC have consistently had Major PPC risk adjusted rates lower than the NYS average.
- Gastrointestinal complications was the only PPC group that had an increase in PPC rates over the 4 years studied.
- The five PPCs with the highest rate per 10,000 discharges were: Cardiac Arrhythmias and Conduction Disturbances, Obstetric Lacerations and Other Trauma with Instrumentation, Obstetrical Hemorrhage without Transfusion, Obstetric Lacerations and Other Trauma without Instrumentation, and Renal Failure without Dialysis.
- Discharges with a Major PPC routinely account for about 10 percent of total charges and costs each year.

PPC Methodology

PPCs were assigned using 3M™ Core Grouping Software Version 31 for all four years of SPARCS data. The PPC software first identifies and removes discharges based on global exclusions (such as HIV, major or metastatic malignancies) and specific clinical exclusions related to each PPC. The remaining discharges are at risk to be assigned a complication. The assignment of PPCs takes several factors into account, such as, All Patient Refined Diagnosis Related Groups (APR-DRG), severity of illness, length of stay, secondary diagnoses and procedure date and time.

Secondary diagnoses, a major factor in the assignment of a PPC, relies upon the present on admission (POA) indicator for each diagnosis. The POA variable identifies if the diagnosis was present on admission (a comorbidity) or if it developed during the hospital stay (a complication). The Department used 3M™ developed logic to assess the reporting and validity of the POA indicator on the SPARCS data. This logic measures the percent of secondary diagnoses at a hospital coded as present on admission, not present on admission or uncertain (high numbers would suggest poor coding). The POA logic also measures the percent of diagnosis codes known to be pre-existing not coded as present on admission, and the percent of secondary diagnoses on elective surgery discharges coded as present on admission. These measures combined indicate if the hospital may be coding the present on admission variable inappropriately. The discharges from these hospitals were suppressed for reporting purposes.

The software identifies 65 PPCs in total, which can be classified into eight groups and two levels. Refer to [Tables 1-3](#) for details on the PPC group and level for each PPC.

Converting Charges to Costs

Estimates of discharge costs were calculated using hospital discharge data from SPARCS and Institutional Cost Report (ICR) data. ICRs include data on cost for each facility as well as ratios of Cost to Charges (RCCs). RCCs are certified, calculated and reported by facilities and are subject to external audit. For example, if a hospital charge is \$20,000 and the RCC is 50%, the estimated cost is \$10,000. As with charges, cost data are hospital-specific. Cost data presented in this analysis was calculated using facility specific 2010 audited RCC files.

Findings

The output of Major PPC rates by hospital for years 2009-2012, by hospital are available on Health Data NY (<https://health.data.ny.gov/>). Health Data NY is a NYSDOH sponsored data site that provides health care providers, researchers, academics, and the general public with access to valuable health data. The data site allows users to download and analyze data in a variety of formats, create visualizations of the data and review metadata.

Major Potentially Preventable Complication (PPC) Rates, Charges and Costs, 2009-2012

[Table 4](#) presents rates, charges and costs for the Major PPC level for 2009-2012. The Major PPC rate is calculated by summing the number of discharges that had at least one Major level PPC, divided by the number of discharges that were at risk for at least one of the Major level PPCs. If a discharge was a PPC for more than one PPC in the Major level, it would only be counted once in the numerator. In addition, if the discharge was at risk for more than one PPC in the Major level, it would only be counted once in the denominator. To do a fair comparison across hospitals, the PPC rates were risk adjusted by APR-DRG and severity of illness (SOI).

Over the four year period, the number of at risk discharges, PPC discharges and Major PPC rate all decreased. Discharges with a Major PPC routinely account for about 10% of the total charges and costs each year.

