TEXAS HEALTH AND HUMAN SERVICES COMMISSION

Potentially Preventable Complications in the Texas Medicaid Population State Fiscal Year 2011

(Fee-for-Service and Primary Care Case Management)

Public Report

November 2012

Note: **Each hospital can obtain a confidential version of this report, with its own PPR results, through its secure mailbox at www.tmhp.com.**

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Note: Section 4 is included only in the hospital-specific versions of this report. The public version does not include any confidential hospital-specific information.

TEXAS HEALTH AND HUMAN SERVICES COMMISSION

KYLE L. JANEK, M.D.
EXECUTIVE COMMISSIONER

The purpose of this report is to provide data on the volume and rate of potentially preventable complications (PPCs) in Texas and out-of-state hospitals that served Texas Medicaid clients during state fiscal year 2011 (September 1, 2010 through August 31, 2011). Clients in Medicaid fee-for-service (FFS) and primary care case management (PCCM) delivery models are included in this report. The managed care delivery model is not represented in this report because a necessary data element known as the present on admission (POA) indicator was not required to be collected on encounter claims until after state fiscal year 2011. The POA is a necessary data element on claims to derive potentially preventable complications. Managed care data will be included in the next annual PPC report that will include state fiscal year 2012 data.

Senate Bill 7 (S.B.7), 82nd Texas Legislature, 1st Called Session, 2011, requires the Health and Human Services Commission (HHSC) to identify potentially preventable complications (PPCs) in the Medicaid population annually and then confidentially report the results to each hospital. A hospital shall distribute the information contained in the PPC report to physicians and other health care providers providing services at the hospital. It also requires HHSC to implement quality-based payments that will adjust reimbursements to hospitals based on the hospital's PPC rate. The PPC quality based payment adjustments will become effective beginning November 1, 2013. This is the first year for which PPC analysis has been performed and reported and shall continue annually from this point forward. HHSC has chosen to produce a report reflecting statewide results which is known as the "public" report and the public report may be found on the HHSC website. The confidential hospital-specific results and report is located in each hospital's specific Texas Medicaid & Healthcare Partnership (TMHP) portal library.

This PPC analysis and reports are based on the "potentially preventable complication" approach developed by 3M Health Information Systems and previously used to analyze complication rates in the Maryland, California, New York Medicaid, and U.S. Medicare populations. In this report, the approach was used to measure complication rates in the Texas Medicaid adult and obstetric fee-for-service and primary care case management populations. Children and newborns were omitted because the PPC tool is not fully developed for those populations.

The PPC approach takes a broad view of inpatient complications, supplementing the more narrow approaches that focus on "never events" or the Medicare list of hospital acquired conditions (HAC). While the never event and HAC lists include only complications that are always or almost always preventable, the PPC list includes a broad list of 1,600 complications that are *potentially* preventable. Septicemia, pneumonia, kidney failure, and obstetric lacerations, for example, are common inpatient complications that are sometimes preventable and sometimes unpreventable. The PPC approach is to measure a hospital's complication rate against peers that treat patients with similar illnesses.

Section 2 of this report shows that 6.0 percent of adult stays and 8.0 percent of obstetric stays included at least one PPC in state fiscal year 2011. Out of 251,994 stays, a total of 17,828 stays included at least one

PPC. Patients who had at least one PPC were at notable risk for additional PPCs as well. Obstetrical complications were the most common PPC category, while cardiovascular-respiratory complications were the most expensive category. Overall, PPCs added an estimated $88.7 million, or 4.2 percent, to the hospital cost of caring for these patients.

Although not all complications are preventable, any reduction in complication rates brings obvious benefits to patients and the health care system more generally. Substantial reductions are possible, as has been demonstrated by initiatives in Maryland, Michigan and elsewhere to reduce infection rates in intensive care units.

In measuring hospital performance, it is essential to reflect the reality that some patients are at much higher risk of complications than others. This analysis compares the actual incidence of each of 65 PPCs with the incidence that would be expected for a hospital with the same patient case mix. Excluding low-volume hospitals, 36 percent of hospitals performed "better" than expected while 38 percent performed worse than expected and the remaining 26 percent were about as expected (See Table 2.4.1 of the report.). The wide range in performance implies that hospitals can learn from each other in reducing complication rates.

This PPC report reflects the commission's work and increasing emphasis on quality, efficiency and initiatives to invest in quality and outcome-based reimbursements within Medicaid and CHIP. A sustained data driven focus on the measurement and public reporting of healthcare quality indicators promotes transparency, accountability and efficiency of the healthcare system. HHSC has a number of initiatives underway, including those using data collection and analysis and payments based on potentially preventable events, such as PPCs.

This analysis was performed for HHSC by the TMHP. HHSC is interested in improving the methodology and making the results more useful to hospitals. Comments and suggestions on this topic are welcomed any time and can be emailed to PPC.Report@tmhp.com.

Kay Ghahremani
Associate Commissioner for Medicaid and CHIP
Texas Health and Human Services Commission
Austin, TX

1 Background and Methodology

Senate Bill 7, 82nd Legislature, 1st Special Session, 2011, requires the Health and Human Services Commission (HHSC) to provide confidential information to each hospital on its performance with regard to potentially preventable complications (PPC). This report meets that requirement for state fiscal year (SFY) 2011 (September 1, 2010 through August 31, 2011). It has been prepared in two versions. The public version describes the methodology and the statewide results but presents no results that are specific to a hospital. The hospital-specific version is identical to the public report except that it also includes a Section 4 with tables of results individualized to each hospital. Each hospital can obtain its own report through its secure portal mailbox at www.tmhp.com.

This report, produced at the direction of the Texas legislature, calculates casemix-adjusted rates of potentially preventable complications both statewide and for individual hospitals.

Section 1 provides the background and methodology for the analysis. Section 1.1 describes the Medicaid fee-for-service (FFS) and Primary Care Case Management (PCCM) reimbursement models of inpatient hospital care. The data necessary to include managed care encounters were not available for SFY 2011 because the present on admission (POA) indicator was not required to be submitted on encounter data until December 2011. Managed care encounter data will be included in the September 2013 release of the PPC report. Section 1.2 describes the data used for this report. The report is focused on adult and obstetric patients. Newborns and pediatrics are excluded because the 3M PPC analytical tool used for this analysis has not been fully developed for these populations. The report also excludes Medicaid patients for whom Medicare was the primary payer and medically needy patients who "spent down" to Medicaid eligibility.

Section 1.3 provides an overview of the various methods of measuring inpatient complications. In particular, an approach based on identifying errors in individual stays is contrasted with the approach used in this PPC report, which is to focus on casemix-adjusted hospital-wide rates of PPCs. The emphasis is on *potentially*—the recognition that infections and other complications may occur even with optimal care but that high PPC rates across a hospital may indicate problems in quality.

A specific algorithm developed by 3M Health Information Systems was used to measure PPCs. This algorithm is described in Section 1.4. For this report, no modifications were made to the PPC algorithm.

The presence of a PPC often creates additional costs for a hospital so it is useful to estimate the cost impact associated with each PPC. These estimates were calculated using the most recent available data on the costs of care at Texas hospitals, following a methodology used in previous studies of other patient populations. The estimated cost impact of PPCs is described in Section 1.5.

Although the 3M PPC software identifies PPCs that occur during inpatient stays, it does not generate hospital-wide rates that can be compared across hospitals. Section 1.6 describes the methodology used by TMHP to compare actual PPC rates with expected PPC results by hospital, where the "expected" rate reflected each hospital's patient mix or casemix. This casemix adjustment is critically important if fair comparisons are to be drawn across hospitals or other patient populations.

Section 2 of the report describes results at the statewide level, followed by frequently asked questions in Section 3. Three appendices provide further detail on results and methodology.

1.1 Medicaid Fee-for-Service and Primary Care Case Management Payment for Inpatient Hospital Services

In SFY 2011 (September 2010 through August 2011), Texas Medicaid paid for approximately 24 percent of all of the inpatient stays in Texas. Payments to hospitals totaled $3.4 billion, which is approximately 7 percent of the industry's combined inpatient and outpatient revenue.[1]

Texas Medicaid funds almost one quarter of inpatient hospital care in the state.

Of these inpatient stays, 467,691 stays, or two-thirds, were funded through the fee-for-service (FFS) and Primary Care Case Management (PCCM) delivery methods. The other one-third of inpatient stays were funded through managed care plans, which are outside the scope of this report.

Of the FFS and PCCM stays, 55 percent of stays were FFS and 45 percent were PCCM. However, there are certain managed care "carve out" inpatient claims (e.g. SSI clients) that were paid by TMHP and are included in the fee-for-service section of the table below. PCCM clients had a designated primary care coordinator, typically a physician, who took responsibility for coordinating the client's care.

Table 1.1.1
Summary of Medicaid Inpatient FFS/PCCM Hospital Utilization, State Fiscal Year 2011

	Stays			Medicaid Payments (in Millions)		
Medicaid Care Category	FFS	PCCM	Total	FFS	PCCM	Total
Pediatric						
Respiratory	7,996	12,153	20,149	$86	$49	$135
Other medical	14,512	15,472	29,984	$156	$89	$246
Other surgical	5,311	4,205	9,516	$135	$85	$220
MH/SA	6,423	5,200	11,623	$41	$23	$65
Subtotal	34,242	37,030	71,272	$418	$246	$665
Adult						
Circulatory	8,309	8,190	16,499	$70	$58	$128
Other medical	41,786	34,860	76,646	$256	$181	$437
Other surgical	13,816	10,300	24,116	$207	$119	$326
MH/SA	4,855	4,074	8,929	$16	$13	$29
Subtotal	68,766	57,424	126,190	$549	$371	$919
Obstetrics	79,822	58,341	138,163	$190	$119	$309
Newborns	75,633	56,284	131,917	$282	$177	$459
Ungroupable	108	41	149	$6	$2	$8
Total	258,571	209,120	467,691	$1,444	$916	$2,360
Percent of total	55%	45%	100%	61%	39%	100%

Notes:

1. FFS=fee-for-service; PCCM=Primary Care Case Management; MH/SA=mental health/substance abuse.
2. Medicaid payments to hospitals shown here exclude additional reimbursements made via supplemental payments (e.g. disproportionate share payments).
3. Totals in this table may not be identical to other information prepared by HHSC due to differences in service dates, paid dates, dates of analysis, inclusion or exclusion of various claim categories, and other reasons.

For the FFS/PCCM population, Table 1.1.2 shows utilization and financial totals by Medicaid Care Category, a categorization intended to reflect the inpatient needs of the Medicaid population as well as the internal organization of a typical hospital. Overall, 30 percent of Medicaid FFS/PCCM stays were for obstetrics, 28 percent for newborns, 15 percent for clients under age 18 (excluding newborns and obstetrics), and 27 percent for adults (excluding obstetrics).

Table 1.1.2

Medicaid FFS/PCCM Stays, State Fiscal Year 2011

Medicaid Care Category	Stays	Days	Billed Charges	Estimated Hospital Cost	Payment	Case mix	Avg Length of Stay
Pediatric							
Respiratory	20,149	74,821	$541,809,845	$160,119,824	$134,902,004	0.88	3.7
Other medical	29,984	118,768	$902,124,706	$278,766,963	$245,601,533	0.95	4.0
Other surgical	9,516	64,586	$833,711,114	$255,660,697	$219,602,142	2.88	6.8
MH/SA	11,623	117,759	$201,131,690	$79,158,041	$64,596,482	0.60	10.1
Subtotal	71,272	375,934	$2,478,777,354	$773,705,525	$664,702,161	1.13	5.3
Adult							
Circulatory	16,499	84,207	$879,209,066	$240,414,546	$127,645,227	2.07	5.1
Other medical	76,646	411,343	$2,870,092,822	$825,461,648	$437,174,940	1.50	5.4
Other surgical	24,116	221,685	$2,189,585,723	$635,706,867	$325,698,779	3.46	9.2
MH/SA	8,929	62,901	$170,372,823	$45,650,462	$28,737,967	0.67	7.0
Subtotal	126,190	780,136	$6,109,260,433	$1,747,233,523	$919,256,913	1.89	6.2
Obstetrics	138,163	342,838	$1,765,924,486	$505,045,884	$309,059,763	0.54	2.5
Newborns	131,917	498,253	$1,965,406,923	$553,587,174	$458,797,117	0.56	3.8
Total	467,542	1,997,161	$12,319,369,196	$3,579,572,106	$2,351,815,954	1.00	4.3

Notes:

1. Casemix was measured using APR-DRGs Version 29 with Texas Medicaid relative weights.
2. Estimated hospital cost was measured by multiplying claim-level charges by hospital-specific cost-to-charge ratios published by Texas Medicaid.
3. Medicaid payments to hospitals shown here exclude additional reimbursements made via supplemental payments (e.g. disproportionate share payments).
4. Totals in this table may not be identical to other information prepared by HHSC due to differences in service dates, paid dates, dates of analysis, inclusion or exclusion of various claim categories, and other reasons.

1.2 Data Included/Excluded in the Report

This analysis is based on the FFS and PCCM Medicaid population in SFY 2011 (September 2010 to August 2011). The data are from an inpatient claim data file that is created annually and subjected to extensive validation, including chaining together multiple claims for a single stay, verifying the bill type, examining extreme values of important data fields, verifying diagnosis and procedure code values, and removing a small number of claims for reasons such as no reported discharge date or zero allowed days. (See Appendix Sections C.1 and C.2)

The report includes fee-for-service and primary care case management stays in SFY 2011, except newborns and pediatrics. Obstetric patients of any age are included.

For the purpose of identifying potentially preventable complications that occurred during an inpatient stay, it is essential to have data that specifies which diagnoses were already present on admission (POA). The SFY 2011 PPC analysis included FFS and PCCM claim data only. Managed care plans were not required to report POA values until December 2011; therefore, encounter data have been excluded from this SFY 2011 PPC report. Managed care encounters will be included in the SFY 2012 PPC report and afterward.

Certain hospitals were exempt from POA reporting requirements in SFY 2011. These hospitals included state-owned teaching facilities, children's hospitals, hospitals designated as critical access under the Medicare program, and others. Texas Medicaid followed Medicare and CMS policy for defining hospitals that were exempt from POA reporting. Of the 467,542 FFS and PCCM stays shown in Table 1.2.1, a total of 46,240 stays were at these exempt hospitals. Although some hospitals reported POA indicators nonetheless, all stays at exempt hospitals were excluded from the analytical dataset because there was no requirement that these indicators be reported completely or accurately. Effective September 1, 2012, all hospitals were required to report POA indicators on inpatient hospital claims.

After excluding the POA exempt hospitals, the remaining data file comprised 168,886 newborn and pediatric stays (under age 18) and 251,994 adult and obstetric stays. Obstetric stays were included regardless of the patient's age.

As will be described in Section 1.4, the 3M PPC algorithm used in this analysis is not fully developed for the newborn and pediatric populations; therefore the analytical dataset for this report comprises 251,994 adult and obstetric stays (Table 1.2.1).

Table 1.2.1
Creation of Analytical Dataset

	Stays	Days	Charges	Cost	Payments	Case mix
Stays excluded because the hospital was exempt from POA reporting (other exemptions may also exist)	46,240	303,962	$1,964,608,471	$765,359,023	$704,973,415	1.33
Adult and obstetric stays included in analytical dataset	251,994	1,068,675	$7,583,477,827	$2,117,379,991	$1,107,306,010	1.19
Newborn and pediatric stays excluded from analytical dataset	168,886	622,676	$2,733,852,577	$687,340,668	$534,996,998	0.62
Other exclusions due to data or grouping issues	422	1,848	$37,430,321	$9,492,424	$4,539,530	2.19
Total FFS/PCCM stays	467,542	1,997,161	$12,319,369,196	$3,579,572,106	$2,351,815,954	1.00

Notes:

1. Estimated hospital cost was measured by multiplying claim level charges by hospital-specific cost to charge ratios published by Texas Medicaid. Ratios were based on the most recent cost report information and were effective June 1, 2012.
2. Medicaid payments to hospitals shown here exclude additional reimbursements made via supplemental payments (e.g. disproportionate share payments).
3. 467,691 stays in Table 1.1.1 minus 149 stays that grouped to error APR-DRGs equals 467,542 stays in this table.

Because the accurate identification of PPCs depends on the accurate submission of POA indicators, a separate evaluation was undertaken of the POA values submitted by the hospitals. In particular, it was important to check the frequency of certain POA values:

- Diagnosis was present at time of inpatient admission = Y
- Diagnosis was not present at time of inpatient admission = N
- Clinically undetermined. Provider unable to clinically determine whether the condition was present at the time of inpatient admission = W
- Documentation insufficient to determine whether the condition was present at the time of inpatient admission = U
- Exempt from POA reporting. This code is the equivalent of a blank on the UB-04

Although it was not feasible to validate POA reporting against medical records, it was possible to compare the frequency of these POA values in the Texas FFS and PCCM dataset with results from similar studies used in other states. It was also possible to compare POA reporting by each hospital against statewide benchmarks. From this limited analysis, it appears that POA reporting in the analytical dataset is very reliable. No hospitals were excluded from this PPC report due to unreliable POA reporting.

1.3 Potentially Preventable Complications as an Indicator of Quality

1.3.1 Quality Concerns in Inpatient Hospital Care

Over the past decade or so, the health-care community has been increasingly concerned by the growing evidence that despite all the successes of modern medicine there remains considerable room for improvement in quality of care.[2] The Institute of Medicine, in *To Err Is Human*, famously estimated that 44,000 to 98,000 hospital patients a year die from preventable errors.[3] In 2002, patients suffered an estimated 1.9 million hospital-acquired infections, with 99,000 related deaths.[4] That same year, only 20 percent of hospitals consistently (more than 90 percent of the time) implemented certain evidence-based processes of care.[5] Infections and other complications account for almost 10 percent of the cost of hospital care, according to analyses of Maryland and California all-payer data.[6]

Efforts to improve hospital quality generally take one of two approaches—a focus on individual stays or a focus on overall casemix-adjusted rate-based performance.

As a general statement, there are two approaches to improving quality. One approach is to view quality problems as mistakes for which individuals should be held responsible. The alternative approach is to view quality problems as more likely to be caused by gaps and overlaps in systems of care.[7] Although this approach recognizes that clear medical errors do occur, it places more emphasis on transparency and collaboration among medical providers. Quality problems "…are not about bad people but about good people working in bad systems," according to Dr. Guy Clifton, a health policy analyst and former Houston neurosurgeon.[8] The goal of quality improvement is also becoming more ambitious; its aim is not just to reduce quality problems, but also to enable quality successes.

Table 1.3.1.1 compares various quality initiatives impacting health care today. The Agency for Healthcare Research and Quality (AHRQ) offers free software to hospitals to encourage the internal evaluation of patient safety measures and other quality measures. Voluntary efforts to report quality measures have been met with some resistance when not linked to payment. The Leapfrog Group—a national consortium of employers and health-care purchasers—gives hospitals the opportunity to submit data on 26 outcome measures, but reporting is incomplete. In Texas, for example, only half of the hospitals submit information to Leapfrog.[9]

In a major "pay for quality" initiative in 2005, Congress required Medicare to reduce payment when a DRG hospital stay includes certain complications. CMS titled the program "Hospital-Acquired Conditions and Present on Admission Indicator Reporting" (HAC and POA). Medicare implemented the program in two phases: first by requiring hospitals to report the POA indicator effective October 1, 2007, and then by implementing payment reductions for a specified list of HACs that became effective with discharges on or after October 1, 2008. Medicare defined a HAC as a condition that "could reasonably have been prevented through the application of evidence-based guidelines."[10] In other words, the presence of a HAC reflects a failure in hospital care. CMS therefore drew the HAC list very narrowly so that payment reduction for specific patients would be clearly defensible in all or almost all cases. In practice, the incidence of HACs is very small. For 2009, Medicare reported that only 0.16 percent of over 9 million stays included a HAC.[11] Moreover, because payment is affected only if the HAC affects the DRG assignment, payment was reduced for only 0.04 percent of stays. The financial impact on Medicare and hospitals has been negligible.

The federal government also requires Medicaid programs to reduce payment for stays that include a "health care acquired condition" (HCAC), a list of conditions that is almost identical to the Medicare HAC list. Incidence is similarly rare. In South Carolina, 0.19 percent of stays included a HCAC and 0.01 percent of stays would change DRGs because of a HCAC.[12] In California, 0.13 percent of stays included a HCAC and 0.02 percent of stays would change the DRG because of a HCAC.[13]

In this Texas analytical dataset, Table 2.5.1 shows that 0.10 percent of stays included a HAC (Texas uses the Medicare HAC list).

