Methods To Estimate the Baseline 2010 PFP National Hospital-Acquired Condition Rate

This document describes the methods AHRQ used to estimate the national rate of hospital-acquired conditions (HACs) for the Partnership for Patients (PFP) program. The estimate includes a wide variety of adverse events, including the nine HACs selected for special focus as part of the PFP, as well as several other HACs. Collectively, 28 specific measures are used: 14 measures to generate rates for the 9 specific PFP HACs and 14 measures to generate a summary rate for "all other" HACs. Of the 28 measures, 21 are from the AHRQ/CMS Medicare Patient Safety Monitoring System (MPSMS), 6 are from the AHRQ Patient Safety Indicators (PSIs), and 1 is based on National Healthcare Safety Network (NHSN) data from CDC. The measures are shown in Table 1 below.

Table 1. Measures Used To Estimate the National Hospital-Acquired Condition Rate

Partnership for Patients Hospital-Acquired Conditions	Source	Measure
Adverse Drug Event (ADE)	MPSMS	ADE Associated With Digoxin
	MPSMS	ADE Associated With Hypoglycemic Agents
	MPSMS	ADE Associated With IV Heparin
	MPSMS	ADE Associated With Low Molecular Weight Heparin and Factor Xa Inhibitor
	MPSMS	ADE Associated With Warfarin
CAUTI	MPSMS	Catheter-Associated Urinary Tract Infections (physician diagnosed)
CLABSI	MPSMS	Blood Stream Infections Associated With Central Venous Catheters
Falls	MPSMS	In-Hospital Patient Falls
Obstetric Adverse Events	PSI	OB Trauma in Vaginal Delivery With (PSI 18) and Without Instrument (PSI 19)
Pressure Ulcers	MPSMS	Hospital-Acquired Pressure Ulcers
Surgical Site Infections	NHSN	SSIs combined for 17 procedures based on CDC NHSN data
VAP	MPSMS	Ventilator-Associated Pneumonia
VTE	MPSMS	Postoperative Venous Thromboembolic Events
"All Other" HACs (not identified for national focus as specific PFP HACs)	MPSMS	Femoral Artery Puncture for Catheter Angiographic Procedures
	MPSMS	Adverse Events Associated With Hip Joint Replacements
	MPSMS	Adverse Events Associated With Knee Joint Replacements
	MPSMS	Contrast Nephropathy Associated With Catheter Angiography
	MPSMS	Hospital-Acquired Methicillin-Resistant Staphylococcus aureus (MRSA)
	MPSMS	Hospital-Acquired Vancomycin-Resistant Enterococcus (VRE)
	MPSMS	Hospital-Acquired Antibiotic-Associated Clostridium difficile
	MPSMS	Mechanical Complications Associated With Central Venous Catheters
	MPSMS	Postoperative Cardiac Events for Cardiac and Noncardiac Surgeries
	MPSMS	Postoperative Pneumonia
	PSI	Iatrogenic Pneumothorax (PSI 6)
	PSI	Post-Op Hemorrhage or Hematoma (PSI 9)
	PSI	Post-Op Respiratory Failure (PSI 11)
	PSI	Accidental Puncture or Laceration (PSI 15)

Acronyms: Central Line-Associated Blood Stream Infection (CLABSI), Medicare Patient Safety Monitoring System (MPSMS), Patient Safety Indicators (PSIs), National Healthcare Safety Network (NHSN).

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Data from these 28 measures are combined to generate a summary national HAC rate that can be calculated annually, and that uses data from the AHRQ Healthcare Cost and Utilization Project (HCUP) on the annual number of hospital inpatient discharges as the denominator for the rate calculation. The details of how the national HAC rate is calculated for PFP are summarized below.