PPC Risk Adjusted Rates and Statistical Significance by Region, 2009-2012

Table 5 presents risk adjusted rates for Major PPCs by region and the significance of the Major PPC risk adjusted rate relative to the statewide rate. A statistical significance value of '**' indicates that a region's PPC rate is statistically higher than the statewide rate. A statistical significance value of '***' indicates that a region's PPC rate is statistically lower than the statewide rate. A significance value of 'NS' indicates that a region's PPC rate is not significantly different from the statewide rate. Across the four years, Long Island routinely had a major PPC risk adjusted rate statistically higher than the statewide rate indicating it is performing worse than the state as a whole. Moreover, Northeastern NY and the Northern Metropolitan area of NYC both consistently had a major PPC risk adjusted rates lower than the statewide rate, demonstrating that each area is performing better than the state as a whole.

PPC Rates by PPC Group, 2009-2012

Tables 6 presents the PPC rate for each of the eight PPC Groups. Again, if a discharge could be in the numerator or denominator more than once, it was only counted once. The PPC group rates decreased over the 4 analysis years for the following groups: perioperative complications, infectious complications, malfunctions, reactions, etc., and other medical and surgical complications. Although small, gastrointestinal complications was the only group that had an increase in PPC rates over the years. The remaining groups fluctuated over the analysis period.

PPC Rates per 10,000 discharges, 2009-2012

Table 7 presents the rate for each potentially preventable complication. For this analysis, if a discharge was considered for more than 1 PPC, it was included in each PPC. The five PPCs with the highest rate per 10,000 discharges were: PPC 12- Cardiac Arrhythmias & Conduction Disturbances, PPC 58- Obstetric Lacerations & Other Trauma with Instrumentation, PPC 55- Obstetrical Hemorrhage without Transfusion, PPC 57- Obstetric Lacerations & Other Trauma without Instrumentation, and PPC 24- Renal Failure without Dialysis.

Conclusions

Overall from 2009 to 2012, the Major PPC rate dropped statewide. As demonstrated previously, variations occurred within region and PPC. The five PPCs with the highest rate per 10,000 discharges were PPC 12- Cardiac Arrhythmias & Conduction Disturbances, PPC 58- Obstetric Lacerations & Other Trauma with Instrumentation, PPC 55- Obstetrical Hemorrhage without Transfusion, PPC 57- Obstetric Lacerations & Other Trauma without Instrumentation, and PPC 24- Renal Failure without Dialysis. The aforementioned complications illustrate an area where attention should be directed to decrease the number of complications.

Tables

Table 1. PPC Groups

PPC Group
1 - Extreme Complications
2 - Cardiovascular-Respiratory Complications
3 - Gastrointestinal Complications
4 - Perioperative Complications
5 - Infectious Complications
6 - Malfunctions, infections from devices; reactions
7 - Obstetrical Complications
8 - Other Medical and Surgical Complications

Table 2. PPC Levels

<i>PPC Level</i>
1 - Other
2 - Major

Table 3. PPC Categories

<i>PPC</i>	<i>PPC Description</i>	<i>PPC Group</i>	<i>PPC Level</i>
01	Stroke & Intracranial Hemorrhage	2	2
02	Extreme CNS Complications	1	2
03	Acute Pulmonary Edema and Respiratory Failure without Ventilation	2	1
04	Acute Pulmonary Edema and Respiratory Failure with Ventilation	1	2
05	Pneumonia & Other Lung Infections	2	2
06	Aspiration Pneumonia	2	2
07	Pulmonary Embolism	2	2
08	Other Pulmonary Complications	2	1
09	Shock	1	2
10	Congestive Heart Failure	2	2
11	Acute Myocardial Infarction	2	2
12	Cardiac Arrhythmias & Conduction Disturbances	2	1
13	Other Cardiac Complications	2	1
14	Ventricular Fibrillation/Cardiac Arrest	1	2
15	Peripheral Vascular Complications except Venous Thrombosis	2	2
16	Venous Thrombosis	2	2
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding	3	1
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	3	2
19	Major Liver Complications	3	2
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding	3	1
21	Clostridium Difficile Colitis	5	2
23	GU Complications except UTI	8	1
24	Renal Failure without Dialysis	8	1
25	Renal Failure with Dialysis	1	2
26	Diabetic Ketoacidosis & Coma	8	1
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	8	2
28	In-Hospital Trauma and Fractures	8	1
29	Poisonings except from Anesthesia	6	1
30	Poisonings due to Anesthesia	6	1
31	Decubitus Ulcer	8	2
32	Transfusion Incompatibility Reaction	6	1
33	Cellulitis	5	1
34	Moderate Infections	5	1
35	Septicemia & Severe Infections	5	2
36	Acute Mental Health Changes	8	1
37	Post-Operative Infection & Deep Wound Disruption without Procedure	4	1
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	4	2
39	Reopening Surgical Site	4	2
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Procedure	4	1
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Procedure	4	2
42	Accidental Puncture/Laceration during Invasive Procedure	4	2
43	Accidental Cut or Hemorrhage during Other Medical Care	8	1
44	Other Surgical Complication - Moderate	8	1
45	Post-procedure Foreign Bodies	4	2
46	Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	4	1