Several states, including Texas, have taken a different approach. Texas has decided to look not just at individual stays but also to look at hospital-wide rates compared with a casemix-adjusted benchmark. The approach is put into place using the "potentially preventable complication" algorithm developed by 3M Health Information Systems. The 3M developers explain that the PPC approach "would replace a mentality of 'this should never happen' with a more realistic attitude—'this has happened too often'—and thus sidestep the argument as to whether an individual has received low-quality care."[14]

The difference between these approaches is exemplified by pneumonia, septicemia, cellulitis, and other serious infections that are often acquired during a hospital stay. Despite their impact on morbidity and mortality, they are not considered HACs (or HCACs). The reason is that for many—but not all—patients they reflect the natural progression of disease. Reducing payment for every patient who acquires an infection during an inpatient stay would be plainly unfair and cause access problems for the sickest patients, i.e., those most susceptible to infection. The PPC approach, by contrast, is to calculate hospital-wide rates of *potentially* preventable complications, adjust these rates for differences in casemix among patients and among hospitals, and compare these casemix-adjusted rates across hospitals relative to a benchmark. The approach therefore enables a much broader look at measuring in-hospital complications. For example, various analyses have found that the proportion of stays with at least one PPC ranges from 5 percent to 11 percent, depending on the population being studied.[15]

Table 1.3.1.1

Alternative Approaches to Measuring and Identifying Complications of Inpatient Care

Elements	Patient Safety Indicators	Leapfrog	"Never Events"	Hospital Acquired Conditions	Potentially Preventable Complications
Developer	Agency for Healthcare Research and Quality	Leapfrog (private consortium)	Centers for Medicare and Medicaid Services and the National Quality Forum	Centers for Medicare and Medicaid Services	3M Health Information Systems
Application	Hospitals use for internal monitoring	Consumer use for comparison	No payment for a never event	Payment reduction to remove the impact, if any, of the HAC on payment	Payments may be increased or decreased based on casemix-adjusted performance rates relative to a benchmark
Identification	Using inpatient hospital claims, specific diagnosis and procedure codes with excluded clinical scenarios	Hospital self-reported	Some never events can be identified through claims; others must be reported to regulators	Specific defined error codes (e codes) on claims	Using inpatient hospital claims, specific diagnosis and procedure codes with excluded clinical scenarios
Present on admission indicators	Essential for some measures	n/a	Needed for some measures	Essential	Essential
Monitoring	Varies	Annual self-reported	Each claim	Each claim	Annual rate compared to a benchmark
Incidence	Rare	n/a	Very rare	Rare	Common
Website	http://qualityindicators.ahrq.gov/Default.aspx	http://leapfroggroup.org/	http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/index.html?redirect=/HospitalQualityInits/06_HACPost.asp	http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/index.html?redirect=/HospitalQualityInits/06_HACPost.asp	http://solutions.3m.com/wps/portal/3M/en_US/Health-Information-Systems/HIS/Products-and-Services/Products-List-A-Z/PPR-and-PPC-Grouping-Software/

Notes:

1. Texas Medicaid uses Hospital-Acquired Conditions as defined for Medicare versus Health Care Acquired Conditions (HCACs).

1.3.2 Reducing Potentially Preventable Complications

Recent years have seen several successful initiatives in Texas and elsewhere to reduce inpatient complication rates.

In recent years, there have been notable accomplishments in reducing certain inpatient complications. In Michigan, for example, the Keystone ICU project to reduce bloodstream infections and ventilator-associated pneumonia is estimated to have saved 1,800 lives, 140,000 hospital days, and $270 million over a five-year period in 103 intensive care units.[16] The statewide Michigan initiative was based on a similar initiative at Johns Hopkins Hospital.[17] In Texas, the Seton hospitals have reported improvements in obstetric outcomes through implementation of relatively simple improvements in patient care.[18] In Massachusetts, Boston Children's Hospital developed a patient safety initiative to improve the transition of patients at shift change in their residency training program, reducing medical errors by as much as 40 percent.[19]

There are 65 PPCs based on approximately 1,600 diagnosis codes that, when acquired during a hospital stay, may result from processes of care rather than from the natural progression of disease.

At the statewide level, Maryland has already implemented a pay-for-quality initiative based on PPCs. Between SFY 2009 and SFY 2010, the state witnessed a 12 percent drop in PPC incidence, generating a savings in hospital costs of approximately $62 million (after casemix adjustment). The 11 PPCs related to infection showed a 19 percent decrease overall, with decreased rates in each of the 11 PPCs ranging from 6 percent to 28 percent, saving approximately $34 million.[20]

1.4 3M Potentially Preventable Complications Methodology

The 3M PPC methodology is a computerized algorithm based on claims data submitted by hospitals that analyzes diagnoses, procedures, present-on-admission (POA) indicators, patient age, patient sex, and patient discharge status.[21] The POA indicator is particularly important because hospitals use it to report whether each diagnosis was present on admission or developed during the hospital stay.

Panels of 3M clinicians reviewed each of approximately 14,400 diagnosis values in the ICD-9-CM coding scheme and identified 1,562 codes that could represent in-hospital complications. These were defined as harmful events or negative outcomes that might result from processes of care and treatment rather than from natural progression of the underlying disease. Potentially preventable complications do not necessarily represent medical errors. Some complications occur even with optimal care. ICD-9-CM procedure codes were also reviewed. Certain procedure codes, such as re-opening a surgical site, may also indicate a PPC. Procedure codes were also useful in identifying the severity of certain PPCs, such as renal failure with or without dialysis and respiratory failure with or without ventilator use.

In all, 3M created 65 PPC groups. Even with optimal care, the preventability of a complication ranges along a continuum from almost always to almost never. The 3M clinician panels therefore put significant effort into identifying circumstances under which a particular complication likely was not potentially preventable. The steps involved in assigning PPCs are summarized in Chart 1.4.1. The workflow is depicted in three phases to make it easy to understand the algorithm. As the algorithm progresses, a PPC output dataset is created. This dataset was used to evaluate the presence of PPCs within the FFS and PCCM claims data. An understanding of the algorithmic process is essential to grasp the clinical care taken to appropriately assign PPCs to a hospital stay.

Every inpatient claim is first assigned to one of 1,256 All Patient-Refined Diagnosis-Related Groups (APR-DRGs). (APR-DRGs are a widely accepted algorithm used to group stays that are similar clinically and in hospital resource use. See Appendix Section C.3.) In Phase 1, the PPC software identifies "global exclusions," which are stays for patients with certain severe or catastrophic conditions who are

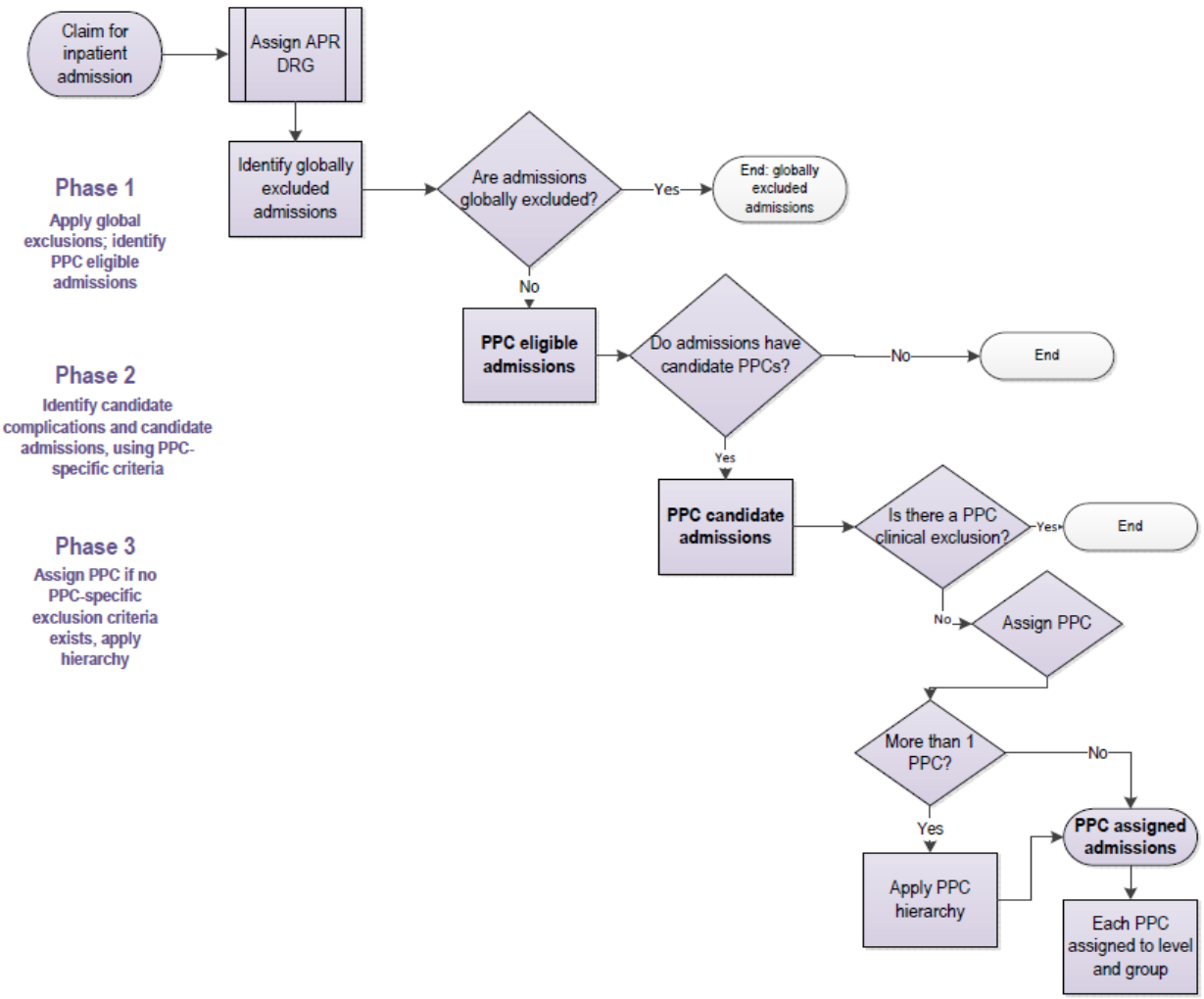
particularly susceptible to a range of complications. All patients with major metastatic cancer, organ transplants, HIV, or major trauma are considered global exclusions from all PPCs, except for PPC 45, Post-Procedure Foreign Bodies. Stays with global exclusions are evaluated for the presence of complications, but these complications are not considered "potentially preventable." Once stays with global exclusions are labeled as such, the remaining stays are considered PPC Eligible Admissions. In Phase 2, PPC Eligible Admissions are then evaluated for candidate PPCs and labeled accordingly.

In Phase 3, PPC Candidate Admissions are evaluated further for PPC-specific exclusions. If a PPC-specific exclusion exists, then that is noted on the stay and the complication is not considered potentially preventable. For example, many complications are not considered potentially preventable if the patient was under 18 years of age. If there are no PPC-specific exclusions, then a PPC is assigned. If more than one PPC is assigned and the PPCs overlap, a hierarchy is applied that eliminates the overlap and assigns only one PPC. Multiple PPCs can be assigned to a stay if they do not clinically overlap; the hierarchy does not affect these. In practice, multiple PPCs sometimes occur within the same stay.

Each PPC is also assigned to a PPC group. For example, the "obstetric complications" group includes eight obstetric PPCs.

In calculating expected PPC rates, the concept of an "at risk" stay is important. If there are 100 stays for a specific APR-DRG and ten have global exclusions, then a maximum of 90 stays are at risk for a PPC. But the same stay may be at risk for one PPC but not another. For example, a patient hospitalized for diabetes would be at risk for PPC 05 (Pneumonia) but not for PPC 55 (Obstetric Hemorrhage without Transfusion). Section 1.6.2 describes how casemix adjustment is performed.

Chart 1.4.1
PPC Algorithm Logic



Notes:

1. Claims data elements are used in the PPC application and a complex series of algorithmic steps occur to determine PPC eligible admissions, PPC candidate admissions, then finally PPC Assigned Admissions.
2. Note: PPC 45 (Post-Procedure Foreign Bodies) is never excluded. If it exists, it will always be assigned.
3. Source: Flowchart created by TMHP based on Hughes et al., *PPC Definitions Manual* V.29.

- Global Exclusion: A set of exclusion criteria for identifying admissions with certain severe or catastrophic conditions that are particularly susceptible to a range of complications, including those with trauma, HIV illness, and major or metastatic malignancies. Globally excluded admissions are not eligible to be assigned to most PPCs.
- PPC Eligible Admission: A PPC eligible admission is an admission that did not meet any global exclusion criteria.
- Candidate Complication: Candidate Complications are those conditions that are considered a PPC when specific PPC assignment criteria are met. For example, a pulmonary embolism is a candidate to be a PPC but will only be a PPC when the specific clinical conditions are met.
- PPC Candidate Admission: A PPC candidate admission is a PPC eligible admission that also has one or more conditions that are candidate complications.
- PPC Specific Exclusion: A set of clinical exclusion criteria used for identifying admissions where a specific PPC may not be preventable and therefore, not assigned. The clinical exclusions most commonly identify complications that are redundant, or are a natural consequence of one of the diagnoses present-on-admission.
- PPC Hierarchy Exclusion: A PPC candidate admission can have more than one candidate complication. Some PPCs have the same assignment criteria except that one of the PPCs is a more significant manifestation of the other complication. In such cases the PPC logic precludes the assignment of the less significant candidate complications based on a hierarchy of related PPCs.

Table 1.4.1 shows examples of the PPC logic as applied to claims data. In Table 1.4.1, hospital-acquired pneumonia, for example, is not considered potentially preventable if any of these conditions is true:

- The patient is under age 18.
- The admission DRG indicates major metastatic cancer, organ transplant, HIV, or major trauma.
- Certain other diagnoses, such as respiratory cancer or pulmonary fibrosis, are present.
- The patient also has chronic pulmonary obstructive disease and the length of stay is less than four days.

Each PPC has PPC-specific logic similar to that shown for the pneumonia PPC. Every patient is therefore at risk for some PPCs, but not others.

Table 1.4.1
Examples of PPC Logic

Pt	Clinical Scenario	PPC	Comment
Example: PPC 05—Pneumonia and Other Lung Infections A patient has diagnosis of 482.39 (Pneumonia Oth Strep) that was not present on admission			
1	Admission APR-DRG 892 (HIV w Major HIV Related Condition)	No	Global exclusion for all PPCs*
2	Patient has primary diagnosis of trauma (e.g., Dx 863.84, Pancreas Injury)	No	Global exclusion for all PPCs*
3	Patient is 17 years old	No	For this PPC, patients under 18 are excluded
4	Patient admission APR-DRG 136 (Respiratory Malignancy)	No	For this PPC, this DRG is excluded
5	Patient has primary or secondary diagnosis of cystic fibrosis	No	For this PPC, Exclusion Group 16 applies**
6	Patient has COPD and length of stay is less than 4 days	No	The inference is that the pneumonia was present on admission
7	25 year old patient, admission APR-DRG 140 (COPD), length of stay = 10 days	Yes	
Example: PPC 55—Obstetrical Hemorrhage without Transfusion A patient is assigned to a delivery obstetrical admission DRG and has diagnosis of 666.12 (Postpa Hem NEC-Del w P/P)			
8	Patient has antepartum hemorrhage	No	For this PPC, Exclusion Group 70 applies**
9	All other patients (unless globally excluded)	Yes	
Example: PPC 57—Obstetric Lacerations & Other Trauma without Instrumentation A patient is assigned to a delivery obstetrical admission DRG and has procedure of 75.62 (Repair OB Lac Rect/Anus)			
10	Patient has body mass index 40 or above	No	For this PPC, Exclusion Group 103 applies**
11	All other patients (unless globally excluded)	Yes	
Example: PPC 35—Septicemia & Severe Infections A patient has diagnosis of 038.12 (MRSA septicemia)			
12	Patient is under age 18 with a medical admission DRG	No	For this PPC, medical patients under 18 are excluded
13	Patient is under age 18 with a surgical admission DRG	Yes	
14	Patient has an infection that triggers PPC 54 (Infections Due to Central Venous Catheters)	Yes	Only the more serious PPC is reported, i.e., PPC 35 not PPC 54
15	Patient has endocarditis	No	For this PPC, Exclusion Group 30 applies**

Notes:

1. * PPC 45 (Post Procedure Foreign Bodies) can be assigned to any stay regardless of global or PPC-specific exclusion criteria.
2. APR-DRG=All Patient-Refined Diagnosis-Related Group; MH/SA=mental health/substance abuse
3. Source: Compiled by TMHP from Hughes et al., PPC Definitions Manual V.29.
4. ** "Exclusion groups" are groups of related diagnoses that are excluded in assigning a specific PPC. For example, Exclusion Group 70 (Antepartum Hemorrhage) is used to prevent the assignment of PPC 55 for obstetric hemorrhage if the patient had an antepartum hemorrhage.

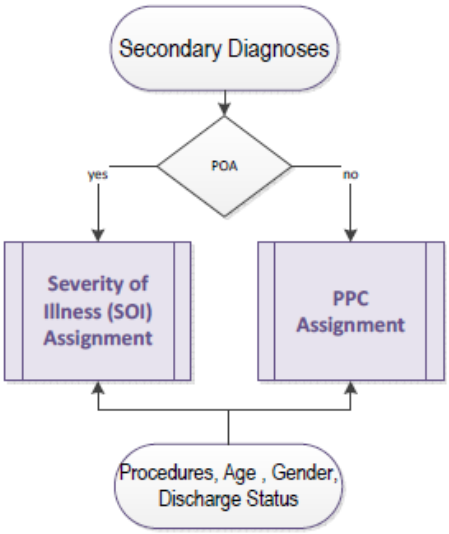
The exclusion of pediatric patients (under age 18) from almost all PPCs is of particular importance for this report. Pediatric inpatients are obviously at risk for a wide range of complications; however, the PPC algorithm is focused on adult medical, adult surgical, and obstetric patients. Although the software does assign PPCs to a few pediatric and newborn stays, in general the stays for these patients are not examined for PPCs. Therefore, these populations were excluded from this analysis. The scope of this report therefore includes adult stays as well as obstetric patients of any age.

The *PPC Definitions Manual* includes detailed listings of the circumstances in which each of the 65 PPCs is and is not assigned. Circumstances are described using specific ICD-9-CM diagnoses and procedure codes.

The PPC logic is designed to fit with the APR-DRG algorithm. The APR-DRG assignment typically reflects all diagnoses present at discharge, including those acquired during the stay. When a secondary diagnosis is not present on admission (POA), it is a candidate for assignment as a PPC as illustrated in Chart 1.4.2 (subject to all the exclusions described earlier). In addition, the performance of specific procedures can result in PPC assignment regardless of the POA values on the claim. Also, note that secondary diagnoses that are present on admission affect the severity of illness and therefore suggest the risk of a PPC, but not the assignment of PPCs. This will be demonstrated in Table 2.3.5, which quantifies the effect of severity of illness on the PPC rate.

Chart 1.4.2

Interplay of Claims Data Elements to Determine PPCs, DRGs, and Risk



Note:

1. *Source* Hughes et al., *PPC Definitions Manual V.29.*

1.5 Estimated Impact of a PPC on the Hospital Cost of Care

In general, the presence of a complication increases the amount of care and therefore the cost of care that a patient receives. An infection may require antibiotics; a laceration, suturing; respiratory failure, mechanical ventilation; kidney failure, dialysis; and so forth. To estimate the incremental impact of a PPC on the hospital cost of care, previous researchers have performed regression analysis using large datasets from the national Medicare population, the Maryland all-payer population, and the California all-payer population. Despite the different populations, these analyses have shown high degrees of correlation between the sets of estimates.[22] In Maryland, where the estimates have been calculated for SFY 2008, SFY 2010, and SFY 2011, there also has been high correlation across the years.

The incremental impact of a PPC on the hospital's cost of care was estimated for each PPC through regression analysis.

For this report, cost estimates were calculated based on Texas Medicaid FFS and PCCM SFY 2011 data using the same methodology as in the Medicare, California, and Maryland analyses. The methodology is fully described in Appendix Section C.6. In brief, Minitab 16 software was used to run a linear regression model to derive estimates of the separate impacts of each APR-DRG and each PPC on the cost of care statewide. The regression yielded estimates of the incremental impact of each PPC on the cost of care. These estimates were evaluated for statistical stability at the 95 percent confidence level. Of the 65 PPCs listed in Table C.6.1, the estimated cost impacts were calculated for the 62 PPCs that occurred at least once in the dataset. Of these, 17 estimated impacts did not meet the standard for stability. For example, the most common PPC, PPC 55 (Obstetrical Hemorrhage without Transfusion), had an estimated cost impact of $75, a standard error of $144 and a t-statistic of 0.52 (=$75/$144). The low t-statistic did not meet the 95 percent confidence level needed to infer that the estimated impact actually differed from zero (Table C.6.1). For these 17 PPCs, the estimated cost impact was therefore shown as zero. For the 45 PPCs where a stable cost impact was estimated, the estimates ranged from $975 (PPC 24, Renal Failure without Dialysis) to $64,677 (PPC 38, Post-Operative Wound Infection and Deep Wound Disruption with Procedure).

1.6 Reporting PPC Results

Actual PPC results will be reported using five measures of incidence and cost.

1.6.1 Actual PPC Results

Results are reported using five related measures:

- "PPC stays" refer to the number of stays with at least one PPC. For example, a stay with both septicemia (PPC 35) and respiratory failure (PPC 03) would count as one PPC stay.
- "PPC rate" refers to the number of stays with at least one PPC divided by the total number of stays. If there were one stay with at least one PPC in 100 stays, then the PPC rate would be 1 percent.
- "PPC count" refers to a count of PPCs. In the above example, there would be two PPCs.
- "PPCs per 100 stays" refers to the count of PPCs per 100 stays. In the above example, there would be two PPCs per 100 stays.
- "PPC cost" is obtained by multiplying the estimated cost impact of a specific PPC by its frequency. In the above example, the PPC cost would be [(1 x $17,491) + (1 x 6,837)] = $24,328 for these two PPCs combined. (The example uses cost impacts estimated from Texas data, as explained in Section 1.5.)

- The relevance of each measure depends on the question being addressed. A focus on PPC stays is appropriate when analyzing the number of patients affected by a PPC. A focus on the PPC count is appropriate when focusing on PPCs themselves. For example, renal failure without dialysis (PPC 24) is the most common non-obstetric PPC. Renal failure can occur among patients with various DRGs. A focus on PPC cost is useful in quantifying the financial impact of PPCs, especially given the wide range of impacts.