1. The national rate of PFP HACs is calculated using the following variables:
    a. **The rate of 21 MPSMS adverse events** in the MPSMS sample provided by the CMS Inpatient Quality Reporting (IQR) sample of charts. The IQR sample for 2010 (the baseline year for the PFP national HAC rate) included approximately 34,000 charts from four patient groups: those included in the Surgical Care Improvement Project (SCIP) (major surgery) sample, and those with a principal diagnosis of acute myocardial infarction (AMI), congestive heart failure (CHF), or pneumonia. The IQR sample is limited to patients 18 years old and over. The rates of the 21 MPSMS adverse events are expressed as a rate for the whole sample population, rather than as a rate for the subpopulation that has the opportunity to experience the adverse event. For example, the CLABSI rate, like all the rates, uses all patients in the denominator, not just the patients who had a central line inserted during their hospital stay. To ensure that the estimated rate will not be affected by variation across years in the proportion of patients from each of the four groups (that is, SCIP, AMI, CHF, and pneumonia), for each of the 21 MPSMS HACs the estimate is a weighted average of the HAC rate for each group, where each group is given a 25% weight.
    b. **The national number of adverse events captured by PSIs 18 and 19 on obstetric injury,** and the national number of four other PSIs (numbers 6, 9, 11, and 15) included among the "all other" HACs.
    c. **The national number of selected surgical site infections computed in a special calculation for the PFP by CDC.** This calculation is based on NHSN data for 17 specific operations: the 12 "SCIP" operations and 5 others.
    d. The data described above for MPSMS are unlike the NHSN and PSI data in two ways. First, they originate as a rate, and second, they are an estimate for four specific subpopulations of hospital patients rather than all inpatients. In order to estimate MPSMS rates for all patients, rather than simply those with one of the four diagnoses included in the 2010-2012 IQR sample, we use data from the 2005-2006 MPSMS sample. Using the 2005-2006 MPSMS data, we estimate, for each of the 21 HACs included in the MPSMS analysis, the ratio of the rate of HACs for all patients in the sample to the rate of HACs for patients with the four diagnoses. As shown in Table 2, these ratios vary from .28 to 1.08, with 14 of 21 ratios being between .4 and .8 and the arithmetic mean of the ratios being .64. The fact that the ratios are, with one exception, all below 1.0 makes intuitive sense: it is credible that the rate of harm is greater for patients who have had major surgery, AMI, CHF, or pneumonia than it is for other patients.
    e. In order to estimate the rate of adverse events for each of the 21 HACs for all patients for which the MPSMS data are used, we multiply the adverse event rate for each of the 21 HACs for patients with one of the four conditions included in the 2010-2012 MPSMS sample as estimated in (a) above by the ratio of adverse events for all patients to adverse events for patients with one of the four diagnoses. Then, in order to estimate the number of adverse events for each of these 21 HACs, we multiply the estimated rate for all patients by the estimated total number of hospital discharges, where the estimate for the total number of hospital discharges comes from HCUP.
2. The estimated **total count of annual HACs** in the PFP national HAC rate is calculated as the sum of the total number of HACs for the 21 MPSMS HACs in (e) above, plus the estimated number of PSI HACs in (b), plus the number of NHSN-estimated HACs in (c).
3. The **PFP national HAC rate** is the total HAC count in (2) above divided by the number of annual hospital inpatient discharges of patients at least 18 years old, as provided by HCUP. Table 3 provides a summary of the data that shows how the 28 rates from all the measures are combined into the PFP national HAC rate.

4. As of April 2014, this method has been repeated for 2011, and for 2012 using preliminary data for the number of annual hospital discharges. To be able to compare the estimated total number of HACs in 2011 and 2012 to 2010 without having that comparison be affected by changes in the total number of discharges, for 2011 and 2012, the data were normalized to generate national counts based on 32,750,000 discharges, which was the total number of discharges in 2010 for inpatients 18 years old and over. This method will be used again to finalize estimates for 2012, 2013, and 2014 as the data become available.