PPC	PPC Description	PPC Group	PPC Level
47	Encephalopathy	8	2
48	Other Complications of Medical Care	8	1
49	Iatrogenic Pneumothorax	6	2
50	Mechanical Complication of Device, Implant & Graft	6	2
51	Gastrointestinal Ostomy Complications	6	1
52	Inflammation & Other Complications of Devices, Implants or Grafts except Vascular Infection	6	2
53	Infection, Inflammation and Clotting Complications of Peripheral Vascular Catheters and Infusions	6	1
54	Infections due to Central Venous Catheters	6	2
55	Obstetrical Hemorrhage without Transfusion	7	1
56	Obstetrical Hemorrhage with Transfusion	7	2
57	Obstetric Lacerations & Other Trauma without Instrumentation	7	2
58	Obstetric Lacerations & Other Trauma with Instrumentation	7	2
59	Medical & Anesthesia Obstetric Complications	7	1
60	Major Puerperal Infection and Other Major Obstetric Complications	7	2
61	Other Complications of Obstetrical Surgical & Perinatal Wounds	7	1
62	Delivery with Placental Complications	7	1
63	Post-Operative Respiratory Failure with Tracheostomy	1	2
64	Other In-Hospital Adverse Events	8	1
65	Urinary Tract Infection	5	2
66	Catheter-Related Urinary Tract Infection	5	2

Table 4. Major PPC Rates per 10,000 Discharges, Charges, and Estimated Costs from 2009 to 2012

Year	Total Discharges	At Risk Discharges	PPC Discharges	Major PPC Rate
2009	2,491,655	2,123,768	77,339	364.2
2010	2,484,607	2,113,594	72,387	342.3
2011	2,497,859	2,120,509	71,133	335.5
2012	2,430,657	2,058,334	67,140	326.2

Charges				
Year	Total Charges	At Risk Charges	PPC Charges	% of Total
2009	\$70,700,828,889	\$63,506,648,056	\$7,774,525,601	11%
2010	\$73,441,270,575	\$65,734,246,155	\$7,581,291,189	10%
2011	\$77,941,165,081	\$69,384,210,670	\$7,804,540,056	10%
2012	\$81,025,934,907	\$72,065,981,366	\$7,803,944,979	10%

Estimated Costs				
Year	Total Costs	At Risk Costs	PPC Costs	% of Total
2009	\$28,428,944,028	\$25,616,047,390	\$3,143,199,399	11%
2010	\$29,531,039,818	\$26,515,016,561	\$3,040,046,217	10%
2011	\$31,709,914,468	\$28,297,702,112	\$3,173,742,094	10%
2012	**	**	**	

Note: ** Costs for CY2012 are not yet available.

Table 5. Major Level PPC Risk Adjusted Rates and Statistical Significance by Region, 2009-2012

Region	2009		2010		2011		2012	
	Risk Adjusted Rate	Sig	Risk Adjusted Rate	Sig	Risk Adjusted Rate	Sig	Risk Adjusted Rate	Sig
Statewide	364.02		342.34		335.36		325.99	
Central	344.11	**	332.92	**	322.62	**	323.73	NS
Long Island	373.32	*	359.58	*	364.81	*	359.18	*
NYC	377.01	*	345.91	NS	337.15	NS	321.13	**
North Eastern	313.59	**	308.96	**	293.47	**	299.99	**
Northern Metro	346.75	**	333.54	**	326.78	**	311.45	**
Western - Buffalo	361.26	NS	328.27	**	332.82	NS	317.49	NS
Western - Rochester	373.82	*	355.56	*	334.36	NS	340.83	*