Because casemix has a substantial effect on PPC incidence, expected PPC results take into account the casemix of a particular hospital or other sub-population.

1.6.2 Expected PPC Results

Although the 3M PPC algorithm identifies the presence of a PPC during an inpatient stay, it does not calculate hospital-wide rates or adjust these rates for differences in patient casemix. In fact, PPC rates vary considerably depending on patient condition, so casemix adjustment is essential in generating fair comparisons across hospitals or any other patient populations. TMHP therefore followed precedent set in the potentially preventable readmission (PPR) reports to calculate "expected" PPC results, where the expectation reflects the casemix of a particular hospital. Hospital performance is then compared not in terms of actual PPC rates but rather in terms of each hospital's actual PPC rate compared with the PPC rate that would be expected for a peer hospital with the same casemix.

The two key casemix adjustors, as identified in previous studies and as seen in this dataset, are the reason for admission and the severity of illness, which are captured by the four-digit APR-DRG code. (Note: Many other patient-specific characteristics have already been taken into account by the software in determining first the APR-DRG and then whether a particular complication would be classified as a PPC.)

Expected PPC results were calculated based on statewide norms calculated from Texas Medicaid FFS and PCCM data. The norms were calculated as follows, using an analytic technique known as indirect standardization.

- ***PPC stays***: For each APR-DRG, the statewide number of stays with at least one PPC was calculated, taking into account the number of stays that were at risk for a PPC. These norms by APR-DRG were used to calculate the expected number of PPC stays by hospital.
- ***PPC count***: For each combination of APR-DRG and PPC, the statewide count of PPCs was calculated, taking into account the number of stays that were at risk for each specific PPC. These norms by APR-DRG and PPC were used to calculate the expected count by hospital for each PPC.
- ***PPC cost***: The expected PPC cost by hospital was calculated by multiplying the expected PPC count by the estimated cost impact of each PPC.

Table 1.6.2.1 shows an example of how the expected PPC count was generated for a specific hospital (using illustrative numbers for ease of understanding). The table demonstrates that for a particular hospital the expected incidence of PPC 03 in patients with DRG 139-1 would equal the number of stays at risk for that particular PPC times the average incidence rate from the statewide norms. Even within DRG 139-1, the number of stays at risk for PPC 03 will differ from the number of stays at risk for other PPCs. (The difference reflects the PPC-specific exclusion criteria that were described in Section 1.4.)

In general, the statewide average was used as the benchmark or norm. For example, for stays in APR-DRG 139-3, the norm was that 2.9% of stays at risk for PPC 03 would be expected to show PPC 03. The only exception would be when there is an outlier contained within the data set that significantly influences the norm. In situations like this the statistical best practice calls for elimination of any such outliers.

Table 1.6.2.1
Example of Calculation of Expected PPC Rate for a Specific Hospital
PPC 03, Acute Pulmonary Edema and Respiratory Failure without Ventilation

A	B	C	D	E	F	G	H	I	J
APR-DRG	Total Stays	Stays at Risk	Statewide PPC Norm	Actual PPCs	Expected PPCs	Actual / Expected PPC Count	Actual PPC Cost	Expected PPC Cost	Actual / Expected PPC Cost
139-1 Pneumonia	200	180	0.000	0	0		$0	$0	
139-2 Pneumonia	200	190	0.000	0	0		$0	$0-	
139-3 Pneumonia	250	175	0.029	5	5.08	0.99	$34,185	$34,732	0.99
139-4 Pneumonia	100	80	0.168	15	13.44	1.12	$102,555	$91,889	1.12
194-1 Heart Failure	300	260	0.000	0	0		$0	$0	
194-2 Heart Failure	400	390	0.000	0	0		$0	$0	
194-3 Heart Failure	500	450	0.016	6	7.20	0.83	$41,022	$49,226	0.83
194-4 Heart Failure	50	40	0.255	6	10.20	0.59	$41,022	$69,737	0.59
All stays	2,000	1,765		32	35.92	0.89	$218,784	$245,584	0.89

Explanation:

1. A specific hospital has 2,000 stays for pneumonia and heart failure, as shown in Column B. (The number 2,000 is made up for purposes of this example.)
2. The number of stays at risk for PPC 03 is 1,765. (This number is also made up for this example.) The same set of stays will have different subsets of stays at risk for each PPC, because the criteria of assigning a PPC differ by PPC.
3. For APR-DRG 139-3, this hospital has five incidences of PPC 03. Based on the statewide incidence of PPC 03 under APR-DRG 139-3, the expected incidence is 175 x 0.029 = 5.08.
4. The estimated cost of PPC 03 = $6,837 (from Appendix Table C.6.1). This estimate is multiplied by the counts of actual and expected incidences of PPC 03 in order to arrive at the actual and expected cost of this PPC.
5. This same procedure is followed for 1,256 APR-DRGs x 65 PPCs for each hospital.
6. In this simplified example, the sum of actual PPCs = 32 while the sum of expected PPCs = 35.92, for an A/E ratio of 0.89. The actual PPC cost = $218,784, while the expected A/E cost = $245,584. The A/E ratio = 0.89. For a given PPC, a hospital's A/E ratio will always be the same for the PPC count and the PPC cost. Across a group of PPCs within a specific hospital, the two A/E ratios will usually differ.

1.6.3 Comparing Performance among Hospitals and Other Sub-Populations

As noted in Section 1.6.2, simple counts of PPC stays or of PPCs or sums of PPC costs cannot be used to compare performance among hospitals or other sub-populations. Because it reflects a difference in casemix, the ratio of actual PPCs to expected PPCs is the appropriate measure.

PPC Performance Ratio = Actual / Expected Ratio = Actual PPC Result / Expected PPC Result

For example, if Hospital A had 100 PPC stays but 120 PPC stays were expected, the A/E ratio would be 100/120 = 0.83. If Hospital B had 90 PPC stays but 85 PPC stays were expected, the A/E ratio would be 1.06. That is, the performance of Hospital A was better even though Hospital A had more PPC stays.

The ratio of actual PPC performance to expected PPC performance is the appropriate measure to compare performance across hospitals or other sub-populations.

1.6.4 Interpretation of Results

The results in this report are the actual data for the Texas Medicaid FFS and PCCM population in SFY 2011. The results are not based on sample data so they need not include caveats about their statistical significance so long as inferences are drawn only about the Texas Medicaid FFS and PCCM population in SFY 2011.

Results need to be interpreted carefully for hospitals that have low volumes of Medicaid stays.

Results for small hospitals or other populations with few stays are sensitive to the presence or absence of even one PPC. For example, if a hospital with 50 stays has two stays with PPCs, then it has a PPC rate of 4 percent. If it has just one additional PPC stay, then its PPC rate would be 6 percent—which would be a 50 percent increase. Two aspects of the methodology lessen the potentially misleading effects of analyzing relatively small numbers of stays.

- ***Low-volume hospitals—***A hospital is defined as "low volume" if it does not have at least 40 stays, at least five actual PPC stays, and at least five expected PPC stays. The results for low-volume hospitals will be reported to those hospitals, but will not be evaluated for statistical significance and are not included in the discussion of statewide patterns. However, data from low volume hospitals are used in the establishment of the norms.
- ***Test of statistical significance—***Although the results were only calculated for SFY 2011, a test of statistical significance can suggest whether the SFY 2011 results might also apply to a broader time frame. Statistical significance depends on two factors: the number of stays and the difference between actual complications and expected complications. Intuitively, there would be more confidence that the "true" rate is higher than expected when the actual/expected (A/E) ratio is 1.40 than when the A/E ratio is 1.10. Similarly, there would be higher confidence in an A/E ratio that is based on 5,000 stays rather than on an A/E ratio that is based on 100 stays.
- The significance of hospital-specific A/E ratios was tested using the Cochran-Mantel-Haenszel (CMH) test of conditional independence.[23] The CMH statistic indicates the likelihood that the observed A/E ratio differs from 1.00 simply by chance. The number of hospitals in which the difference between the A/E ratio and 1.00 is statistically significant will also be shown using the 90 percent confidence level.

2 Statewide Results

2.1 Overall PPC Incidence

Overall, 6% of adult stays and 8% of obstetric stays included at least one PPC.

In SFY 2011, there were 21,774 potentially preventable complications (PPCs) within the analytical dataset. As discussed in Section 1.4 and as shown in Table 2.1.1, the PPC algorithm is much more applicable to the obstetric and adult populations than to the newborn and pediatric populations. The 3M PPC logic for almost all non-obstetric PPCs excludes patients under age 18 by definition. Therefore, Tables 2.1.2 through 2.5.2 refer only to the obstetric and adult populations (i.e., the "analytical dataset").

Overall, 6.0 percent of adult stays and 8.0 percent of obstetric stays included at least one PPC. Within the adult population, surgical patients were at higher risk for a PPC than medical patients. Patients admitted with mental health or substance abuse conditions were at low risk for a PPC (although they were at substantial risk for a potentially preventable readmission, as demonstrated in the most recent PPR report).

Table 2.1.1

Potentially Preventable Complications, by Medicaid Care Category

Medicaid Care Category	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/ PPC Stay	PPCs/ 100 Stays	PPC Cost
Included in Analytical Dataset							
Adult--Circulatory	16,089	1,415	8.8%	2,046	1.45	12.7	$14,826,726
Adult--Other medical	73,441	3,227	4.4%	4,228	1.31	5.8	$32,260,834
Adult--Other surgical	23,104	2,578	11.2%	3,981	1.54	17.2	$34,929,540
Adult--MH/SA	8,012	74	0.9%	91	1.23	1.1	$641,341
Subtotal adult	120,646	7,294	6.0%	10,346	1.42	8.6	$82,658,440
Obstetrics	131,348	10,534	8.0%	11,428	1.08	8.7	$6,041,432
Analytical dataset	251,994	17,828	7.1%	21,774	1.22	8.6	$88,699,873
Excluded from Analytical Dataset							
Pediatric--Respiratory	15,204	8	0.1%	8	1.00	0.1	$168,956
Pediatric--Other medical	19,376	5	0.0%	5	1.00	0.0	$114,045
Pediatric--Other surgical	5,393	35	0.6%	35	1.00	0.6	$662,839
Pediatric--MH/SA	4,593	0	0.0%	0	0.00	0.0	$0
Subtotal pediatric	44,566	48	0.1%	48	1.00	0.1	$945,840
Newborns	124,320	21	0.0%	21	1.00	0.0	$470,791
Total excluded	168,886	69	0.0%	69	1.00	0.0	$1,416,631
Total stays	420,880	17,897	4.3%	21,843	1.22	5.2	$90,116,504

Notes:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.

If a stay included one PPC, it often included more than one. In the analytical dataset, the average stay with at least one PPC included 1.22 PPCs (Table 2.1.1). For adult surgical patients, for example, the average number of PPCs per PPC stay was 1.54. The adult surgical category also had a higher rate of PPCs per 100 stays, which reflected both the likelihood of at least one PPC occurring and the number of PPCs per PPC stay.

Each of the 65 PPCs was categorized into one of eight PPC groups. Table 2.1.2 shows the breakdown of the 21,774 PPCs by PPC group while Table 2.1.3 shows the incidence of the 25 most common PPCs. The tables show that obstetrical complications were most common, but other types of complications were more costly. In part, this reflects the fact that the estimated cost impact of several obstetric PPCs did not meet the criteria for statistical stability, as discussed in Appendix Section C.6. For these PPCs, the cost impact is counted as zero in Tables 2.1.2 and 2.1.3. Within the "obstetrics complications" PPC group in Table 2.1.2, there were also some obstetric PPCs that had statistically stable estimated cost impacts, which is why the PPC cost for this group is shown as positive but low. But even if a positive cost had been used for every obstetric PPC (e.g., by applying cost estimates from another state), obstetric PPCs usually have relatively small cost impacts per PPC. Other PPCs, such as pneumonia and septicemia, are less common but tend to have larger cost impacts.

Table 2.1.3 shows that the most common PPC by far was PPC 55, Obstetrical Hemorrhage without Transfusion. This is the result of an outlier situation as explained in section 1.6.2. Though deliveries always involve bleeding, this diagnosis code refers to "anemia due to frank, rapid blood loss."[24] It therefore seems possible that post-delivery hemorrhages may be overstated due to some coding outliers. To mitigate the impact of this apparent anomaly on comparisons of hospital performance, the statewide norms for PPC 55 were calculated after carefully reviewing and removing any outliers.

Table 2.1.2
Summary by PPC Group

PPC Group Description	PPC Count	% of All PPCs	PPC Cost	% of PPC Cost
Obstetrical Complications	10,804	50%	$1,427,682	2%
Cardiovascular-Respiratory Complications	2,922	13%	$23,187,061	26%
Infectious Complications	2,458	11%	$22,703,327	26%
Other Medical and Surgical Complications	2,423	11%	$5,967,346	7%
Extreme Complications	1,318	6%	$16,107,188	18%
Perioperative Complications	779	4%	$6,855,759	8%
Malfunctions, Reactions, etc.	606	3%	$5,925,222	7%
Gastrointestinal Complications	464	2%	$6,526,289	7%
Totals	21,774	100%	$88,699,873	100%

Notes:

1. PPC groups are mutually exclusive clinically descriptive 3M categories to facilitate reporting and display of PPCs.
2. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Appendix Section C.6.

Table 2.1.3 Summary of Top 25 PPCs by Frequency						
PPC	Description	Group Description	PPC Count	% PPC	Cost per PPC	PPC Cost
55	Obstetrical Hemorrhage w/out Transfusion	Obstetrical Complications	6,306	29.0%	$0	$0
24	Renal Failure w/out Dialysis	Other Medical and Surgical Complications	1,709	7.8%	$975	$1,666,788
57	Obstetric Lacerations & Other Trauma w/out Instrumentation	Obstetrical Complications	1,663	7.6%	$0	$0
65	Urinary Tract Infection	Infectious Complications	1,266	5.8%	$6,494	$8,221,151
59	Medical & Anesthesia Obstetric Complications	Obstetrical Complications	787	3.6%	$0	$0
56	Obstetrical Hemorrhage with Transfusion	Obstetrical Complications	740	3.4%	$1,929	$1,427,682
35	Septicemia & Severe Infections	Infectious Complications	688	3.2%	$17,491	$12,033,877
5	Pneumonia & Other Lung Infections	Cardiovascular-Respiratory Complications	672	3.1%	$9,249	$6,215,328
58	Obstetric Lacerations & Other Trauma with Instrumentation	Obstetrical Complications	643	3.0%	$0	$0
3	Acute Pulmonary Edema and Respiratory Failure w/out Ventilation	Cardiovascular-Respiratory Complications	612	2.8%	$6,837	$4,184,428
9	Shock	Extreme Complications	428	2.0%	$19,841	$8,491,948
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	Extreme Complications	394	1.8%	$5,509	$2,170,428
40	Post-Operative Hemorrhage & Hematoma w/out Hemorrhage Control Procedure or I&D Procedure	Perioperative Complications	344	1.6%	$7,334	$2,522,999
14	Ventricular Fibrillation/Cardiac Arrest	Extreme Complications	340	1.6%	$6,294	$2,140,062
6	Aspiration Pneumonia	Cardiovascular-Respiratory Complications	297	1.4%	$8,408	$2,497,295
62	Delivery with Placental Complications	Obstetrical Complications	265	1.2%	$0	$0
8	Other Pulmonary Complications	Cardiovascular-Respiratory Complications	254	1.2%	$4,186	$1,063,244
61	Other Complications of Obstetrical Surgical & Perineal Wounds	Obstetrical Complications	236	1.1%	$0	$0
52	Inflammation & Other Complications of Devices, Implants or Grafts except Vascular Infection	Malfunctions, Reactions, etc.	235	1.1%	$11,044	$2,595,411
47	Encephalopathy	Other Medical and Surgical Complications	225	1.0%	$3,382	$760,995
42	Accidental Puncture/Laceration during Invasive Procedure	Perioperative Complications	222	1.0%	$2,233	$495,659
11	Acute Myocardial Infarction	Cardiovascular-Respiratory Complications	221	1.0%	$0	$0
16	Venous Thrombosis	Cardiovascular-Respiratory Complications	211	1.0%	$13,465	$2,841,052
1	Stroke & Intracranial Hemorrhage	Cardiovascular-Respiratory Complications	204	0.9%	$16,067	$3,277,586
19	Major Liver Complications	Gastrointestinal Complications	185	0.8%	$17,958	$3,322,193
Top 25 PPCs			19,147	88%		$65,928,125
All PPCs			21,774	100%		$88,699,873

Notes:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.
2. See Appendix Table B.1 for the complete list of PPCs.

2.2 Impact on Hospital Cost and Medicaid Payment

In addition to their impacts on patients, potentially preventable complications have two types of effects in financial terms. In both cases, the word "potentially" should be emphasized. Not all complications are preventable, and therefore, it is not feasible to reduce hospital costs and Medicaid payments for PPCs to zero.

2.2.1 Hospital Cost

$88.7 million or 4.2 percent of the $2.1 billion cost of Texas FFS and PCCM care was attributable to PPCs.

For the 251,994 stays within the analytical dataset, the estimated hospital cost of care was $2.1 billion (Table 2.2.1.1). This estimate was based on hospital charges and hospital-specific cost-to-charge ratios. Within this $2.1 billion, the cost attributable to PPCs was estimated at $88.7 million. The resulting ratio of 4.2 percent is lower than similar ratios estimated for the nationwide Medicare population (11.0 percent), the California all-payer population (9.4 percent), and the Maryland all-payer population (9.6 percent).[25] The lesser magnitude reflects the differences in casemix among the four populations. The Texas dataset had a much higher proportion of obstetrics while the other three populations included a higher proportion of adults with multiple comorbidities who are more vulnerable to serious complications. Additionally, several of the most common PPCs in the Texas analytical dataset had an estimated cost impact of zero, as explained in Section 1.5.

Across all stays in the analytical dataset, the estimated dollar impact of PPCs was modest at $352 per stay (Table 2.2.1.1). For adults with circulatory conditions or surgical conditions, however, it was more notable–$922 per circulatory stay and $1,512 per surgical stay.

It should also be noted that these cost estimates exclude the cost of care provided by physicians, post-discharge providers, and other non-hospital providers.

Table 2.2.1.1

Estimated Impact of PPCs on the Hospital Cost of Care

Medicaid Care Category	Total Stays	Estimated Hospital Cost	Cost / Stay	PPC Stays	PPC Rate	PPC Count	PPC Cost	PPC Cost / Total Cost	PPC Cost / Total Stays
Adult--Circulatory	16,089	$233,231,402	$14,496	1,415	8.8%	2,046	$14,826,726	6.4%	$922
Adult--Other medical	73,441	$776,942,011	$10,579	3,227	4.4%	4,228	$32,260,834	4.2%	$439
Adult--Other surgical	23,104	$594,152,428	$25,716	2,578	11.2%	3,981	$34,929,540	5.9%	$1,512
Adult--MH/SA	8,012	$39,319,316	$4,908	74	0.9%	91	$641,341	1.6%	$80
Subtotal adult	120,646	1,643,645,157	$13,624	7,294	6.0%	10,346	$82,658,440	5.0%	$685
Obstetrics	131,348	$473,734,835	$3,607	10,534	8.0%	11,428	$6,041,432	1.3%	$46
Analytical dataset	251,994	$2,117,379,991	$8,403	17,828	7.1%	21,774	$88,699,873	4.2%	$352

Notes:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.

2.2.2 Medicaid Payment

It is also relevant to examine the impact on Medicaid payments. That is, how much of Medicaid's payment is for potentially preventable complications? This is not a straightforward question but Table 2.2.2.1 illustrates how it can be answered.

In SFY 2011, Texas Medicaid used MS-DRGs to calculate payment for most of the hospitals whose data is included within the analytical dataset. The APR-DRG algorithm used in this report differs from MS-DRGs but the principle is the same. That is, the presence of a PPC only affects payment if it causes the stay to group to a different DRG. Consider, for example, the presence or absence of a potentially preventable urinary tract infection (UTI). If the UTI affects the DRG assignment, then it affects payment; otherwise, it does not.

In one-third of PPC stays, the DRG or severity of illness changes due to the presence of a PPC.

Of the 17,828 PPC stays in the analytical dataset, 6,753 stays would have had a different APR-DRG if the PPC diagnoses had been ignored (Table 2.2.2.1). In 96 percent of these situations, the effect of the PPC was to increase the level of severity within the same base APR-DRG. For example, a stay might be assigned to APR-DRG 139-2 (pneumonia, severity 2) without the PPC but APR-DRG 139-3 (pneumonia, severity 3) with the PPC. In the other 4 percent of situations, the effect was to push the stay into a different base APR-DRG. For example, a stay might be assigned to base APR-DRG 134 (Pulmonary Embolism) without the PPC but base APR-DRG 004 (Tracheostomy with Mechanical Ventilation 96+ Hrs) with the PPC.

For these 6,753 stays, the total casemix (that is, the average casemix per stay times the number of stays) was 14,031 including the PPCs and 8,403 excluding the PPCs (Table 2.2.2.1). For all 251,994 stays in the analytical dataset, total casemix was 298,832 including the PPCs and 293,204 excluding the PPCs. That is, if not for the PPCs the total casemix would have been 1.9 percent lower than it was. Medicaid payment does not track casemix exactly, but in general it is fair to say that higher casemix is associated with higher payment. Given total Medicaid payment of $1.1 billion for the stays in the analytical dataset, approximately 1.9 percent or $20.9 million may be thought of as Medicaid payment for PPCs in the adult and obstetric populations, excluding hospitals that were exempt from POA reporting.