Table 2. Summary of Ratio Calculations

PFP HAC Category	MPSMS Measure	Rate per 1,000 Discharges in FFS Medicare Patients >64 Years: All Diagnoses (CY 2005-2006 Combined)	Rate per 1,000 Discharges in FFS Medicare Patients >64 Years: Four Principal Diagnoses Only: AMI, HF, Pneumonia, & SCIP (CY 2005-2006 Combined)	Ratio (Calculated as All Diagnoses Rate/Four Principal Diagnoses Rate)
ADE	ADE Associated With Digoxin	0.19	0.17	1.08
ADE	ADE Associated With Hypoglycemic Agents	34.06	44.28	0.77
ADE	ADE Associated With IV Heparin	10.22	20.59	0.50
ADE	ADE Associated With Low Molecular Weight Heparin and Factor Xa Inhibitor	13.90	25.24	0.55
ADE	ADE Associated With Warfarin	10.85	17.40	0.62
CLABSI	Blood Stream Infections Associated With Central Venous Catheters	1.44	2.24	0.64
CAUTI	Catheter-Associated Urinary Tract Infections	18.80	25.58	0.73
Falls	In-Hospital Patient Falls	12.25	14.56	0.84
Pressure Ulcers	Hospital-Acquired Pressure Ulcers	53.03	62.45	0.85
VAP	Ventilator-Associated Pneumonia	1.30	2.67	0.49
VTE	Postoperative Venous Thromboembolic Events	1.84	4.39	0.42
All Other HACs	Contrast Nephropathy Associated With Catheter Angiography	8.46	18.35	0.46
All Other HACs	Femoral Artery Puncture for Catheter Angiographic Procedures	3.02	3.62	0.83
All Other HACs	Hospital-Acquired Antibiotic-Associated C. difficile	4.21	5.17	0.81
All Other HACs	Hospital-Acquired MRSA	1.23	1.55	0.79
All Other HACs	Hospital-Acquired VRE	0.37	0.52	0.72

Table 2. Summary of Ratio Calculations *(continued)*

PFP HAC Category	MPSMS Measure	Rate per 1,000 Discharges in FFS Medicare Patients >64 Years: All Diagnoses (CY 2005-2006 Combined)	Rate per 1,000 Discharges in FFS Medicare Patients >64 Years: Four Principal Diagnoses Only: AMI, HF, Pneumonia, & SCIP (CY 2005-2006 Combined)	Ratio (Calculated as All Diagnoses Rate/Four Principal Diagnoses Rate)
All Other HACs	Adverse Events Associated With Hip Joint Replacements	1.02	3.70	0.28
All Other HACs	Adverse Events Associated With Knee Joint Replacements	1.02	3.62	0.28
All Other HACs	Mechanical Complications Associated With Central Venous Catheters	4.00	5.25	0.76
All Other HACs	Postoperative Cardiac Events for Cardiac and Noncardiac Surgeries	4.00	8.70	0.46
All Other HACs	Postoperative Pneumonia	4.39	9.73	0.45

Table 3. 2010 Estimated Final HAC Data (Finalized May 2012)

PFP Hospital-Acquired Conditions			Information on 2010 Measured HACs Baseline		
Partnership for Patients Hospital-Acquired Condition	Source	Measure	2010 PFP HACs (Not Rounded)	2010 (18+ y.o.) Discharges (HCUP)	2010 PFP Measured HACs per 1,000 Discharges
ADE	MPSMS	ADE Associated With Digoxin	11,650	32,750,000	0.356
	MPSMS	ADE Associated With Hypoglycemic Agents	930,863	32,750,000	28.423
	MPSMS	ADE Associated With IV Heparin	170,973	32,750,000	5.221
	MPSMS	ADE Associated With Low Molecular Weight Heparin and Factor Xa Inhibitor	335,826	32,750,000	10.254
	MPSMS	ADE Associated With Warfarin	171,609	32,750,000	5.240
	MPSMS	Total ADE (sum of above 5 measures)	1,620,921	32,750,000	49.496
CAUTI	MPSMS	Catheter-Associated Urinary Tract Infections	401,139	32,750,000	12.249
CLABSI	MPSMS	Blood Stream Infections Associated With Central Venous Catheters	18,091	32,750,000	0.552
Falls	MPSMS	In-Hospital Patient Falls	262,317	32,750,000	8.010
Obstetric Adverse Events	PSI	OB Trauma in Vaginal Delivery With (PSI 18) and Without Instrument (PSI 19)	82,300	32,750,000	2.513