Note: '**' indicates that a region's PPC rate is statistically higher than the statewide rate

'**' indicates that a region's PPC rate is statistically lower than the statewide rate

Table 6. PPC Rates by Group, 2009-2012

PPC Group Number	PPC Group Name	Year	At Risk Discharges	PPC Discharges	PPC Group Rate per 10,000
1	Extreme Complications	2009	1,934,144	12,608	65.19
		2010	1,927,471	12,042	62.48
		2011	1,932,277	12,186	63.07
		2012	1,873,275	12,631	67.43
2	Cardiovascular-Respiratory Complications	2009	1,911,135	46,253	242.02
		2010	1,904,796	44,891	235.67
		2011	1,910,600	44,283	231.78
		2012	1,852,557	43,072	232.50
3	Gastrointestinal Complications	2009	1,908,505	6,242	32.71
		2010	1,901,887	6,314	33.20
		2011	1,907,439	6,356	33.32
		2012	1,849,332	6,193	33.49
4	Perioperative Complications	2009	2,004,159	14,551	72.60
		2010	1,999,183	13,018	65.12
		2011	2,005,353	12,381	61.74
		2012	1,946,690	10,973	56.37
5	Infectious Complications	2009	2,032,082	33,998	167.31
		2010	2,019,765	31,946	158.17
		2011	2,025,457	30,999	153.05
		2012	1,963,843	28,195	143.57
6	Malfunctions, Reactions, etc.	2009	2,086,882	8,873	42.52

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PPC Group Number	PPC Group Name	Year	At Risk Discharges	PPC Discharges	PPC Group Rate per 10,000
		2010	2,075,249	8,383	40.40
		2011	2,080,968	7,942	38.16
		2012	2,017,356	7,412	36.74
7	Obstetrical Complications	2009	217,906	12,972	595.30
		2010	218,089	12,300	563.99
		2011	219,017	12,487	570.14
		2012	214,475	12,529	584.17
8	Other Medical and Surgical Complications	2009	2,063,350	25,640	124.26
		2010	2,051,926	25,464	124.10
		2011	2,058,041	24,717	120.10
		2012	1,995,155	23,491	117.74

Note: Discharges may be represented in more than one PPC Group.

Table 7. PPC Rates per 10,000 discharges, 2009-2012

#	PPC Description	Rate Per 10,000 Discharges			
		2009	2010	2011	2012
1	Stroke & Intracranial Hemorrhage	15.34	15.67	15.58	16.45
2	Extreme CNS Complications	5.49	5.48	5.88	6.11
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	73.30	73.23	73.45	76.30
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	11.72	11.60	10.88	10.35
5	Pneumonia & Other Lung Infections	53.12	50.38	48.48	47.19
6	Aspiration Pneumonia	21.27	23.09	21.96	22.98
7	Pulmonary Embolism	9.57	9.27	9.79	9.25
8	Other Pulmonary Complications	24.65	25.25	25.46	26.19
9	Shock	33.84	34.54	35.36	38.44
10	Congestive Heart Failure	31.30	29.65	27.29	27.12
11	Acute Myocardial Infarction	30.38	30.16	29.43	28.11
12	Cardiac Arrhythmias & Conduction Disturbances	2,672.50	2,666.00	2,840.00	2,894.50
13	Other Cardiac Complications	4.02	3.72	4.33	5.26
14	Ventricular Fibrillation/Cardiac Arrest	22.45	19.33	19.70	22.05
15	Peripheral Vascular Complications except Venous Thrombosis	4.83	4.32	4.07	4.15
16	Venous Thrombosis	18.93	17.47	18.02	18.00