Table 2.2.2.1 Top 25 Base APR-DRGs Stays Where Presence of a PPC Affected DRG Assignment								
Base APR-DRG	Stays Change DRG	Stays Change Base DRG	Stays Change SOI	Billed Charges	Estimated Hospital Cost	Payment	APR-DRG Total Casemix w/out PPC Diagnoses	APR-DRG Total Casemix All Diagnoses
560 Vaginal Del	2,955	174	2781	$31,370,363	$9,954,415	$5,495,069	1,204	1,525
540 Cesarean Del	951	-	951	$22,141,362	$6,891,823	$3,250,577	675	1,014
541 Vag Del w Ster &/or D&C	339	-	339	$4,330,325	$1,417,603	$528,164	182	206
194 Heart Failure	148	1	147	$7,464,755	$2,054,031	$864,769	170	312
140 COPD	82	4	78	$5,136,688	$1,358,747	$554,255	94	159
139 Oth Pneumonia	73	16	57	$7,360,964	$2,216,531	$829,717	100	256
165 Coronary Bypass w Cath	66	1	65	$14,948,525	$3,933,253	$1,700,566	401	536
221 Maj Small & Large Bowel Procs	65	5	60	$11,860,314	$3,432,964	$1,530,806	254	460
045 CVA & Precereb Occl w Infarct	58	6	52	$6,944,401	$2,212,630	$766,488	124	250
383 Cellulitis & Oth Bact Skin Inf	55	1	54	$4,482,166	$1,110,895	$306,286	61	132
460 Renal Failure	50	2	48	$5,497,028	$1,532,932	$413,704	74	187
302 Knee Joint Replacement	46	-	46	$3,924,750	$1,120,235	$540,403	120	176
720 Septicemia & Disseminated Inf	45	-	45	$3,536,764	$1,029,878	$332,833	68	149
021 Craniotomy Exc for Trauma	39	7	32	$12,357,568	$3,710,053	$1,637,013	243	427
174 Percut CV Procs w AMI	38	-	38	$3,672,684	$1,006,340	$534,986	120	169
420 Diabetes	38	2	36	$3,144,587	$952,412	$283,210	37	90
130 Resp Sys Diag w MV 96+ Hrs	37	-	37	$7,954,153	$1,961,602	$857,918	221	258
263 Laparoscopic Cholecystectomy	33	-	33	$2,496,383	$755,900	$286,772	59	107
305 Amput of Lower Limb Exc Toes	33	1	32	$3,661,355	$1,253,763	$582,725	89	167
166 Coronary Bypass w/o Cath	32	4	28	$8,098,911	$2,449,449	$857,492	156	261
137 Maj Resp Inf & Inflammations	31	9	22	$4,314,821	$1,233,859	$450,735	66	133
191 Cardiac Cath Exc Ischem Disease	31	-	31	$3,084,681	$859,818	$278,385	68	118
005 Trach, MV 96+ Hrs, w/o Ext Proc	30	-	30	$13,494,258	$3,319,601	$1,224,266	279	378
951 Mod Ext Proc Unrel To Diag	30	-	30	$6,380,751	$1,275,962	$527,628	85	194
282 Dis of Pancreas Exc Malig	29	4	25	$3,501,356	$1,122,590	$319,596	47	110
Top 25 base DRGs with DRG change	5,334	237	5,097	201,159,914	$58,167,287	$24,954,364	4,996	7,775
All PPC stays with DRG change	6,753	281	6,472	$382,664,561	$107,890,774	$43,333,939	8,403	14,031
All stays	251,994	281	6,472	$7,583,477,827	$2,117,379,991	$1,107,306,010	293,204	298,832

Notes:

1. Casemix was measured using Texas Medicaid relative weights for APR-DRG V.29.
2. SOI=severity of illness
3. See Appendix Table B.2 for the full list of APR-DRGs where the presence of a PPC affected DRG assignment.

2.3 PPC Incidence by Reason for Admission and Severity of Illness

The incidence of PPCs depends predictably on both the reason for the admission and the severity of illness. In the APR-DRG grouping algorithm, the first three digits may be thought of as the principal reason why the patient is in the hospital. Reasons for admission typically reflect diagnoses (e.g., pneumonia, septicemia) or major procedures (e.g., heart valve replacement, appendectomy). The fourth digit of the DRG indicates the severity of illness, that is, the complications and comorbidities that can have major impacts on how sick a patient is. Tables 2.3.1, 2.3.2, and 2.3.3 show PPC incidence by base APR-DRG, sorted in three different orders:

The incidence of PPCs varies substantially based on both the reason for admission and the severity of illness.

- Declining order by total PPC stays
- Declining order by total stays, regardless of whether a PPC was present
- Declining order by PPC risk, that is, total PPCs per 100 stays

Table 2.3.1 PPC Incidence by Top 25 Base APR-DRG: In Declining Order by PPC Stays							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs / PPC Stay	PPCs / 100 Stays	PPC Cost
560 Vaginal Del	72,530	6,324	8.7%	6,657	1.05	9.2	$1,232,294
540 Cesarean Del	40,444	3,136	7.8%	3,552	1.13	8.8	$3,489,506
541 Vag Del w Ster &/or D&C	4,900	759	15.5%	827	1.09	16.9	$255,595
194 Heart Failure	4,091	330	8.1%	417	1.26	10.2	$2,496,272
720 Septicemia & Disseminated Inf	4,040	230	5.7%	283	1.23	7.0	$1,997,288
542 Vag Del w Proc Exc Ster &/or D&C	222	196	88.3%	261	1.33	117.6	$83,382
221 Maj Small & Large Bowel Procs	962	194	20.2%	316	1.63	32.8	$3,414,564
460 Renal Failure	2,754	193	7.0%	251	1.30	9.1	$2,360,634
005 Trach, MV 96+ Hrs, w/o Ext Proc	402	176	43.8%	340	1.93	84.6	$3,427,657
140 COPD	4,018	154	3.8%	180	1.17	4.5	$1,049,349
045 CVA & Precereb Occl w Infarct	1544	150	9.7%	219	1.46	14.2	$1,526,631
139 Oth Pneumonia	3,145	149	4.7%	176	1.18	5.6	$1,131,341
165 Coronary Bypass w Cath	356	141	39.6%	241	1.71	67.7	$1,624,321
173 Oth Vascular Procs	750	136	18.1%	197	1.45	26.3	$1,774,387
130 Resp Sys Diag w MV 96+ Hrs	518	135	26.1%	228	1.69	44.0	$2,019,026
133 Pulmon Edema & Resp Failure	1,409	117	8.3%	148	1.26	10.5	$1,001,304
383 Cellulitis & Oth Bact Skin Inf	3244	110	3.4%	151	1.37	4.7	$1,064,398
004 Trach, MV 96+ Hrs, w Ext Proc	334	108	32.3%	257	2.38	76.9	$2,878,181
302 Knee Joint Replacement	909	104	11.4%	127	1.22	14.0	$785,006
305 Amput of Lower Limb Exc Toes	466	98	21.0%	149	1.52	32.0	$1,114,445
263 Laparoscopic Cholecystectomy	1,736	97	5.6%	152	1.57	8.8	$1,454,257
021 Craniotomy Exc for Trauma	501	97	19.4%	164	1.69	32.7	$1,538,223
174 Percut CV Procs w AMI	686	96	14.0%	144	1.50	21.0	$1,152,071
420 Diabetes	2,530	94	3.7%	113	1.20	4.5	$854,500
710 Inf & Parasit Dis Incl HIV w O.R. Proc	725	93	12.8%	122	1.31	16.8	$823,520
Top 25	153,216	13,417	8.8%	15,672	1.17	10.2	$40,548,151
All DRGs	251,994	17,828	7.1%	21,774	1.22	8.6	$88,699,873
Top 25 as percent of all	61%	75%		72%			46%

Notes:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.

Table 2.3.1 shows the APR-DRGs that account for the highest numbers of PPC stays. The four obstetric delivery APR-DRGs (540, 541, 542, and 560) accounted for 47 percent of all stays and 52 percent of all PPCs. This is due to an outlier in the data set, which was removed for the purpose of calculating a statistically defensible statewide benchmark. The actual experience, however, remained in the total calculations, which is why the true number of PPC's appears overstated.

In terms of PPC cost, the impact was notable on APR-DRG 005 (Tracheostomy, Mechanical Ventilation over 96 hours, Without Extensive Procedure) and APR-DRG 221 (Major Small and Large Bowel Procedures). Although these APR-DRGs were relatively uncommon, the percentage of patients that had a PPC, the average number of PPCs per PPC stay, and the cost impact of the PPCs were all relatively high. PPCs added $8,527 to the average hospital cost of APR-DRG 005 (e.g., $3,427,657 / 402 = $8,527) and $3,549 to the average hospital cost of APR-DRG 221.

Table 2.3.2 ranks the 25 most common base DRGs, that is, the 25 most common reasons for hospitalization. These DRGs represent 70 percent of all stays in the analytical dataset. Within the obstetrical category, it is clear that the risk of a PPC is highest for deliveries; the PPC rate for antepartum diagnoses is relatively low.

Table 2.3.2

PPC Incidence by Top 25 Base APR-DRG: In Declining Order by Total Stays

Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs / PPC Stay	PPCs / 100 Stays	PPC Cost
560 Vaginal Del	72,530	6,324	8.7%	6,657	1.05	9.2	$1,232,294
540 Cesarean Del	40,444	3,136	7.8%	3,552	1.13	8.8	$3,489,506
566 Oth Antepartum Diags	7,569	54	0.7%	58	1.07	0.8	$466,962
541 Vag Del w Ster &/or D&C	4,900	759	15.5%	827	1.09	16.9	$255,595
194 Heart Failure	4,091	330	8.1%	417	1.26	10.2	$2,496,272
720 Septicemia & Disseminated Inf	4,040	230	5.7%	283	1.23	7.0	$1,997,288
140 COPD	4,018	154	3.8%	180	1.17	4.5	$1,049,349
383 Cellulitis & Oth Bact Skin Inf	3,244	110	3.4%	151	1.37	4.7	$1,064,398
139 Oth Pneumonia	3,145	149	4.7%	176	1.18	5.6	$1,131,341
460 Renal Failure	2,754	193	7.0%	251	1.30	9.1	$2,360,634
750 Schizophrenia	2,620	13	0.5%	14	1.08	0.5	$87,173
463 Kidney & Urinary Tract Inf	2,585	75	2.9%	91	1.21	3.5	$732,409
420 Diabetes	2,530	94	3.7%	113	1.20	4.5	$854,500
753 Bipolar Dis	2,504	15	0.6%	16	1.07	0.6	$109,090
425 Electrolyte Dis Exc Hypovolemia	2,194	59	2.7%	80	1.36	3.6	$557,519
053 Seizure	1,983	57	2.9%	74	1.30	3.7	$591,552
563 Threatened Abortion	1,977	11	0.6%	11	1.00	0.6	$62,825
263 Laparoscopic Cholecystectomy	1,736	97	5.6%	152	1.57	8.8	$1,454,257
751 Maj Depression	1,682	13	0.8%	13	1.00	0.8	$63,876
812 Poisoning of Medicinal Agents	1,630	56	3.4%	70	1.25	4.3	$576,694
282 Dis of Pancreas Exc Malig	1,556	75	4.8%	96	1.28	6.2	$681,703
045 CVA & Precereb Occl w Infarct	1,544	150	9.7%	219	1.46	14.2	$1,526,631
513 Uterine/Adnexa Procs Non-Malig	1,506	92	6.1%	105	1.14	7.0	$745,099
133 Pulmon Edema & Resp Failure	1,409	117	8.3%	148	1.26	10.5	$1,001,304
662 Sickle Cell Anemia Crisis	1,398	43	3.1%	57	1.33	4.1	$469,543
Top 25	175,589	12,406	7.1%	13,811	1.11	7.9	$25,057,812
All DRGs	251,994	17,828	7.1%	21,774	1.22	8.6	$88,699,873
Top 25 as percent of all	70%	70%		63%			28%

Notes:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.

Table 2.3.3 ranks the base DRGs in terms of the PPC risk, that is, in terms of PPCs per 100 stays. (DRGs with fewer than 40 stays are not shown.) This table can be useful to hospitals that wish to identify those patients who are most at risk for a PPC. These patients typically have an above-average risk of experiencing at least one PPC (the "PPC rate") *and* above-average risk for multiple PPCs per stay ("PPCs/PPC stay"). Patients undergoing cardiac procedures and those with tracheostomies are at high risk of a PPC, as are the small number of patients in DRG 542 (Vaginal Delivery with Procedure except Sterilization and/or D&C).

Table 2.3.3

PPC Incidence by Top 25 Base APR-DRG: In Declining Order by PPC Risk

Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs / PPC Stay	PPCs / 100 Stays	PPC Cost
542 Vag Del w Proc Exc Ster &/or D&C	222	196	88.3%	261	1.33	117.6	$83,382
162 Cardiac Valve Procs w Cath	53	35	66.0%	58	1.66	109.4	$395,176
005 Trach, MV 96+ Hrs, w/o Ext Proc	402	176	43.8%	340	1.93	84.6	$3,427,657
163 Cardiac Valve Procs w/o Cath	114	52	45.6%	96	1.85	84.2	$746,783
004 Trach, MV 96+ Hrs, w Ext Proc	334	108	32.3%	257	2.38	76.9	$2,878,181
165 Coronary Bypass w Cath	356	141	39.6%	241	1.71	67.7	$1,624,321
169 Maj Vascular Procs	138	47	34.1%	84	1.79	60.9	$753,400
950 Ext Proc Unrel To Diag	232	63	27.2%	127	2.02	54.7	$1,254,525
405 Oth Procs for Metabolic Dis	71	20	28.2%	33	1.65	46.5	$370,632
166 Coronary Bypass w/o Cath	215	64	29.8%	96	1.50	44.7	$633,037
130 Resp Sys Diag w MV 96+ Hrs	518	135	26.1%	228	1.69	44.0	$2,019,026
261 Maj Biliary Tract Procs	46	13	28.3%	19	1.46	41.3	$243,949
220 Maj Stomach & Esophag Procs	229	53	23.1%	93	1.75	40.6	$952,012
260 Maj Pancreas & Liver Procs	185	40	21.6%	73	1.83	39.5	$731,871
120 Maj Resp & Chest Procs	162	41	25.3%	58	1.41	35.8	$513,686
262 Cholecystectomy Exc Laparo	176	37	21.0%	63	1.70	35.8	$511,828
022 Ventricular Shunt Procs	224	47	21.0%	77	1.64	34.4	$651,647
221 Maj Small & Large Bowel Procs	962	194	20.2%	316	1.63	32.8	$3,414,564
021 Craniotomy Exc for Trauma	501	97	19.4%	164	1.69	32.7	$1,538,223
305 Amput of Lower Limb Exc Toes	466	98	21.0%	149	1.52	32.0	$1,114,445
224 Peritoneal Adhesiolysis	121	21	17.4%	38	1.81	31.4	$318,784
312 Skin Graft for Connect Tis Diags	45	10	22.2%	13	1.30	28.9	$101,160
264 Oth Hepatobiliary & Abdo Procs	62	7	11.3%	17	2.43	27.4	$190,549
161 Defib & Heart Assist Implant	302	48	15.9%	81	1.69	26.8	$657,732
173 Oth Vascular Procs	750	136	18.1%	197	1.45	26.3	$1,774,387
Top 25	6,886	1,879	27.3%	3,179	1.69	46.2	$26,900,954
All DRGs	251,994	17,828	7.1%	21,774	1.22	8.6	$88,699,873
Top 25 as percent of all	3%	11%		15%			30%

Notes:

1. Base DRGs with fewer than 40 stays are not shown.

Table 2.3.4 shows the impact of severity of illness on the risk of a PPC, after adjusting by base DRG. This table shows a consistent pattern in which sicker patients are at higher risk for potentially preventable complications. This is intuitively obvious to clinicians, but the table underscores the need to carefully adjust for casemix when comparing PPC rates across hospitals or other populations.

Table 2.3.4

Effect of Severity of Illness on PPC Risk (Top 15 DRGs by Total Stays)

Base DRG		Total	Level of Severity (SOI)			
			Severity 1	Severity 2	Severity 3	Severity 4
560 Vaginal Del	All Stays	72,530	49,736	19,502	3,255	37
	PPC Rate	8.7%	2.2%	21.8%	29.5%	43.2%
540 Cesarean Del	All Stays	40,444	29,769	7,991	2,570	114
	PPC Rate	7.8%	3.8%	14.9%	28.0%	70.2%
566 Oth Antepartum Diags	All Stays	7,569	2,555	3,777	1,167	70
	PPC Rate	0.7%	0.0%	0.3%	2.4%	17.1%
541 Vag Del w Ster &/or D&C	All Stays	4,900	3,193	1,473	231	3
	PPC Rate	15.5%	3.7%	35.0%	52.8%	66.7%
194 Heart Failure	All Stays	4,091	270	1,761	1,688	372
	PPC Rate	8.1%	0.4%	1.2%	10.8%	33.6%
720 Septicemia & Disseminated Inf	All Stays	4,040	63	578	1,302	2097
	PPC Rate	5.7%	0.0%	0.5%	3.9%	8.4%
140 COPD	All Stays	4,018	685	1,851	1,304	178
	PPC Rate	3.8%	0.0%	0.6%	7.2%	27.0%
383 Cellulitis & Oth Bact Skin Inf	All Stays	3,244	797	1,486	845	116
	PPC Rate	3.4%	0.1%	0.7%	6.4%	37.9%
139 Oth Pneumonia	All Stays	3,145	272	1,322	1231	320
	PPC Rate	4.7%	0.4%	1.6%	5.4%	18.8%
460 Renal Failure	All Stays	2,754	46	401	2,061	246
	PPC Rate	7.0%	0.0%	2.2%	5.0%	32.5%
750 Schizophrenia	All Stays	2,620	691	1,775	149	5
	PPC Rate	0.5%	0.0%	0.4%	3.4%	20.0%
463 Kidney & Urinary Tract Inf	All Stays	2,585	319	1,220	927	119
	PPC Rate	0.0%	2.8%	3.3%	2.8%	0.0%
420 Diabetes	All Stays	2,530	409	1,134	811	176
	PPC Rate	3.7%	0.2%	0.6%	5.8%	22.2%
753 Bipolar Dis	All Stays	2,504	728	1,688	88	0
	PPC Rate	0.6%	0.0%	0.6%	5.7%	0.0%
425 Electrolyte Dis Exc Hypovolemia	All Stays	2,194	111	1,058	919	106
	PPC Rate	2.7%	0.0%	0.4%	3.5%	21.7%

Note:

1. For each APR-DRG, the PPC rate is the number of PPC stays as a percentage of all stays. A PPC stay has at least one PPC.

2.4 PPC Performance by Hospital

For each hospital, PPC performance was evaluated by comparing the actual versus expected values of three measures: the number of PPC stays, the PPC count, and the PPC cost. As described in Section 1.6.1, the three measures enable different perspectives. The number of PPC stays is the patient perspective—that is, the number of patients who were affected by at least one PPC. The PPC count tallies the number of PPCs, since many patients are affected by more than one PPC. The PPC cost shows the financial impact of PPCs. In practice, the more costly PPCs also tend to be more serious in clinical terms, so PPC cost is also a rough proxy for impact on the patient.

36% of hospitals performed "better" than expected while 38% performed worse than expected, indicating that opportunity exists for hospitals to learn from each other.

For each measure, the hospital's actual experience was compared with what would have been expected for a hospital with the same mix of patients. If the Actual/Expected (A/E) ratio was less than 0.90, then performance was better than expected. If the A/E ratio was more than 1.10, then performance was worse than expected. The interpretations shown in table 2.4.1 were those of TMHP, using the same categories as used in the previous analysis of potentially preventable readmissions. Table 2.4.1 shows results for 210 hospitals, excluding 233 low-volume hospitals for which results can be unstable (Section 1.6.4). In terms of the number of PPC stays, 76 hospitals, or 36 percent, performed better than expected, 55 performed about as expected and 79 hospitals performed worse than expected. In statistical terms, these were the actual results for SFY 2011, and they were not based on a sample of claims. A test of statistical significance, however, assesses the probability that the results seen in SFY 2011 might be similar to those from a different period. For 111 hospitals, the A/E rate met the 90 percent confidence level as differing from 1.00. The table also shows results for the PPC count and PPC cost.

Table 2.4.1
Number of Hospitals by PPC Performance

Interpretation	A/E Ratio	PPC Stays	% of All Hosps	Stat Sig Diff	PPC Count	% of All Hosps	PPC Cost	% of All Hosps
Much better than expected	Less than 0.75	42	20%	36	39	19%	61	29%
Better than expected	0.75 – 0.90	34	16%	16	41	20%	33	16%
About as expected	0.90 – 1.10	55	26%	0	67	32%	52	25%
Worse than expected	1.10 – 1.25	35	17%	19	25	12%	26	12%
Much worse than expected	More than 1.25	44	21%	40	38	18%	38	18%
Total hospitals		210	100%	111	210	100%	210	100%

Notes:

1. The "PPC rate" refers to the number of stays with at least one PPC as a percentage of all stays. The "PPC count" is the total number of PPCs, allowing for an individual PPC stay to have more than one PPC. "PPC cost" refers to the PPC count multiplied by the appropriate estimated cost impact for each PPC. Each stay was considered an independent observation, so statistical significance was calculated for the PPC rate. Totals for PPC counts and PPC cost, by contrast, depended on the incidence and frequency by PPC of PPC stays and were therefore not considered independent observations.
2. Low-volume hospitals are excluded.
3. "Stat Sig Diff" shows the number of hospitals where the difference from 1.00 is statistically significant at the 90 percent confidence level using the CMH Statistic. See Section 1.6.4.