Table 3. 2010 Estimated Final HAC Data (Finalized May 2012) *(continued)*

PFP Hospital-Acquired Conditions			Information on 2010 Measured HACs Baseline		
Partnership for Patients Hospital-Acquired Condition	**Source**	**Measure**	**2010 PFP HACs (Not Rounded)**	**2010 (18+ y.o.) Discharges (HCUP)**	**2010 PFP Measured HACs per 1,000 Discharges**
Pressure Ulcer	MPSMS	Hospital-Acquired Pressure Ulcers	1,317,211	32,750,000	40.220
Surgical Site Infection	NHSN	SSIs for 17 procedures in 2010 with CDC data	96,467	32,750,000	2.946
VAP	MPSMS	Ventilator-Associated Pneumonia	37,604	32,750,000	1.148
VTE (updated June 2014)	MPSMS	Postoperative Venous Thromboembolic Events	27,564	32,750,000	0.842
All Other Hospital-Acquired Conditions	MPSMS	Femoral Artery Puncture for Catheter Angiographic Procedures	75,804	32,750,000	2.315
	MPSMS	Adverse Events Associated With Hip Joint Replacements	30,413	32,750,000	0.929
	MPSMS	Adverse Events Associated With Knee Joint Replacements	28,855	32,750,000	0.881
	MPSMS	Contrast Nephropathy Associated With Catheter Angiography	227,419	32,750,000	6.944
	MPSMS	Hospital-Acquired MRSA	14,828	32,750,000	0.453
	MPSMS	Hospital-Acquired VRE	13,186	32,750,000	0.403
	MPSMS	Hospital-Acquired Antibiotic-Associated C. difficile	86,916	32,750,000	2.654
	MPSMS	Mechanical Complications Associated With Central Venous Catheters	114,689	32,750,000	3.502
	MPSMS	Postoperative Cardiac Events for Cardiac and Noncardiac Surgeries	43,120	32,750,000	1.317
	MPSMS	Postoperative Pneumonia	96,896	32,750,000	2.959
	PSI	Iatrogenic Pneumothorax (PSI 6)	13,490	32,750,000	0.412
	PSI	Post-Op Hemorrhage or Hematoma (PSI 9)	20,691	32,750,000	0.632
	PSI	Post-Op Respiratory Failure (PSI 11)	50,058	32,750,000	1.528
	PSI	Accidental Puncture or Laceration (PSI 15)	77,194	32,750,000	2.357
	MPSMS & PSI	Total All Other HACs (sum of above 14 measures)	893,559	32,750,000	27.284
Total PFP HACs, and HACs per 1,000 discharges (updated June 2014)			4,757,173		145.26
Total PFP HACs, and HACs per 1,000 discharges (rounded) (updated June 2014)			4,757,000		145

Ideally, we would have estimated the adverse event rates for the 21 MPSMS HACs using data from patients with all diagnoses, rather than being restricted to the four diagnoses that were included in the 2010 IQR sample. Because the 2010 IQR sample did not include patients with all diagnoses, we used the 2005 and 2006 MPSMS data, as described above, to estimate the ratio of adverse events for all diagnoses to adverse events for the four diagnoses. However, the 2005 and 2006 sample was restricted to Medicare patients age 65 and over, and it is possible that the ratios we estimated with those data are not correct for all patients. It makes sense to think, for example, that because many of the adverse events we measure are less common among obstetric patients than among other patients, the ratio for all patients would be lower than the ratio for Medicare patients 65 years old and over. It is also possible that the ratio has changed from 2005-2006 to the present.

New MPSMS data are now available based on an expanded 2012-2013 IQR sample that includes charts from patients with diagnoses other than those in the four diagnosis groups present in the 2010-2011 IQR sample. Use of these data may enable the development of a new method that could provide an improved estimate of the PFP national HAC rate. Information from these 2012 and 2013 charts is currently being analyzed to ensure the reliability of the MPSMS rates and other data present in charts from these additional IQR samples. Preliminary data and calculations based on data that include the new IQR samples suggest that a method that includes data from these additional charts would produce somewhat lower national HAC rates than have been computed to date, but not necessarily change the annual trends in the HAC rates.

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