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#	PPC Description	Rate Per 10,000 Discharges			
		2009	2010	2011	2012
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding	21.76	22.00	21.96	21.78
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	0.75	0.87	0.87	0.94
19	Major Liver Complications	6.37	6.27	6.55	6.91
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding	5.78	6.00	6.12	5.94
21	Clostridium Difficile Colitis	28.94	27.36	27.61	26.77
23	GU Complications except UTI	4.40	4.34	4.78	5.15
24	Renal Failure without Dialysis	109.02	111.17	106.44	105.28
25	Renal Failure with Dialysis	0.35	0.32	0.25	0.16
26	Diabetic Ketoacidosis & Coma	0.75	0.66	0.63	0.71
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	1.16	1.35	1.48	1.46
28	In-Hospital Trauma and Fractures	2.81	2.52	2.16	2.28
29	Poisonings except from Anesthesia	1.08	0.99	1.04	1.09
30	Poisonings due to Anesthesia	0.00	0.03	0.00	0.01
31	Decubitus Ulcer	8.20	7.85	7.90	6.05
32	Transfusion Incompatibility Reaction	0.01	0.01	0.02	0.02
33	Cellulitis	14.04	13.15	13.44	12.44
34	Moderate Infections	8.29	7.81	6.96	6.61
35	Septicemia & Severe Infections	44.48	43.55	42.63	40.11
36	Acute Mental Health Changes	4.33	4.50	4.47	4.19
37	Post-Operative Infection & Deep Wound Disruption without Procedure	47.14	43.88	42.59	40.01
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	0.71	0.45	0.59	0.41
39	Reopening Surgical Site	0.92	1.09	0.99	0.95
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Procedure	128.28	114.94	112.06	101.95
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Procedure	0.83	0.77	0.68	0.91
42	Accidental Puncture/Laceration during Invasive Procedure	44.74	41.02	39.52	35.19
43	Accidental Cut or Hemorrhage during Other Medical Care	0.03	0.01	0.03	0.01
44	Other Surgical Complication - Moderate	14.32	12.99	14.18	14.80
45	Post-procedure Foreign Bodies	1.36	0.95	1.28	0.95

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#	PPC Description	Rate Per 10,000 Discharges			
		2009	2010	2011	2012
46	Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	0.00	0.00	0.00	0.00
47	Encephalopathy	13.53	14.62	15.32	15.64
48	Other Complications of Medical Care	6.17	5.79	5.86	6.15
49	Iatrogenic Pneumothorax	4.88	4.69	4.77	4.37
50	Mechanical Complication of Device, Implant & Graft	6.71	6.63	6.76	6.60
51	Gastrointestinal Ostomy Complications	4.82	4.34	4.13	3.75
52	Inflammation & Other Complications of Devices, Implants or Grafts except Vascular Infection	15.78	15.28	14.14	14.64
53	Infection, Inflammation and Clotting Complications of Peripheral Vascular Catheters and Infusions	9.17	8.86	7.56	6.92
54	Infections due to Central Venous Catheters	4.61	3.76	3.77	3.25
55	Obstetrical Hemorrhage without Transfusion	203.47	228.13	239.25	257.19
56	Obstetrical Hemorrhage with Transfusion	6.79	7.21	9.12	10.07
57	Obstetric Lacerations & Other Trauma without Instrumentation	166.16	152.44	156.59	152.88
58	Obstetric Lacerations & Other Trauma with Instrumentation	440.50	436.69	487.88	475.56
59	Medical & Anesthesia Obstetric Complications	96.73	102.16	98.39	104.34
60	Major Puerperal Infection and Other Major Obstetric Complications	79.98	32.19	22.79	20.75
61	Other Complications of Obstetrical Surgical & Perinatal Wounds	38.41	33.98	34.20	32.45
62	Delivery with Placental Complications	43.91	43.14	44.10	44.85
63	Post-Operative Respiratory Failure with Tracheostomy	1.88	1.82	1.57	1.30
64	Other In-Hospital Adverse Events	0.36	0.23	0.22	0.18
65	Urinary Tract Infection	112.56	104.14	99.09	91.75
66	Catheter-Related Urinary Tract Infection	1.50	1.54	1.46	1.56

Note: There is not a PPC #22

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Contact Information

We welcome questions, comments and feedback on this Statistical Brief.

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