Chart 2.4.1 shows results for all three measures for the top 15 hospitals, which together accounted for 42 percent of the stays in the analytical dataset. The impact of a possible outlier could skew the results of the actual number of PPC stays when compared to the expected results. In order to maintain perspective for the other hospitals, the vertical axis of the chart has been truncated at 1.50.

In general, the PPC stay measure tended to be highly correlated with the PPC count measure (correlation coefficient = 0.95 for the 210 high-volume hospitals). The correlation between a hospital's performance in terms of PPC stays and its performance in terms of PPC cost, however, was not as strong.

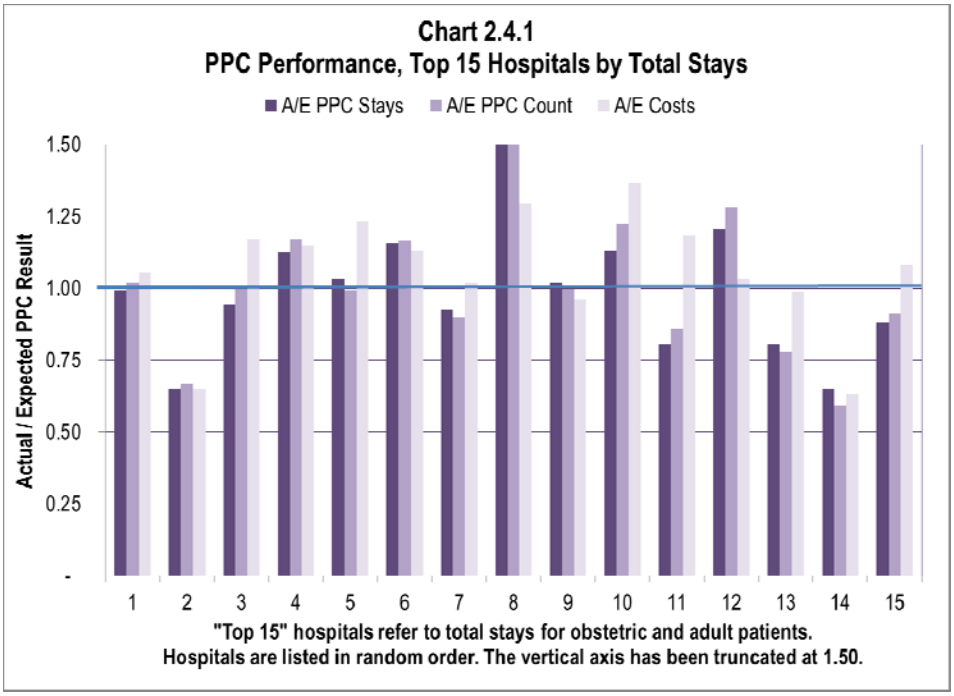
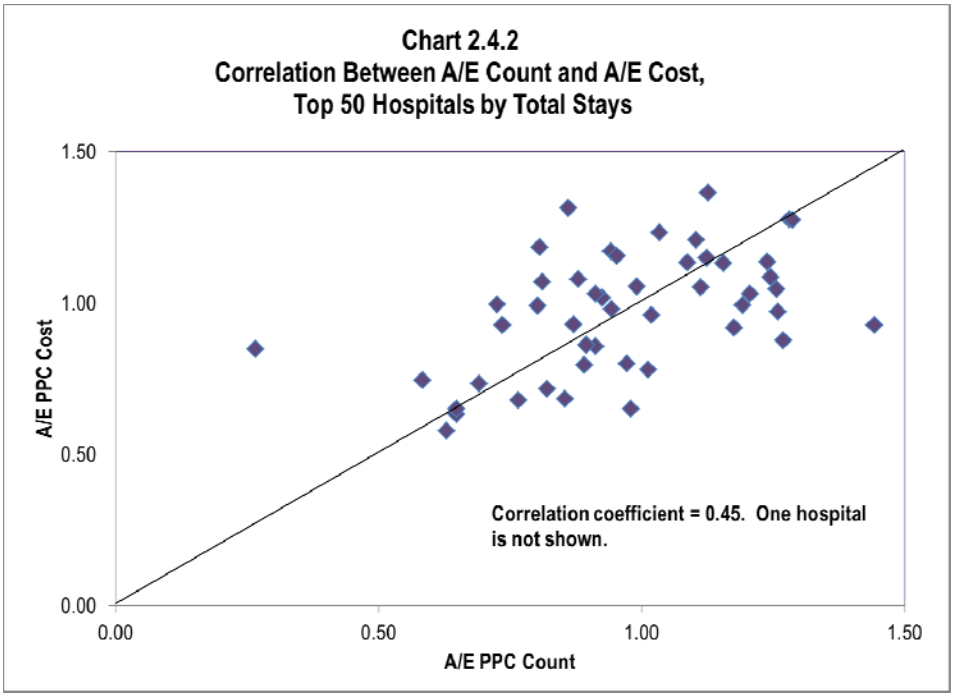


Chart 2.4.2 shows the top 50 hospitals in terms of total stays. The correlation coefficient between A/E PPC stays and A/E PPC cost for these hospitals was 0.38, where 1.00 would indicate perfect correlation and 0.00 would indicate zero correlation. (For the 210 high-volume hospitals, the correlation coefficient was 0.34.) The explanation is that some PPCs are more common but less costly while other PPCs are less common but more costly. Therefore both the number of PPC stays and the cost of PPCs are useful measures to track and report.



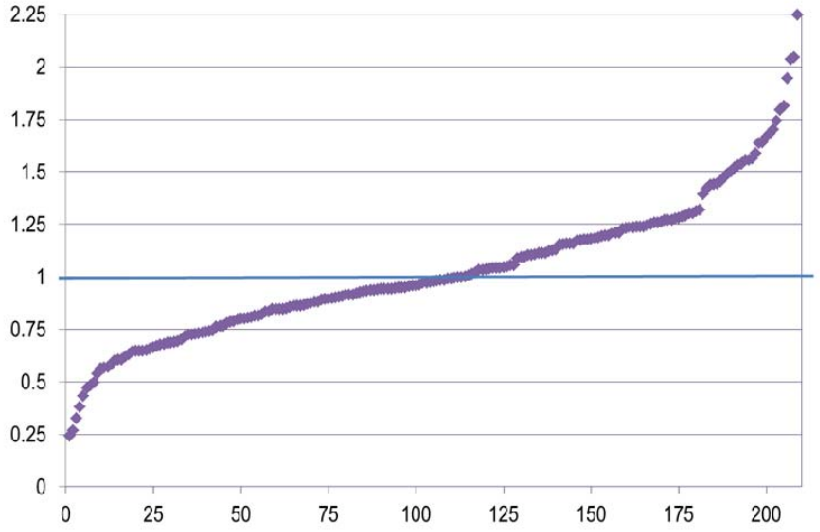
For the 210 hospitals, Chart 2.4.3 shows the range of results for A/E PPC stays and Chart 2.4.4 shows the range of results for A/E PPC cost. Each chart shows a substantial range in performance.

In terms of PPC stays, there were 42 hospitals with A/E ratios under 0.75 and 44 hospitals with A/E ratios above 1.25. If a broader time period were chosen, it is likely that the range of results would be narrower because of the statistical phenomenon of regression to the mean. (That is, some hospitals at the lower or upper ends of the range simply had a good or bad year in state fiscal year 2011.) Nevertheless, the range in hospital performance is wide enough to suggest that hospitals can learn from each other how to reduce PPCs.

In terms of PPC cost, the range was wider. A total of 61 hospitals had A/E ratios under 0.75 while 38 had A/E ratios over 1.25. Those hospitals with zero A/E values were small hospitals with a few PPCs, each of which had an estimated cost impact of zero.

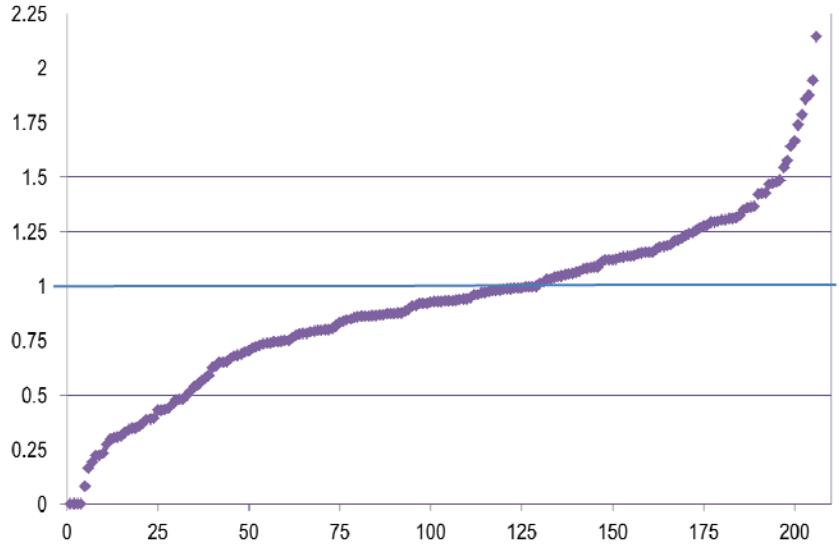
Overall, this analysis included 443 hospitals, of which 210 Texas hospitals met the threshold as high-volume providers. Another 110 Texas hospitals and 123 out-of-state hospitals were included in the analytical dataset but were considered low-volume hospitals. These counts do not include the 123 Texas hospitals and 9 out-of-state hospitals that were excluded from the analytical dataset because they were exempt from reporting present-on-admission indicators (Section 1.2).

Chart 2.4.3
Ranking of Hospitals by A/E PPC Stays



Each point is a hospital. Low-volume hospitals are not shown. The vertical axis has been truncated at 2.25.

Chart 2.4.4
Ranking of Hospitals by A/E PPC Cost



Each point is a hospital. Low-volume hospitals are not shown. The vertical axis has been truncated at 2.25.

2.5 PPC Incidence and HAC Incidence

The differences between potentially preventable complications and hospital-acquired conditions were described in Section 1.3. These methods overlap but are very different approaches to measuring complications acquired during an inpatient stay. The PPC list is much more broadly drawn than the HAC list. Table 2.5.1 shows that 7.07 percent of stays in the analytical dataset included at least one PPC while only 0.09 percent stays included at least one HAC.

Of the 219 stays that included a HAC, 172 stays also had at least one PPC assigned to them (Table 2.5.2). This is as expected, since both the HAC and PPC lists are intended to include complications that occur during an inpatient stay. With regard to the 47 stays that included a HAC but not a PPC, the most likely explanation is that the stay was globally excluded from having a PPC assigned to it. As explained in Section 1.4, stays for metastatic cancer, HIV, major trauma and certain other conditions are not considered "eligible" for PPC assignment, because the patient is so sick that complications are unlikely to be "potentially preventable." The HAC list contains no such allowance for casemix or clinical exclusions; if the complication is present then it counts as a HAC.

Table 2.5.1
PPC Incidence and HAC Incidence

PPC and HAC Incidence	Stay Count	PPC Stays	PPC Count	HAC Stays	HAC Count
No HAC or PPC assigned	234,119	-	-	-	-
HAC criteria met, no PPC assigned	47	-	-	47	47
No HAC, one or more PPCs assigned	17,656	17,656	21,499	-	-
Both HAC and PPC present	172	172	275	172	174
Total stays in analytical dataset	251,994	17,828	21,774	219	221
Percent of total stays		7.07%		0.09%	

Note:

1. "PPC stays" and "HAC stays" refer to the number of stays with at least one PPC or HAC, respectively. "PPC count" and "HAC count" refer to the actual numbers of PPCs and HACs.

Table 2.5.2 Incidence of HACs			
HAC	Stays	HAC Count	PPC Count
Stays Where Both a HAC and PPC Were Assigned			
Catheter-associated urinary tract infection (UTI)	15	15	23
Deep vein thrombosis (DVT)/pulmonary embolism (PE) w/ ttl knee replcmnt or hip replcmnt	13	13	20
Falls and trauma	22	22	31
Foreign object retained after surgery	1	1	1
Manifestations of poor glycemic control	13	13	17
Stage III & IV pressure ulcers	12	12	19
Surgical site infection - certain orthopedic procedures of spine, shoulder and elbow	5	6	10
Vascular catheter-associated infection	91	92	154
Subtotal	172	174	275
Stays Where a HAC Was Assigned but a PPC Was Not			
Catheter-associated urinary tract infection (UTI)	5	5	0
Falls and trauma	11	11	0
Foreign object retained after surgery	1	1	0
Manifestations of poor glycemic control	1	1	0
Stage III & IV pressure ulcers	11	11	0
Vascular catheter-associated infection	18	18	0
Subtotal	47	47	0
Total	219	221	275

3 Frequently Asked Questions

1. What counts as a PPC?

Potentially preventable complications (PPCs) are harmful events or negative outcomes that develop after hospital admission and may result from processes of care and treatment rather than from the natural progression of the underlying illness and are therefore potentially preventable. Examples include accidental laceration during a procedure, improper administration of medication, hospital-acquired pneumonia, and C. difficile colitis. There are 65 PPCs in V.29 of the PPC Classification System. Please see Appendix Table B.1 for the list of PPCs.

2. Who developed the PPC methodology? Who else uses it?

The specific PPC methodology used in this analysis was developed by 3M Health Information Systems. It has also been used by the Maryland Health Services Cost Review Commission and the New York Medicaid program. Published articles have also reported results from application of the PPC methodology to national Medicare data, all-payer data in California, and all-payer data in Maryland.

3. Why were APR-DRGs, and not Medicare MS-DRGs, used to measure casemix?

The Medicare MS-DRG algorithm was designed only for the Medicare population. The APR-DRG algorithm was designed for use with an all-patient population and fits a Medicaid population well.[26] The 3M PPC methodology was designed to be applied to APR-DRGs.

4. Is this the same approach that Medicare has taken? What is the difference?

The approaches are quite different, as summarized in Table 1.3.1. The Texas Legislature specifically required measurement of potentially preventable conditions, in addition to existing policy on the Medicare list of hospital acquired conditions (HAC) and a non-payment policy on "never events."

While the HAC and never event approaches focus on individual adverse events that could always or almost always be prevented, the PPC approach focuses on a much broader list of complications that are potentially, but not always, preventable. Payment may be reduced or denied for specific stays that include a HAC or never event. Under the PPC approach, by contrast, the focus is on casemix-adjusted hospital-wide rates in comparison with a statewide benchmark.

5. How does coding on the claim form (UB-04 or X12N 837I) affect casemix measurement and PPC results?

The risk of PPCs, and therefore the hospital's performance in comparison with the statewide benchmark, depends on the APR-DRG assigned to each stay. The assignment of both the base APR-DRG and the severity of illness depends on the number, nature, and interaction of ICD-9-CM diagnoses and procedures coded by the hospital on the claim. (There is no single list of complications and comorbidities, as there is under Medicare.) Hospitals are therefore advised to code each claim thoroughly so that the APR-DRG assignment is as accurate as possible. Hospitals are not required to list the APR-DRG on the claim as this is done by TMHP as part of the PPC analysis.

In addition, the present on admission (POA) indicator is essential in identifying PPCs. Hospitals are required to submit valid values of the POA indicator for all primary and secondary diagnoses. These values indicate whether each diagnosis was present on admission or was acquired during the stay. A review of POA coding in the analytical dataset used for this report found that POA coding was reliable overall.

6. What steps were taken to adjust for differences in casemix among hospitals?

Every stay was classified to one of 1,256 APR-DRGs that reflected the reason for admission and the severity of illness. Every stay was also checked for the presence of one or more PPCs. In some situations (for example a patient with metastatic cancer) a PPC that otherwise might have been assigned was not assigned because a complication was considered too difficult to prevent for a patient in this APR-DRG. For each combination of APR-DRG and PPC, a statewide PPC rate was calculated based on Texas Medicaid FFS/PCCM data. For each hospital, an expected PPC rate was calculated for each PPC based on that hospital's specific mix of APR-DRGs. See Table 1.6.2.1 for an example.

7. Are the results statistically significant?

Results are based on the complete data for SFY 2011, not on a sampling methodology. There is no question of statistical significance so long as inferences are made only about the Texas Medicaid FFS and PCCM population in SFY 2011. In a different time period, the results might be different, especially if a hospital had a small volume of stays in SFY 2011. To assess the likelihood of this, a categorical statistic called the Cochran-Mantel-Haenszel (CMH) statistic was used. Refer to Section 1.6.4.

8. How were hospitals identified in the analysis?

Hospitals were identified by their Texas Provider Identifier (TPI) number, which is submitted by hospitals on FFS and PCCM claims that are paid directly by the Texas Medicaid program.

9. Can my hospital appeal the finding of individual stays having potentially preventable complications assigned?

No. In the approach taken here, what matters is a hospital's overall rate of PPCs, not any particular stay. This approach recognizes that some complications will occur, and focuses instead on the hospital's casemix-adjusted PPC rate in comparison with a statewide norm.

10. Why is the number of Medicaid stays reported for my hospital different from the number of Medicaid stays in my hospital's database?

In the hospital-specific version of this report, Section 4 shows counts of Medicaid FFS and PCCM stays for a specific hospital. (The public version of this report does not include Section 4.) There are several possible reasons why the count of stays might differ from a hospital's own count. Most importantly, several types of patients and stays were categorically excluded from the report, for reasons discussed in Sections 1.2 and 1.4. The largest of these categories was pediatric stays. In addition, less than 1 percent of stays were excluded from the analytical dataset because of data issues, as explained in Appendix Section C.2. The Excel claim-level PPC report being provided to each hospital shows the specific claims that were excluded from analysis for each hospital.

11. What are the consequences of having a high PPC rate? Will payment be affected?

A high PPC rate indicates that your hospital's experience with PPCs adjusted for casemix is higher than the statewide benchmark. This indicates opportunities to improve the quality of patient care. Because you receive the detail of the PPCs that are identified, your hospital can focus efforts to address specific areas of concern. A hospital's rate of PPCs will affect payments starting September 1, 2013, as required by S.B. 7, 82nd Legislature, Regular Session 2011. The methodology is currently under development by HHSC. Further communications will follow.

12. Will the Office of Inspector General or other agencies investigate hospitals based on these results?

Various state and federal agencies oversee the quality of care provided by hospitals, physicians and other providers. TMHP is not aware of specific oversight efforts planned as a result of this analysis.

13. What can a hospital do to reduce its PPC rate?

Many organizations and individual hospitals are working on this question. Some useful resources include:

- The Institute for Healthcare Improvement has tools, white papers and other information on improving patient safety, including information on how to track central line catheter-related bloodstream infections. More information is available at www.ihi.org.
- The Agency for Healthcare Research and Quality funds research on patient safety. For example, one report stresses the need for adequate post-surgical staffing to anticipate, identify and promptly treat complications in order to reduce mortality.[27] See www.ahrq.com for more examples.
- Discussions of applying checklist approaches and improving the culture of patient safety are available in several books and articles.[28]

14. Will these results for my hospital be reported publicly?

The hospital-specific reports are confidential information and will only be shared with authorized personnel at each hospital, per statute.

15. How can I get my hospital's report?

The reports will be available to hospital staff when they log into their account on the www.tmhp.com homepage under an active link called "View PPE Provider Reports." Only users with authorization to view the R&S reports will have access to view the PPC reports. You may contact your hospital's administrative office to get the appropriate permission levels to view the reports. You may also send an email to PPC.Report@tmhp.com for more information.

16. What information is contained in the confidential hospital reports?

The hospital-specific version of this report includes a Section 4 with hospital-specific data in a format that is very similar to tables in Sections 1 and 2. In addition, each hospital will receive an Excel claim-level detail file that includes detailed information on the claims included and excluded from the analysis.

17. Is there support or training on how to understand these reports and use them for improvement?

Yes. An informational presentation will be held in Austin in November 2012. Additional presentations will be done via webinar. Hospitals will be advised of specific dates and times via TMHP standard communication.

18. What else can I do to get my questions answered?

The PPC methodology itself is well-described in the *3M PPC Classification System Definitions Manual*, available to Texas hospitals by contacting Gregg Perfetto at gmperfetto@mmm.com. Questions about the methodology and results in this report may be directed to the Texas Medicaid and Healthcare Partnership at PPC.Report@tmhp.com.

19. I have a suggestion for how to improve the PPC methodology. How do I make my point?

An advantage of the PPC methodology is its transparency, which enables clinicians to understand in detail what circumstances do and do not count as a PPC. In particular, the *3M PPC Classification System Definitions Manual* shows the detailed criteria used to identify PPCs. 3M Health Information Systems welcomes suggestions to refine the methodology. These may be sent to Gregg Perfetto at gmperfetto@mmm.com.

20. Are there plans for additional analysis or reporting in future years?

Yes. The PPC analysis will be repeated annually, as directed by the Health and Human Services Commission.

Appendix A Terminology

Note: Some definitions in this appendix are drawn from 3M Health Information Systems, *Potentially Preventable Complications: Definitions Manual V.29* by Hughes et al.[29] All copyrights in and to the 3M™ Software are owned by 3M. All rights reserved.

Actual to Expected (A/E) Ratio
The ratio of actual PPC stays compared with expected PPC stays, where the expected number depends on the base APR-DRG and is adjusted for the patient's severity of illness. Similar A/E ratios are calculated for the PPC count and PPC cost. See Section 1.6.2 for a detailed explanation.

Analytical Dataset
The analytical dataset is the foundational set of data from which this report is derived. Please see Section 1.2, which describes data included and excluded from the PPC report.

APR-DRG
An algorithm that assigns an inpatient stay to a diagnosis related group (DRG) based on diagnoses, procedures, and other clinical information on the claim. The All Patient Refined DRG algorithm is proprietary to 3M Health Information Systems and was designed for use with all types of patients. It is in the format 123-4, where the first three digits indicate the base DRG (i.e., the reason for admission) and the fourth digit indicates the severity of illness. See Appendix Section C.3.

APR-DRG assignment
DRG assignment is performed by APR-DRG software based on diagnosis, procedure, gender, age and discharge status. DRG assignment is necessary prior to identification of PPCs.

Benchmark
The benchmark, or norm, is the standard by which hospital PPC performance is compared. For this PPC report, the benchmark is the Texas statewide average.

Casemix
The casemix refers to the mix of patients that were treated during the reporting time period, with "higher" casemix referring to sicker patients who require more hospital resources. Casemix is measured using APR-DRG relative weights. Hospitals with two stays that group to APR-DRG 139-1 (relative weight = 0.5075) and three stays that group APR-DRG 140-1 (relative weight = 0.7996) would have casemix = [(2 x 0.5075) + (3 x 0.7996)] / 5 = 0.6828.

Cochran-Mantel-Haenszel Test

The Cochran-Mantel-Haenszel test is a test of conditional independence that is applicable in categorical data analysis and that is used to indicate the likelihood that a hospital's A/E ratio differed from 1.00 simply due to random variation.

Comorbidity
Comorbidity is defined as the presence of one or more disorders or diseases in addition to a primary disease or disorder. A comorbidity may or may not be clinically related to the primary disease.

Cost Estimates
Incremental cost estimates were derived using a linear regression model to capture the cost related to each PPC. Cost estimates for the PPC report are based on the Texas Medicaid FFS/ PCCM SFY 2011 data per the methodology outlined in Section 1.5 and Appendix Section C.6.

Exempt
Hospitals or specific diagnoses may be exempt from POA reporting. When a hospital is exempt, the POA indicator field for diagnoses on the claim should be coded as exempt. When a specific diagnosis is exempt, the POA indicator field is coded as exempt for those diagnoses only.

Expected PPC Results
Expected PPC results were calculated based on statewide norms calculated from Texas Medicaid FFS and PCCM data. Norms were calculated as follows.

- PPC stays: For each APR-DRG, the statewide number of stays with at least one PPC was calculated, taking into account the number of stays that were at risk for a PPC. These norms by APR-DRG were used to calculate the expected number of PPC stays by hospital.
- PPC count: For each combination of APR-DRG and PPC, the statewide count of PPCs was calculated, taking into account the number of stays that were at risk for each specific PPC. These norms by APR-DRG and PPC were used to calculate the expected count by hospital for each PPC.
- PPC cost: The expected PPC cost by hospital was calculated by multiplying the expected PPC count by the estimated cost impact of each PPC.

Fee-for-Service (FFS)

Fee-for-service Medicaid is a health care delivery model under which Medicaid clients may receive care from any enrolled provider and providers are paid directly by the Medicaid program.

Global Exclusion
The global exclusion criteria within the PPC classification system were used to identify admissions for certain severe or catastrophic conditions that are particularly susceptible to a range of complications. Examples include HIV illness and major or metastatic malignancies. Complications that occur in globally excluded stays are not considered potentially preventable (except for foreign objects remaining after surgery).

Health and Human Services Commission (HHSC)
The Texas Health and Human Services Commission administers the Texas Medicaid program.

Indirect Rate Standardization
An analytic technique, borrowed from epidemiology, which adjusts for the differences between sub-populations which, in this case, are patients in different hospitals. For example, in Section 1.6.2.1 the technique is used to calculate the expected incidence of a particular PPC among patients with a specific DRG. The expected incidence for a hospital equals the number of stays at risk for that particular PPC times the average incidence rate statewide.

Linear Regression Model
A linear regression model is a mathematical methodology used in this analysis to isolate and estimate the cost of each PPC by assuming a linear relationship between variables. Please see Section 1.5 and Appendix Section C.6.

Low-Volume Hospital
A hospital is defined as “low volume” for this analysis if it does not have at least 40 inpatient Medicaid stays, at least five PPC stays, and at least five expected PPC stays. Low-volume hospitals are excluded because low numbers can generate misleading results. See Appendix Section C.7.3.

Medicaid Care Category
A Medicaid Care Category is based on age and APR-DRG. The categorization was developed by TMHP to reflect both the policy portfolios of a typical Medicaid agency and the internal organization of a typical hospital. See Appendix Section C.4.

Medicaid Management Information System (MMIS)
The Medicaid Management Information System is the computer system used to adjudicate Texas Medicaid claims.

Primary Care Case Management (PCCM)
Primary care case management clients choose a primary care provider (PCP) who acts as their medical home. The PCP is responsible for managing their care and, in some states, acting as a gatekeeper to specialty services. Payments for hospital and other services received by the client are made directly by the Medicaid program.

Principal Diagnosis
The diagnosis that, after investigation, was found to be the principal reason why the patient was admitted.

Pediatric
For purposes of this analysis, "pediatric" was defined as under age 18 to be consistent with the definition used in the 3M PPC software. Different definitions may be used for other purposes within the Medicaid program.

Potentially Preventable Complication (PPC)
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, C. difficile colitis) 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 preventable. There are 65 PPCs in V.29 of the PPC Classification System. Please see Appendix Table B.1 for a list of PPCs.

PPC Classification System
A clinically-based classification system that identifies inpatient acute care hospital complications that are potentially preventable based on computerized discharge data. The output from the PPC Classification system can be used to compute complication rates for hospitals. Complication rates can be used to improve quality of care and for payment methods based on quality. The PPC Classification System algorithms are complex and are designed to exclude patients with conditions that may be prone to unavoidable complications.

PPC Assigned Admission.
A PPC assigned admission is a PPC candidate admission with one or more candidate complications that are not excluded by the PPC exclusion or hierarchy exclusion logic.

PPC Eligible Admission
A PPC eligible admission is an admission that did not meet any global exclusion criteria. Admissions that met the global exclusion criteria are not eligible admissions for any PPC (except the PPC for foreign object retained after surgery).

PPC Candidate Admission
A PPC candidate admission is a PPC eligible admission that also has one or more conditions that are candidate complications. Candidate complications are considered PPCs only if specific criteria are met.

PPC Group
Each of the 65 PPCs is assigned to one of eight mutually exclusive clinically descriptive groups to facilitate the reporting and display of PPC information.

PPC Hierarchy Exclusion
A PPC candidate admission can have more than one candidate complication. Some PPCs have the same assignment criteria except that one of the PPCs is a more significant manifestation of the other complication. In such cases the PPC logic precludes the assignment of the less significant candidate complication based on a hierarchy of related PPCs.

PPC Matrix
The PPC matrix is a numerical analysis done in a spreadsheet format that contains a row for every APR-DRG and a column for every PPC. Cells in the matrix show the incidence of each PPC for each APR-DRG. This matrix reflects Texas Medicaid FFS/PCCM data. It is used to calculate actual/expected ratios for each hospital. Please see Section 1.6.2.

PPC Specific Exclusion
A set of clinical exclusion criteria used to identify admissions where a specific PPC may not be preventable and therefore, should not be assigned. The clinical exclusions most commonly identify complications that are redundant or are a natural consequence of one of the diagnoses present on admission.

PPC Cost
PPC cost is obtained by multiplying the estimated cost impact of a specific PPC by its frequency. The estimated cost impact of a PPC is derived using a linear regression model from TX FFS/PCCM data. See Appendix Section C.6.

PPC Count
PPC count refers to a count of PPCs.

PPCs per 100 Stays
PPCs per 100 stays refer to the count of PPCs per 100 stays.

PPC Rate
PPC rate refers to the number of stays with at least one PPC divided by the total number of stays. If there is one stay with at least one PPC in 100 stays, then the PPC rate would be 1 percent.

PPC Stay
A PPC stay is an inpatient stay that includes at least one PPC. For example, a stay with both septicemia (PPC 35) and respiratory failure (PPC 03) would count as one PPC stay.

Present-on-admission (POA) Indicator
The POA indicator is a data element on the inpatient claim (e.g., UB-04) that indicates if a principal or secondary diagnosis was present at the time of admission.

Severity of Illness
The severity of illness is the extent of physiologic decompensation or organ system loss of function. For each base APR-DRG, it is indicated by an ordinal ranking from 1 to 4, with 4 being the highest severity.

State Fiscal Year (SFY)
State Fiscal Year 2011 was September 2010 through August 2011.

Statistical Significance
Statistical significance is a way to mathematically measure if data findings were caused by chance. When a result is referred to as statistically significant it is regarded as real and unlikely to have occurred by chance. This report tests for statistical significance at the 90 percent or 95 percent confidence level, depending on the context. A test of statistical significance can suggest whether these state fiscal year 2011 results might also apply to a broader time frame.

Texas Medicaid & Healthcare Partnership (TMHP)
TMHP is a coalition of contractors headed by Xerox that carries out the Medicaid claims payment and primary care case management administrator duties for the state of Texas, under contract with the Texas Health and Human Services Commission.

Texas Provider Identifier (TPI)
The Texas Provider Identifier is a unique provider identifier that is assigned by the Texas Medicaid program to hospitals and other providers. The TPI was the identifier used to uniquely identify hospitals for the purposes of this report.

Appendix B Supplementary Data Tables

B.1 Summary of PPCs by Frequency

Appendix Table B.1 Summary of PPCs by Frequency						
PPC	Description	Group Description	PPC Count	Percent of Total PPC	Cost per PPC	PPC Cost
01	Stroke & Intracranial Hemorrhage	Cardiovascular-Respiratory Complications	204	0.9%	$16,067	$3,277,586
02	Extreme CNS Complications	Extreme Complications	86	0.4%	$5,184	$445,824
03	Acute Pulmonary Edema and Respiratory Failure w/out Ventilation	Cardiovascular-Respiratory Complications	612	2.8%	$6,837	$4,184,428
04	Acute Pulmonary Edema and Respiratory Failure with Ventilation	Extreme Complications	394	1.8%	$5,509	$2,170,428
05	Pneumonia & Other Lung Infections	Cardiovascular-Respiratory Complications	672	3.1%	$9,249	$6,215,328
06	Aspiration Pneumonia	Cardiovascular-Respiratory Complications	297	1.4%	$8,408	$2,497,295
07	Pulmonary Embolism	Cardiovascular-Respiratory Complications	116	0.5%	$18,088	$2,098,208
08	Other Pulmonary Complications	Cardiovascular-Respiratory Complications	254	1.2%	$4,186	$1,063,244
09	Shock	Extreme Complications	428	2.0%	$19,841	$8,491,948
10	Congestive Heart Failure	Cardiovascular-Respiratory Complications	182	0.8%	$2,879	$523,905
11	Acute Myocardial Infarction	Cardiovascular-Respiratory Complications	221	1.0%	$0	$0
12	Cardiac Arrythmias & Conduction Disturbances	Cardiovascular-Respiratory Complications	61	0.3%	$0	$0
13	Other Cardiac Complications	Cardiovascular-Respiratory Complications	43	0.2%	$7,075	$304,225
14	Ventricular Fibrillation/Cardiac Arrest	Extreme Complications	340	1.6%	$6,294	$2,140,062
15	Peripheral Vascular Complications except Venous Thrombosis	Cardiovascular-Respiratory Complications	49	0.2%	$3,710	$181,790
16	Venous Thrombosis	Cardiovascular-Respiratory Complications	211	1.0%	$13,465	$2,841,052
17	Major Gastrointestinal Complications w/out Transfusion or Significant Bleeding	Gastrointestinal Complications	164	0.8%	$10,401	$1,705,797
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	Gastrointestinal Complications	39	0.2%	$9,041	$352,599
19	Major Liver Complications	Gastrointestinal Complications	185	0.8%	$17,958	$3,322,193
20	Other Gastrointestinal Complications w/out Transfusion or Significant Bleeding	Gastrointestinal Complications	76	0.3%	$15,075	$1,145,700
21	Clostridium Difficile Colitis	Infectious Complications	148	0.7%	$3,941	$583,312
23	GU Complications except UTI	Other Medical and Surgical Complications	49	0.2%	$3,532	$173,068
24	Renal Failure w/out Dialysis	Other Medical and Surgical Complications	1,709	7.8%	$975	$1,666,788
25	Renal Failure with Dialysis	Extreme Complications	42	0.2%	$30,775	$1,292,550
26	Diabetic Ketoacidosis & Coma	Other Medical and Surgical Complications	17	0.1%	$12,003	$204,051
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	Other Medical and Surgical Complications	163	0.7%	$2,726	$444,322
28	In-Hospital Trauma and Fractures	Other Medical and Surgical Complications	23	0.1%	$0	$0
29	Poisonings except from Anesthesia	Malfunctions, Reactions, etc.	23	0.1%	$0	$0
31	Decubitus Ulcer	Other Medical and Surgical Complications	74	0.3%	$14,611	$1,081,214
32	Transfusion Incompatibility Reaction	Malfunctions, Reactions, etc.	1	0.0%	$0	$0

Appendix Table B.1 Summary of PPCs by Frequency						
PPC	Description	Group Description	PPC Count	Percent of Total PPC	Cost per PPC	PPC Cost
33	Cellulitis	Infectious Complications	175	0.8%	$3,457	$604,905
34	Moderate Infections	Infectious Complications	171	0.8%	$7,369	$1,260,082
35	Septicemia & Severe Infections	Infectious Complications	688	3.2%	$17,491	$12,033,877
36	Acute Mental Health Changes	Other Medical and Surgical Complications	20	0.1%	$7,546	$150,920
37	Post-Operative Infection & Deep Wound Disruption w/out Procedure	Perioperative Complications	79	0.4%	$13,435	$1,061,365
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	Perioperative Complications	15	0.1%	$64,677	$970,155
39	Reopening Surgical Site	Perioperative Complications	68	0.3%	$16,210	$1,102,280
40	Post-Operative Hemorrhage & Hematoma w/out Hemorrhage Control Procedure or I&D Procedure	Perioperative Complications	344	1.6%	$7,334	$2,522,999
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Procedure	Perioperative Complications	50	0.2%	$14,066	$703,300
42	Accidental Puncture/Laceration during Invasive Procedure	Perioperative Complications	222	1.0%	$2,233	$495,659
44	Other Surgical Complication – Moderate	Other Medical and Surgical Complications	49	0.2%	$14,150	$693,350
46	Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	Perioperative Complications	1	0.0%	$0	$0
47	Encephalopathy	Other Medical and Surgical Complications	225	1.0%	$3,382	$760,995
48	Other Complications of Medical Care	Other Medical and Surgical Complications	93	0.4%	$8,523	$792,639
49	Iatrogenic Pneumothrax	Malfunctions, Reactions, etc.	78	0.4%	$0	$0
50	Mechanical Complication of Device, Implant & Graft	Malfunctions, Reactions, etc.	84	0.4%	$14,699	$1,234,716
51	Gastrointestinal Ostomy Complications	Malfunctions, Reactions, etc.	54	0.2%	$10,498	$566,892
52	Inflammation & Other Complications of Devices, Implants or Grafts except Vascular Infection	Malfunctions, Reactions, etc.	235	1.1%	$11,044	$2,595,411
53	Infection, Inflammation and Clotting Complications of Peripheral Vascular Catheters and Infusions	Malfunctions, Reactions, etc.	64	0.3%	$0	$0
54	Infections due to Central Venous Catheters	Malfunctions, Reactions, etc.	67	0.3%	$22,809	$1,528,203
55	Obstetrical Hemorrhage w/out Transfusion	Obstetrical Complications	6,306	29.0%	$0	$0
56	Obstetrical Hemorrhage with Transfusion	Obstetrical Complications	740	3.4%	$1,929	$1,427,682
57	Obstetric Lacerations & Other Trauma w/out Instrumentation	Obstetrical Complications	1,663	7.6%	$0	$0
58	Obstetric Lacerations & Other Trauma with Instrumentation	Obstetrical Complications	643	3.0%	$0	$0
59	Medical & Anesthesia Obstetric Complications	Obstetrical Complications	787	3.6%	$0	$0
60	Major Puerperal Infection and Other Major Obstetric Complications	Obstetrical Complications	164	0.8%	$0	$0
61	Other Complications of Obstetrical Surgical & Perineal Wounds	Obstetrical Complications	236	1.1%	$0	$0
62	Delivery with Placental Complications	Obstetrical Complications	265	1.2%	$0	$0
63	Post-Operative Respiratory Failure with Tracheostomy	Extreme Complications	28	0.1%	$55,942	$1,566,376
64	Other In-Hospital Adverse Events	Other Medical and Surgical Complications	1	0.0%	$0	$0
65	Urinary Tract Infection	Infectious Complications	1,266	5.8%	$6,494	$8,221,151
66	Catheter-Related Urinary Tract Infection	Infectious Complications	10	0.0%	$0	$0
Totals			21,774	100.0%		$88,699,873
Notes:						

Appendix Table B.1 Summary of PPCs by Frequency						
PPC	Description	Group Description	PPC Count	Percent of Total PPC	Cost per PPC	PPC Cost
1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Appendix Section C.6.						
2. PPC 22 has been retired. Urinary tract infection (UTI) has been replaced with two other PPCs: 65 UTIs and 66 Catheter-related UTIs.						

B.2 Stays Where Presence of a PPC Affected DRG Assignment

Appendix Table B.2 Stays Where Presence of a PPC Affected DRG Assignment								
Base APR-DRG	Stays Change DRG	Stays Change Base DRG	Stays Change SOI	Billed Charges	Estimated Hospital Cost	Payment	APR-DRG Total Casemix without PPC Diagnoses	APR-DRG Total Casemix All Diagnoses
004 Trach, MV 96+ Hrs, w Ext Proc	16	-	16	$8,732,161	$1,963,379	$1,027,775	192	259
005 Trach, MV 96+ Hrs, w/o Ext Proc	30	-	30	$13,494,258	$3,319,601	$1,224,266	279	378
021 Craniotomy Exc for Trauma	39	7	32	$12,357,568	$3,710,053	$1,637,013	243	427
022 Ventricular Shunt Procs	14	7	7	$5,919,756	$1,412,770	$657,358	94	173
023 Spinal Procs	4	-	4	$674,593	$192,638	$84,646	19	35
024 Extracranial Vascular Procs	10	1	9	$1,905,481	$607,444	$253,665	45	85
026 Oth Nerv Sys & Related Procs	1	-	1	$208,110	$49,946	$14,756	4	9
040 Spinal Dis & Injuries	1	-	1	$401,083	$136,368	$23,204	2	10
042 Degen Nerv Sys Dis Exc Ms	5	-	5	$333,322	$129,926	$35,090	9	17
043 Mult Sclerosis	4	-	4	$156,067	$67,430	$29,401	7	16
044 Intracranial Hemorrhage	20	1	19	$2,602,664	$792,861	$290,022	56	91
045 CVA & Precereb Occl w Infarct	58	6	52	$6,944,401	$2,212,630	$766,488	124	250
046 Nonspec CVA w/o Infarct	1	-	1	$96,807	$16,457	$4,320	1	2
047 Transient Ischemia	5	-	5	$318,719	$62,270	$17,948	5	7
048 Nerve Disorders	7	-	7	$343,349	$88,130	$36,808	8	11
049 Bact & Tub Inf of Nervous Sys	5	-	5	$505,894	$218,027	$53,025	16	30
050 Non-Bact Inf of Nerv Sys	2	-	2	$149,648	$50,143	$22,249	4	8
052 Nontraumatic Stupor & Coma	6	-	6	$195,230	$60,411	$31,444	7	15
053 Seizure	16	1	15	$1,431,895	$347,262	$98,969	20	49
054 Migraine & Oth Headaches	1	-	1	$36,450	$9,477	$4,614	1	1
058 Oth Dis of Nervous Sys	4	-	4	$169,153	$45,141	$29,987	5	9
089 Maj Cranial/Facial Bone Procs	5	-	5	$561,363	$192,140	$93,153	16	31
090 Maj Larynx & Trachea Procs	2	-	2	$455,387	$219,258	$43,728	15	22
091 Oth Maj Head & Neck Procs	1	-	1	$204,779	$110,581	$13,191	3	5
097 Tonsil & Adenoid Procs	1	1	0	$513,411	$179,694	$66,538	5	13
098 Oth Ear, Nose Throat Procs	4	2	2	$949,246	$233,789	$145,028	15	30
110 Ear, Nose, Throat, Facial Malig	2	-	2	$82,347	$39,565	$39,114	4	10
113 Inf of Upper Resp Tract	1	-	1	$15,031	$4,509	$-	1	1
114 Dental & Oral Conditions	2	-	2	$138,560	$28,839	$31,238	2	5
115 Oth Ear, Nose, Throat Diags	5	-	5	$291,130	$78,439	$39,005	7	9

Appendix Table B.2 Stays Where Presence of a PPC Affected DRG Assignment								
Base APR-DRG	Stays Change DRG	Stays Change Base DRG	Stays Change SOI	Billed Charges	Estimated Hospital Cost	Payment	APR-DRG Total Casemix without PPC Diagnoses	APR-DRG Total Casemix All Diagnoses
120 Maj Resp & Chest Procs	14	-	14	$2,521,915	$722,357	$300,870	64	110
121 Oth Resp & Chest Procs	9	-	9	$1,132,646	$353,781	$154,131	28	52
130 Resp Sys Diag w MV 96+ Hrs	37	-	37	$7,954,153	$1,961,602	$857,918	221	258
131 Cystic Fibrosis - Pulmon Dis	1	-	1	$147,165	$48,565	$10,803	3	4
133 Pulmon Edema & Resp Failure	21	-	21	$2,238,877	$576,729	$243,875	36	55
134 Pulmonary Embolism	17	1	16	$2,502,793	$644,017	$171,271	33	59
136 Resp Malig	3	-	3	$339,584	$84,458	$38,937	6	7
137 Maj Resp Inf & Inflammations	31	9	22	$4,314,821	$1,233,859	$450,735	66	133
139 Oth Pneumonia	73	16	57	$7,360,964	$2,216,531	$829,717	100	256
140 COPD	82	4	78	$5,136,688	$1,358,747	$554,255	94	159
141 Asthma	16	1	15	$1,100,892	$225,633	$78,420	11	23
142 Interstitial & Alveolar Lung Dis	8	1	7	$477,423	$229,462	$71,411	13	22
143 Oth Resp Diags Exc Minor	8	-	8	$915,258	$188,758	$53,548	9	17
144 Resp Symptoms & Minor Diags	7	-	7	$324,184	$77,117	$19,437	6	10
161 Defib & Heart Assist Implant	12	-	12	$2,906,927	$807,883	$386,616	77	122
162 Cardiac Valve Procs w Cath	15	-	15	$5,253,920	$1,253,067	$505,291	103	192
163 Cardiac Valve Procs w/o Cath	22	1	21	$7,828,860	$2,394,923	$819,685	145	254
165 Coronary Bypass w Cath	66	1	65	$14,948,525	$3,933,253	$1,700,566	401	536
166 Coronary Bypass w/o Cath	32	4	28	$8,098,911	$2,449,449	$857,492	156	261
167 Oth Cardiothoracic Procs	5	1	4	$1,716,272	$514,863	$196,836	23	55
169 Maj Vascular Procs	14	-	14	$2,994,635	$1,202,569	$377,942	65	113
170 Pacemaker Impl w AMI or Shock	1	-	1	$64,355	$21,881	$10,384	4	4
171 Pacemaker Impl w/o AMI or Shock	1	-	1	$117,597	$23,519	$13,548	2	3
173 Oth Vascular Procs	28	1	27	$4,650,188	$1,191,984	$423,950	97	195
174 Percut CV Procs w AMI	38	-	38	$3,672,684	$1,006,340	$534,986	120	169
175 Percut CV Procs w/o AMI	18	-	18	$2,604,897	$711,144	$246,593	55	72
177 Pacemaker & Defib Revision	1	-	1	$106,302	$34,017	$13,508	2	7
180 Oth Circulatory Sys Procs	10	-	10	$1,700,325	$496,492	$139,557	24	43
190 Acute Myocardial Infarction	22	-	22	$1,680,779	$415,796	$190,841	38	65
191 Cardiac Cath Exc Ischem Disease	31	-	31	$3,084,681	$859,818	$278,385	68	118
192 Cardiac Cath for Ischem Disease	11	-	11	$1,066,976	$250,568	$99,270	16	20
193 Acute & Subacute Endocarditis	4	-	4	$551,479	$162,629	$38,531	8	18
194 Heart Failure	148	1	147	$7,464,755	$2,054,031	$864,769	170	312
197 Peripheral & Oth Vascular Dis	12	-	12	$742,584	$221,656	$88,853	15	25
198 Angina Pect & Atherosclerosis	7	-	7	$268,456	$94,072	$23,347	6	8
199 Hypertension	16	1	15	$1,044,423	$321,351	$93,714	14	31
201 Cardiac Arrhythmias	14	1	13	$1,875,898	$367,428	$147,851	15	34
203 Chest Pain	8	1	7	$259,611	$78,446	$30,052	7	10
204 Syncope & Collapse	4	-	4	$230,253	$54,279	$13,581	4	5

Appendix Table B.2 Stays Where Presence of a PPC Affected DRG Assignment								
Base APR-DRG	Stays Change DRG	Stays Change Base DRG	Stays Change SOI	Billed Charges	Estimated Hospital Cost	Payment	APR-DRG Total Casemix without PPC Diagnoses	APR-DRG Total Casemix All Diagnoses
205 Cardiomyopathy	1	-	1	$152,031	$34,967	$8,318	1	3
206 Complic of CV Device or Proc	3	-	3	$347,937	$97,432	$25,866	4	7
207 Oth Circulatory Sys Diags	8	-	8	$491,752	$146,328	$65,341	10	18
220 Maj Stomach & Esophag Procs	19	-	19	$2,960,414	$963,167	$399,026	72	118
221 Maj Small & Large Bowel Procs	65	5	60	$11,860,314	$3,432,964	$1,530,806	254	460
223 Oth Small & Large Bowel Procs	4	-	4	$1,180,042	$287,287	$143,740	10	20
224 Peritoneal Adhesiolysis	10	1	9	$1,376,422	$556,572	$194,296	29	66
225 Appendectomy	10	-	10	$772,877	$242,782	$97,910	19	38
226 Anal Procs	8	-	8	$675,901	$213,243	$67,121	10	23
227 Oth Hernia Procs	12	3	9	$3,528,174	$760,215	$229,098	37	74
228 Inguin, Fem & Umbil Hernia Procs	5	-	5	$416,292	$126,617	$52,007	7	18
229 Oth Digestive & Abdo Procs	4	-	4	$598,293	$233,672	$62,554	14	33
240 Digestive Malig	3	-	3	$138,360	$51,045	$32,602	6	9
241 Peptic Ulcer & Gastritis	23	1	22	$1,364,572	$397,004	$154,966	32	68
242 Maj Esophageal Dis	3	-	3	$133,062	$30,877	$14,940	4	7
243 Oth Esophageal Dis	11	-	11	$603,360	$160,501	$54,459	11	20
244 Diverticulitis & Diverticulosis	3	-	3	$281,825	$74,292	$11,017	3	6
245 Inflammatory Bowel Disease	1	-	1	$135,932	$33,983	$25,461	1	2
246 Gastroint Vasc Insufficiency	3	-	3	$263,219	$45,258	$18,655	5	12
247 Intestinal Obstruction	8	1	7	$1,057,301	$340,958	$68,435	10	26
248 Maj Gastroint & Peritoneal Inf	11	-	11	$988,358	$306,456	$60,685	14	24
249 Non-Bact Gastroenteritis, N & V	10	-	10	$357,092	$97,125	$30,472	7	10
251 Abdominal Pain	6	-	6	$228,919	$59,311	$18,993	5	6
252 Complic of Gi Device or Proc	3	-	3	$436,836	$129,641	$16,510	3	8
253 Oth & Unspec Gi Hemorrhage	8	-	8	$547,240	$133,943	$53,386	10	18
254 Oth Digestive Sys Diags	16	-	16	$659,780	$184,244	$97,448	16	29
260 Maj Pancreas & Liver Procs	13	-	13	$4,387,881	$1,155,559	$390,737	58	122
261 Maj Biliary Tract Procs	3	-	3	$328,737	$98,409	$78,992	10	14
262 Cholecystectomy Exc Laparo	15	-	15	$2,241,485	$722,853	$212,693	43	98
263 Laparoscopic Cholecystectomy	33	-	33	$2,496,383	$755,900	$286,772	59	107
264 Oth Hepatobiliary & Abdo Procs	2	-	2	$824,800	$246,976	$44,505	8	18
279 Hepatic Coma & Oth Maj Liver Dis	6	-	6	$597,563	$173,295	$39,039	7	16
280 Alcoholic Liver Disease	16	-	16	$1,175,844	$357,038	$107,132	18	40
281 Malig of Hepatobiliary Sys	5	-	5	$343,511	$161,179	$38,967	9	13
282 Dis of Pancreas Exc Malig	29	4	25	$3,501,356	$1,122,590	$319,596	47	110
283 Oth Dis of the Liver	15	-	15	$1,196,276	$329,887	$112,896	19	45
284 Dis of Gallbladder	7	-	7	$371,031	$93,133	$43,047	10	23
301 Hip Joint Replacement	18	-	18	$1,145,674	$323,825	$188,628	50	68
302 Knee Joint Replacement	46	-	46	$3,924,750	$1,120,235	$540,403	120	176

Appendix Table B.2 Stays Where Presence of a PPC Affected DRG Assignment								
Base APR-DRG	Stays Change DRG	Stays Change Base DRG	Stays Change SOI	Billed Charges	Estimated Hospital Cost	Payment	APR-DRG Total Casemix without PPC Diagnoses	APR-DRG Total Casemix All Diagnoses
303 Lumb Fusion for Back Curvature	2	-	2	$403,787	$57,903	$62,713	14	18
304 Lumb Fusion Exc Back Curvature	12	-	12	$1,581,679	$419,422	$260,120	54	87
305 Amput of Lower Limb Exc Toes	33	1	32	$3,661,355	$1,253,763	$582,725	89	167
308 Hip & Femur Procs for Trauma	29	1	28	$2,766,673	$893,035	$382,865	75	134
309 Hip & Femur Procs Non-Trauma	9	2	7	$1,347,589	$413,234	$135,243	31	42
310 Disc Excision & Decompress	15	-	15	$1,905,382	$551,600	$195,481	35	50
312 Skin Graft for Connect Tis Diags	2	-	2	$293,650	$122,055	$34,050	7	11
313 Knee & Lower Leg Procs Exc Foot	20	-	20	$1,884,206	$593,786	$214,564	48	91
314 Foot & Toe Procs	14	-	14	$1,078,716	$272,659	$177,425	28	40
315 Shoulder And Arm Procs	11	-	11	$1,195,421	$290,471	$109,661	28	64
316 Hand & Wrist Procs	3	-	3	$154,739	$40,665	$20,953	4	9
317 Soft Tissue Procs	10	-	10	$1,096,500	$256,685	$133,328	26	43
320 Oth Muscskl & Connect Tis Procs	8	-	8	$862,608	$221,371	$106,865	20	30
321 Cervical Spinal Fusion	10	1	9	$2,216,401	$570,168	$278,280	45	78
340 Fracture of Femur	1	-	1	$41,567	$-	$5,319	1	1
342 Fx & Dislc Exc Femur, Pelvis, Back	2	-	2	$66,269	$19,589	$9,957	2	3
344 Musculoskeletal Inf	7	1	6	$777,120	$313,039	$115,632	12	27
346 Connective Tissue Dis	11	-	11	$1,985,632	$372,303	$107,708	14	28
347 Oth Back & Neck Dis, Fx & Injuries	6	-	6	$433,559	$127,573	$41,442	8	17
349 Complic of Ortho Device or Proc	3	-	3	$249,215	$46,843	$22,844	4	8
351 Oth Muscskl & Connect Tis Diags	11	-	11	$645,964	$195,391	$51,177	15	28
361 Skin Graft for Cutaneous Diags	13	-	13	$1,796,615	$458,204	$123,871	32	56
362 Mastectomy Procs	1	-	1	$72,770	$16,009	$7,134	2	2
363 Breast Procs Exc Mastectomy	1	-	1	$31,151	$8,411	$6,194	1	3
364 Oth Cutaneous & Related Procs	17	1	16	$2,851,363	$695,110	$212,518	38	59
380 Skin Ulcers	12	-	12	$955,191	$262,654	$82,434	16	28
381 Maj Skin Dis	2	-	2	$122,987	$37,643	$17,190	4	9
383 Cellulitis & Oth Bact Skin Inf	55	1	54	$4,482,166	$1,110,895	$306,286	61	132
384 Trauma To Cutaneous Tissue	1	-	1	$54,864	$23,043	$9,639	2	3
385 Oth Cutaneous Tis & Breast Dis	4	-	4	$177,032	$55,918	$15,907	4	6
401 Pituitary & Adrenal Procs	1	-	1	$516,510	$72,311	$14,460	3	6
403 Procs for Obesity	5	1	4	$1,952,380	$345,464	$96,215	20	42
404 Thyroid Procs	1	-	1	$172,752	$55,280	$72,742	4	6
405 Oth Procs for Metabolic Dis	3	-	3	$336,243	$124,325	$32,566	7	18
420 Diabetes	38	2	36	$3,144,587	$952,412	$283,210	37	90
421 Nutritional Dis	5	-	5	$278,682	$66,353	$14,191	6	16
422 Hypovolemia	6	-	6	$210,528	$59,360	$23,492	4	8
424 Oth Endocrine Dis	7	-	7	$482,770	$110,065	$37,719	8	16
425 Electrolyte Dis Exc Hypovolemia	17	-	17	$1,305,180	$323,215	$76,852	16	34

Appendix Table B.2 Stays Where Presence of a PPC Affected DRG Assignment								
Base APR-DRG	Stays Change DRG	Stays Change Base DRG	Stays Change SOI	Billed Charges	Estimated Hospital Cost	Payment	APR-DRG Total Casemix without PPC Diagnoses	APR-DRG Total Casemix All Diagnoses
441 Maj Bladder Procs	5	1	4	$885,018	$244,198	$145,983	21	45
442 Kidney & Urinary Procs for Malig	5	-	5	$824,678	$206,127	$75,781	13	35
443 Kidney & Urinary Procs Nonmalig	12	-	12	$1,374,128	$367,347	$165,355	30	54
444 Renal Dialysis Access Proc	8	-	8	$866,325	$228,255	$86,183	18	30
445 Oth Bladder Procs	2	-	2	$158,259	$60,843	$15,364	4	4
446 Urethral Procs	3	-	3	$187,756	$33,047	$28,115	6	10
447 Oth Kidney & Urinary Procs	5	-	5	$1,748,024	$386,661	$62,133	15	63
460 Renal Failure	50	2	48	$5,497,028	$1,532,932	$413,704	74	187
462 Nephritis & Nephrosis	2	-	2	$245,345	$58,100	$14,012	4	7
463 Kidney & Urinary Tract Inf	28	1	27	$1,676,111	$414,953	$137,232	25	51
465 Urinary Stones & Obstruction	2	-	2	$231,170	$35,628	$11,407	3	4
466 Complic Genitourin Dev or Proc	10	-	10	$630,382	$165,208	$64,505	13	23
468 Oth Kidney & Urinary Diags	18	1	17	$1,103,590	$249,799	$121,927	22	44
480 Maj Male Pelvic Procs	1	-	1	$70,032	$21,010	$5,311	2	3
484 Oth Male Reproductive Procs	1	-	1	$112,641	$15,770	$14,740	2	4
501 Male Reproduct Diags Exc Malig	3	-	3	$350,635	$83,200	$15,516	3	11
512 Uterine/Adnexa Procs Oth Malig	5	-	5	$236,072	$90,215	$39,629	11	16
513 Uterine/Adnexa Procs Non-Malig	19	-	19	$951,915	$240,779	$110,948	23	37
514 Fem Reproduct Reconstr Procs	2	-	2	$204,899	$58,794	$8,299	2	3
517 D&C for Non-Obstetric Diags	2	-	2	$210,386	$70,024	$11,972	6	8
519 Uterine/Adnexa Procs Leiomyoma	6	-	6	$650,160	$213,869	$34,305	9	16
530 Female Reproductive Sys Malig	2	-	2	$85,148	$28,298	$14,181	3	7
531 Female Reproductive Sys Inf	1	-	1	$13,287	$4,119	$3,312	1	1
532 Menstrual & Oth Fem Reprod Dis	4	-	4	$228,185	$41,641	$13,245	3	6
540 Cesarean Del	951	-	951	$22,141,362	$6,891,823	$3,250,577	675	1,014
541 Vag Del w Ster &/or D&C	339	-	339	$4,330,325	$1,417,603	$528,164	182	206
542 Vag Del w Proc Exc Ster &/or D&C	7	-	7	$296,229	$102,325	$29,976	4	11
544 D&C for Obstetric Diags	5	-	5	$355,576	$113,214	$19,097	5	12
545 Ectopic Pregnancy Proc	8	-	8	$371,099	$125,671	$34,181	9	15
560 Vaginal Del	2,955	174	2,781	$31,370,363	$9,954,415	$5,495,069	1,204	1,525
561 Postpartum Diags w/o Proc	2	-	2	$117,494	$38,821	$9,225	2	6
563 Threatened Abortion	5	-	5	$124,931	$32,502	$8,429	2	3
564 Abortion w/o D&C	1	-	1	$11,204	$2,577	$1,950	0	1
566 Oth Antepartum Diags	13	-	13	$410,463	$84,595	$25,217	7	19
651 Oth Procs of Blood & Rel Organs	5	-	5	$1,172,850	$423,796	$115,831	8	39
660 Maj Hem/Immun Diag	2	-	2	$187,762	$58,702	$9,726	3	7
662 Sickle Cell Anemia Crisis	19	-	19	$864,783	$186,150	$81,420	20	34
663 Oth Dis of Blood & Rel Organs	16	-	16	$1,429,605	$349,978	$95,014	16	32
680 Maj O.R. Proc Lymphatic	1	-	1	$100,090	$53,048	$17,174	3	5

Appendix Table B.2 Stays Where Presence of a PPC Affected DRG Assignment								
Base APR-DRG	Stays Change DRG	Stays Change Base DRG	Stays Change SOI	Billed Charges	Estimated Hospital Cost	Payment	APR-DRG Total Casemix without PPC Diagnoses	APR-DRG Total Casemix All Diagnoses
Neoplasm								
681 Oth O.R. Proc Lymphatic Neoplasm	1	-	1	$196,294	$58,888	$13,355	5	10
691 Lymphoma, Myeloma & Non-Ac Leuk	2	-	2	$290,489	$76,218	$16,359	6	12
693 Chemothapy	3	-	3	$209,704	$56,641	$26,446	4	12
694 Lymphatic & Oth Malig & Neoplasms	2	-	2	$145,738	$46,636	$14,331	5	6
710 Inf & Parasit Dis Incl HIV w O.R. Proc	18	1	17	$4,560,210	$1,116,135	$474,745	70	144
711 Post-Op, Device Inf w O.R. Proc	18	2	16	$2,418,179	$793,820	$320,544	69	121
720 Septicemia & Disseminated Inf	45	-	45	$3,536,764	$1,029,878	$332,833	68	149
721 Post-Op, Post-Trauma, Device Inf	7	-	7	$337,707	$101,931	$45,168	9	17
723 Viral Illness	1	-	1	$16,153	$7,108	$1,845	1	2
724 Oth Inf & Parasit Diseases	4	-	4	$633,196	$114,701	$23,802	5	10
750 Schizophrenia	4	-	4	$88,572	$38,591	$11,894	3	4
751 Maj Depression	5	-	5	$125,904	$22,245	$12,795	3	3
753 Bipolar Dis	4	-	4	$201,287	$36,091	$13,377	2	3
756 Acute Anxiety & Delirium States	1	-	1	$23,249	$8,137	$2,648	1	1
775 Alcohol Abuse & Dependence	5	-	5	$417,174	$123,941	$29,049	6	15
776 Oth Drug Abuse & Dependence	3	1	2	$443,382	$208,307	$74,237	5	16
791 O.R. Proc for Complic of Care	10	-	10	$1,880,337	$682,919	$202,892	22	43
811 Allergic Reactions	1	-	1	$194,670	$40,881	$4,006	1	3
812 Poisoning of Medicinal Agents	14	-	14	$1,013,281	$236,102	$101,008	14	33
813 Oth Complics of Treatment	6	-	6	$958,436	$307,094	$55,997	8	14
816 Toxic Eff of Non-Medicinal Subst	8	1	7	$638,047	$193,003	$76,604	9	35
850 Proc w Diag of Rehab or Other	1	-	1	$136,410	$43,651	$4,558	4	12
860 Rehabilitation	6	-	6	$462,304	$134,286	$61,668	16	25
861 Signs, Symptoms & Oth Factors	7	-	7	$341,220	$58,083	$24,658	6	8
950 Ext Proc Unrel To Diag	19	-	19	$6,086,865	$1,387,613	$367,075	85	160
951 Mod Ext Proc Unrel To Diag	30	-	30	$6,380,751	$1,275,962	$527,628	85	194
952 Nonext Proc Unrel To Diag	12	1	11	$1,510,786	$390,422	$187,045	30	65
All PPC stays	6,775	281	6,494	$384,345,340	$108,306,570	$43,524,781	8,403	14,031
All stays	251,994	281	6,494	$7,583,477,827	$2,117,379,991	$1,107,306,010	296,238	298,832

Notes:

1. Casemix was measured using Texas Medicaid relative weights for APR-DRG V.29.
2. SOI=severity of illness
3. For an explanation of the table, please see Section 2.2.2.

B.3 PPC Incidence by Base APR-DRG

Appendix Table B.3 PPC Incidence by Base APR-DRG							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/PPC Stay	PPCs/100 Stays	PPC Cost
001 Liver &/or Intest Transpl	23	0	0.0%	0	0.0	0.0	0
002 Heart &/or Lung Transpl	9	0	0.0%	0	0.0	0.0	0
003 Bone Marrow Transpl	16	0	0.0%	0	0.0	0.0	0
004 Trach, MV 96+ Hrs, w Ext Proc	334	108	32.3%	257	2.4	76.9	$2,878,181
005 Trach, MV 96+ Hrs, w/o Ext Proc	402	176	43.8%	340	1.9	84.6	$3,427,657
006 Pancreas Transpl	3	0	0.0%	0	0.0	0.0	0
020 Craniotomy for Trauma	113	0	0.0%	0	0.0	0.0	0
021 Craniotomy Exc for Trauma	501	97	19.4%	164	1.7	32.7	$1,538,223
022 Ventricular Shunt Procs	224	47	21.0%	77	1.6	34.4	$651,647
023 Spinal Procs	120	14	11.7%	16	1.1	13.3	$106,869
024 Extracranial Vascular Procs	288	35	12.2%	44	1.3	15.3	$348,627
026 Oth Nerv Sys & Related Procs	106	6	5.7%	11	1.8	10.4	$81,549
040 Spinal Dis & Injuries	45	2	4.4%	5	2.5	11.1	$37,945
041 Nervous Sys Malig	231	0	0.0%	0	0.0	0.0	0
042 Degen Nerv Sys Dis Exc Ms	190	12	6.3%	14	1.2	7.4	$84,761
043 Mult Sclerosis	204	9	4.4%	11	1.2	5.4	$93,669
044 Intracranial Hemorrhage	394	58	14.7%	82	1.4	20.8	$622,339
045 CVA & Precereb Occl w Infarct	1,544	150	9.7%	219	1.5	14.2	$1,526,631
046 Nonspec CVA w/o Infarct	45	3	6.7%	4	1.3	8.9	$13,963
047 Transient Ischemia	455	14	3.1%	19	1.4	4.2	$122,132
048 Nerve Disorders	766	23	3.0%	34	1.5	4.4	$218,025
049 Bact & Tub Inf of Nervous Sys	76	14	18.4%	18	1.3	23.7	$146,987
050 Non-Bact Inf of Nerv Sys	69	14	20.3%	18	1.3	26.1	$193,361
051 Viral Meningitis	78	2	2.6%	5	2.5	6.4	$49,792
052 Nontraumatic Stupor & Coma	335	20	6.0%	28	1.4	8.4	$189,419
053 Seizure	1,983	57	2.9%	74	1.3	3.7	$591,552
054 Migraine & Oth Headaches	312	5	1.6%	5	1.0	1.6	$28,730
055 Head Trauma w Coma >1 Hr	200	0	0.0%	0	0.0	0.0	0
056 Complic Skull Fx, Coma <1 Hr	56	0	0.0%	0	0.0	0.0	0
057 Uncomplic Head Trauma	74	3	4.1%	3	1.0	4.1	$13,963
058 Oth Dis of Nervous Sys	526	17	3.2%	19	1.1	3.6	$126,749
070 Orbital Procs	20	1	5.0%	1	1.0	5.0	$14,699
073 Eye Procs Exc Orbit	30	1	3.3%	1	1.0	3.3	$13,465
080 Acute Maj Eye Inf	43	0	0.0%	0	0.0	0.0	0
082 Eye Dis Exc Maj Inf	93	0	0.0%	0	0.0	0.0	0
089 Maj Cranial/Facial Bone Procs	75	5	6.7%	6	1.2	8.0	$42,605
090 Maj Larynx & Trachea Procs	36	5	13.9%	10	2.0	27.8	$81,285
091 Oth Maj Head & Neck Procs	29	2	6.9%	3	1.5	10.3	$23,077
092 Facial Bone Procs Exc Major	59	0	0.0%	0	0.0	0.0	0

Appendix Table B.3 PPC Incidence by Base APR-DRG							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/PPC Stay	PPCs/100 Stays	PPC Cost
093 Sinus & Mastoid Procs	23	0	0.0%	0	0.0	0.0	0
095 Cleft Lip & Palate Repair	4	1	25.0%	2	2.0	50.0	$14,172
097 Tonsil & Adenoid Procs	41	0	0.0%	0	0.0	0.0	0
098 Oth Ear, Nose Throat Procs	141	10	7.1%	14	1.4	9.9	$90,732
110 Ear, Nose, Throat, Facial Malig	152	4	2.6%	4	1.0	2.6	$33,400
111 Vertigo & Oth Labyrinth Dis	124	0	0.0%	0	0.0	0.0	0
113 Inf of Upper Resp Tract	277	6	2.2%	7	1.2	2.5	$46,468
114 Dental & Oral Conditions	167	6	3.6%	7	1.2	4.2	$80,689
115 Oth Ear, Nose, Throat Diags	192	12	6.3%	17	1.4	8.9	$166,836
120 Maj Resp & Chest Procs	162	41	25.3%	58	1.4	35.8	$513,686
121 Oth Resp & Chest Procs	264	37	14.0%	61	1.6	23.1	$593,343
130 Resp Sys Diag w MV 96+ Hrs	518	135	26.1%	228	1.7	44.0	$2,019,026
131 Cystic Fibrosis - Pulmon Dis	124	8	6.5%	9	1.1	7.3	$66,401
133 Pulmon Edema & Resp Failure	1,409	117	8.3%	148	1.3	10.5	$1,001,304
134 Pulmonary Embolism	528	43	8.1%	59	1.4	11.2	$468,378
135 Maj Chest & Resp Trauma	126	0	0.0%	0	0.0	0.0	0
136 Resp Malig	561	13	2.3%	15	1.2	2.7	$84,316
137 Maj Resp Inf & Inflammations	943	91	9.7%	125	1.4	13.3	$966,194
138 Bronchiolitis & RSV Pneumonia	5	0	0.0%	0	0.0	0.0	0
139 Oth Pneumonia	3,145	149	4.7%	176	1.2	5.6	$1,131,341
140 COPD	4,018	154	3.8%	180	1.2	4.5	$1,049,349
141 Asthma	863	19	2.2%	20	1.1	2.3	$149,876
142 Interstitial & Alveolar Lung Dis	157	14	8.9%	15	1.1	9.6	$97,294
143 Oth Resp Diags Exc Minor	555	33	5.9%	36	1.1	6.5	$230,006
144 Resp Symptoms & Minor Diags	750	17	2.3%	19	1.1	2.5	$115,154
160 Maj Repair of Heart Anomaly	4	2	50.0%	2	1.0	50.0	$10,680
161 Defib & Heart Assist Implant	302	48	15.9%	81	1.7	26.8	$657,732
162 Cardiac Valve Procs w Cath	53	35	66.0%	58	1.7	109.4	$395,176
163 Cardiac Valve Procs w/o Cath	114	52	45.6%	96	1.8	84.2	$746,783
165 Coronary Bypass w Cath	356	141	39.6%	241	1.7	67.7	$1,624,321
166 Coronary Bypass w/o Cath	215	64	29.8%	96	1.5	44.7	$633,037
167 Oth Cardiothoracic Procs	34	13	38.2%	26	2.0	76.5	$219,694
169 Maj Vascular Procs	138	47	34.1%	84	1.8	60.9	$753,400
170 Pacemaker Impl w AMI or Shock	13	4	30.8%	4	1.0	30.8	$23,487
171 Pacemaker Impl w/o AMI or Shock	131	5	3.8%	6	1.2	4.6	$25,352
173 Oth Vascular Procs	750	136	18.1%	197	1.4	26.3	$1,774,387
174 Percut CV Procs w AMI	686	96	14.0%	144	1.5	21.0	$1,152,071
175 Percut CV Procs w/o AMI	597	45	7.5%	62	1.4	10.4	$401,249
176 Pacemaker & Defib Replacement	19	1	5.3%	1	1.0	5.3	17491.1
177 Pacemaker & Defib Revision	52	4	7.7%	6	1.5	11.5	$54,242
180 Oth Circulatory Sys Procs	158	27	17.1%	38	1.4	24.1	$356,494
190 Acute Myocardial Infarction	725	72	9.9%	107	1.5	14.8	$755,067

Appendix Table B.3 PPC Incidence by Base APR-DRG							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/PPC Stay	PPCs/100 Stays	PPC Cost
191 Cardiac Cath Exc Ischem Disease	504	64	12.7%	94	1.5	18.7	$640,949
192 Cardiac Cath for Ischem Disease	831	31	3.7%	40	1.3	4.8	$296,177
193 Acute & Subacute Endocarditis	46	9	19.6%	12	1.3	26.1	$101,765
194 Heart Failure	4,091	330	8.1%	417	1.3	10.2	$2,496,272
196 Cardiac Arrest	65	0	0.0%	0	0.0	0.0	0
197 Peripheral & Oth Vascular Dis	1040	42	4.0%	54	1.3	5.2	$426,173
198 Angina Pect & Atherosclerosis	1065	23	2.2%	25	1.1	2.3	$193,582
199 Hypertension	627	21	3.3%	21	1.0	3.3	$68,746
200 Cardiac Structural Dis	40	1	2.5%	1	1.0	2.5	$22,809
201 Cardiac Arrhythmias	1070	47	4.4%	62	1.3	5.8	$521,741
203 Chest Pain	1231	18	1.5%	20	1.1	1.6	$128,200
204 Syncope & Collapse	586	7	1.2%	8	1.1	1.4	$53,314
205 Cardiomyopathy	23	2	8.7%	4	2.0	17.4	$31,058
206 Complic of CV Device or Proc	152	8	5.3%	13	1.6	8.6	$70,343
207 Oth Circulatory Sys Diags	371	20	5.4%	26	1.3	7.0	$174,936
220 Maj Stomach & Esophag Procs	229	53	23.1%	93	1.8	40.6	$952,012
221 Maj Small & Large Bowel Procs	962	194	20.2%	316	1.6	32.8	$3,414,564
222 Oth Stomach & Esophag Procs	46	3	6.5%	3	1.0	6.5	$42,525
223 Oth Small & Large Bowel Procs	178	27	15.2%	45	1.7	25.3	$400,505
224 Peritoneal Adhesiolysis	121	21	17.4%	38	1.8	31.4	$318,784
225 Appendectomy	588	22	3.7%	26	1.2	4.4	$173,966
226 Anal Procs	178	17	9.6%	23	1.4	12.9	$196,610
227 Oth Hernia Procs	371	32	8.6%	38	1.2	10.2	$295,119
228 Inguin, Fem & Umbil Hernia Procs	136	13	9.6%	18	1.4	13.2	$148,263
229 Oth Digestive & Abdo Procs	159	13	8.2%	15	1.2	9.4	$104,003
240 Digestive Malig	451	7	1.6%	8	1.1	1.8	$47,485
241 Peptic Ulcer & Gastritis	1036	50	4.8%	69	1.4	6.7	$585,755
242 Maj Esophageal Dis	160	15	9.4%	22	1.5	13.8	$159,333
243 Oth Esophageal Dis	394	18	4.6%	22	1.2	5.6	$176,637
244 Diverticulitis & Diverticulosis	414	9	2.2%	11	1.2	2.7	$74,895
245 Inflammatory Bowel Disease	282	10	3.5%	15	1.5	5.3	$140,527
246 Gastroint Vasc Insufficiency	63	7	11.1%	10	1.4	15.9	$51,524
247 Intestinal Obstruction	803	23	2.9%	31	1.3	3.9	$206,881
248 Maj Gastroint & Peritoneal Inf	482	33	6.8%	42	1.3	8.7	$384,736
249 Non-Bact Gastroenteritis, N & V	1,385	32	2.3%	36	1.1	2.6	$205,218
251 Abdominal Pain	713	15	2.1%	15	1.0	2.1	$104,625
252 Complic of Gi Device or Proc	293	8	2.7%	15	1.9	5.1	$125,393
253 Oth & Unspec Gi Hemorrhage	849	36	4.2%	46	1.3	5.4	$384,775
254 Oth Digestive Sys Diags	1,275	41	3.2%	46	1.1	3.6	$348,497
260 Maj Pancreas & Liver Procs	185	40	21.6%	73	1.8	39.5	$731,871
261 Maj Biliary Tract Procs	46	13	28.3%	19	1.5	41.3	$243,949
262 Cholecystectomy Exc Laparo	176	37	21.0%	63	1.7	35.8	$511,828

Appendix Table B.3 PPC Incidence by Base APR-DRG							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/PPC Stay	PPCs/100 Stays	PPC Cost
263 Laparoscopic Cholecystectomy	1,736	97	5.6%	152	1.6	8.8	$1,454,257
264 Oth Hepatobiliary & Abdo Procs	62	7	11.3%	17	2.4	27.4	$190,549
279 Hepatic Coma & Oth Maj Liver Dis	1,284	42	3.3%	51	1.2	4.0	$461,521
280 Alcoholic Liver Disease	1,205	87	7.2%	125	1.4	10.4	$1,027,480
281 Malig of Hepatobiliary Sys	460	10	2.2%	13	1.3	2.8	$86,741
282 Dis of Pancreas Exc Malig	1,556	75	4.8%	96	1.3	6.2	$681,703
283 Oth Dis of the Liver	897	44	4.9%	69	1.6	7.7	$537,762
284 Dis of Gallbladder	546	25	4.6%	39	1.6	7.1	$306,269
301 Hip Joint Replacement	525	57	10.9%	69	1.2	13.1	$462,596
302 Knee Joint Replacement	909	104	11.4%	127	1.2	14.0	$785,006
303 Lumb Fusion for Back Curvature	14	4	28.6%	7	1.8	50.0	$59,288
304 Lumb Fusion Exc Back Curvature	567	39	6.9%	49	1.3	8.6	$313,009
305 Amput of Lower Limb Exc Toes	466	98	21.0%	149	1.5	32.0	$1,114,445
308 Hip & Femur Procs for Trauma	466	72	15.5%	109	1.5	23.4	$835,502
309 Hip & Femur Procs Non-Trauma	162	24	14.8%	36	1.5	22.2	$323,572
310 Disc Excision & Decompress	323	30	9.3%	40	1.3	12.4	$267,804
312 Skin Graft for Connect Tis Diags	45	10	22.2%	13	1.3	28.9	$101,160
313 Knee & Lower Leg Procs Exc Foot	687	50	7.3%	73	1.5	10.6	$512,376
314 Foot & Toe Procs	601	57	9.5%	68	1.2	11.3	$405,655
315 Shoulder And Arm Procs	310	25	8.1%	37	1.5	11.9	$250,376
316 Hand & Wrist Procs	127	5	3.9%	5	1.0	3.9	$36,178
317 Soft Tissue Procs	230	26	11.3%	36	1.4	15.7	$260,485
320 Oth Muscskl & Connect Tis Procs	187	13	7.0%	17	1.3	9.1	$89,564
321 Cervical Spinal Fusion	475	21	4.4%	31	1.5	6.5	$228,852
340 Fracture of Femur	44	3	6.8%	4	1.3	9.1	$36,331
341 Fx of Pelvis or Dislocation of Hip	48	0	0.0%	0	0.0	0.0	0
342 Fx & Dislc Exc Femur, Pelvis, Back	173	8	4.6%	12	1.5	6.9	$91,493
343 Muscskl Malig & Pathol Fx	204	1	0.5%	1	1.0	0.5	$6,294
344 Musculoskeletal Inf	413	21	5.1%	24	1.1	5.8	$172,306
346 Connective Tissue Dis	405	34	8.4%	55	1.6	13.6	$447,694
347 Oth Back & Neck Dis, Fx & Injuries	483	21	4.3%	30	1.4	6.2	$211,830
349 Complic of Ortho Device or Proc	191	12	6.3%	14	1.2	7.3	$86,770
351 Oth Muscskl & Connect Tis Diags	584	26	4.5%	28	1.1	4.8	$163,550
361 Skin Graft for Cutaneous Diags	196	32	16.3%	41	1.3	20.9	$360,614
362 Mastectomy Procs	384	14	3.6%	16	1.1	4.2	$129,229
363 Breast Procs Exc Mastectomy	116	5	4.3%	6	1.2	5.2	$49,842
364 Oth Cutaneous & Related Procs	452	45	10.0%	63	1.4	13.9	$553,074
380 Skin Ulcers	449	27	6.0%	33	1.2	7.3	$335,379
381 Maj Skin Dis	88	6	6.8%	11	1.8	12.5	$91,318
382 Malignant Breast Dis	123	0	0.0%	0	0.0	0.0	0
383 Cellulitis & Oth Bact Skin Inf	3,244	110	3.4%	151	1.4	4.7	$1,064,398
384 Trauma To Cutaneous Tissue	161	5	3.1%	7	1.4	4.3	$43,488

Appendix Table B.3 PPC Incidence by Base APR-DRG							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/PPC Stay	PPCs/100 Stays	PPC Cost
385 Oth Cutaneous Tis & Breast Dis	273	7	2.6%	9	1.3	3.3	$85,179
401 Pituitary & Adrenal Procs	46	7	15.2%	11	1.6	23.9	$116,152
403 Procs for Obesity	330	14	4.2%	33	2.4	10.0	$357,058
404 Thyroid Procs	112	6	5.4%	8	1.3	7.1	$72,816
405 Oth Procs for Metabolic Dis	71	20	28.2%	33	1.7	46.5	$370,632
420 Diabetes	2,530	94	3.7%	113	1.2	4.5	$854,500
421 Nutritional Dis	84	6	7.1%	7	1.2	8.3	$68,938
422 Hypovolemia	560	17	3.0%	23	1.4	4.1	$155,979
423 Inborn Errors of Metabolism	52	5	9.6%	9	1.8	17.3	$93,928
424 Oth Endocrine Dis	352	16	4.5%	22	1.4	6.3	$124,242
425 Electrolyte Dis Exc Hypovolemia	2,194	59	2.7%	80	1.4	3.6	$557,519
440 Kidney Transpl	10	0	0.0%	0	0.0	0.0	0
441 Maj Bladder Procs	33	9	27.3%	16	1.8	48.5	$141,932
442 Kidney & Urinary Procs for Malig	108	9	8.3%	13	1.4	12.0	$78,896
443 Kidney & Urinary Procs Nonmalig	300	30	10.0%	45	1.5	15.0	$366,730
444 Renal Dialysis Access Proc	276	27	9.8%	32	1.2	11.6	$323,395
445 Oth Bladder Procs	33	5	15.2%	8	1.6	24.2	$41,470
446 Urethral Procs	213	12	5.6%	14	1.2	6.6	$107,370
447 Oth Kidney & Urinary Procs	150	25	16.7%	39	1.6	26.0	$426,122
460 Renal Failure	2,754	193	7.0%	251	1.3	9.1	$2,360,634
461 Kidney & Urinary Tract Malig	56	0	0.0%	0	0.0	0.0	0
462 Nephritis & Nephrosis	38	4	10.5%	4	1.0	10.5	$45,127
463 Kidney & Urinary Tract Inf	2,585	75	2.9%	91	1.2	3.5	$732,409
465 Urinary Stones & Obstruction	359	9	2.5%	12	1.3	3.3	$105,335
466 Complic Genitourin Dev or Proc	637	35	5.5%	47	1.3	7.4	$426,034
468 Oth Kidney & Urinary Diags	857	56	6.5%	69	1.2	8.1	$541,224
480 Maj Male Pelvic Procs	40	6	15.0%	7	1.2	17.5	$31,432
481 Penis Procs	24	2	8.3%	2	1.0	8.3	$9,567
482 Transurethral Prostatectomy	43	4	9.3%	4	1.0	9.3	$20,701
483 Testes & Scrotal Procs	34	2	5.9%	2	1.0	5.9	$18,321
484 Oth Male Reproductive Procs	19	3	15.8%	4	1.3	21.1	$27,193
500 Malig, Male Reproductive Sys	30	0	0.0%	0	0.0	0.0	0
501 Male Reproduct Diags Exc Malig	159	6	3.8%	11	1.8	6.9	$92,883
510 Radical Hysterectectomy	61	5	8.2%	5	1.0	8.2	$33,310
511 Procs for Uterine/Adnexa Malig	66	0	0.0%	0	0.0	0.0	0
512 Uterine/Adnexa Procs Oth Malig	77	7	9.1%	7	1.0	9.1	$54,081
513 Uterine/Adnexa Procs Non-Malig	1,506	92	6.1%	105	1.1	7.0	$745,099
514 Fem Reproduct Reconstr Procs	95	5	5.3%	5	1.0	5.3	$27,904
517 D&C for Non-Obstetric Diags	60	2	3.3%	3	1.5	5.0	$19,442
518 Oth Fem Reproductive Procs	142	3	2.1%	4	1.3	2.8	$17,036
519 Uterine/Adnexa Procs Leiomyoma	517	29	5.6%	37	1.3	7.2	$266,991
530 Female Reproductive Sys Malig	176	6	3.4%	7	1.2	4.0	$53,937

Appendix Table B.3 PPC Incidence by Base APR-DRG							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/PPC Stay	PPCs/100 Stays	PPC Cost
531 Female Reproductive Sys Inf	224	3	1.3%	4	1.3	1.8	$32,876
532 Menstrual & Oth Fem Reprod Dis	245	6	2.4%	6	1.0	2.4	$30,716
540 Cesarean Del	40,444	3,136	7.8%	3,552	1.1	8.8	$3,489,506
541 Vag Del w Ster &/or D&C	4,900	759	15.5%	827	1.1	16.9	$255,595
542 Vag Del w Proc Exc Ster &/or D&C	222	196	88.3%	261	1.3	117.6	$83,382
544 D&C for Obstetric Diags	783	12	1.5%	18	1.5	2.3	$155,149
545 Ectopic Pregnancy Proc	801	23	2.9%	25	1.1	3.1	$167,244
546 Oth O.R. Proc for Ob Diag Exc Del	233	11	4.7%	11	1.0	4.7	$64,306
560 Vaginal Del	72,530	6,324	8.7%	6,657	1.1	9.2	$1,232,294
561 Postpartum Diags w/o Proc	1236	6	0.5%	6	1.0	0.5	$40,185
563 Threatened Abortion	1,977	11	0.6%	11	1.0	0.6	$62,825
564 Abortion w/o D&C	558	2	0.4%	2	1.0	0.4	$23,985
565 False Labor	95	0	0.0%	0	0.0	0.0	0
566 Oth Antepartum Diags	7,569	54	0.7%	58	1.1	0.8	$466,962
650 Splenectomy	29	3	10.3%	5	1.7	17.2	$49,284
651 Oth Procs of Blood & Rel Organs	45	6	13.3%	11	1.8	24.4	$99,823
660 Maj Hem/Immun Diag	556	11	2.0%	16	1.5	2.9	$150,303
661 Coagulation & Platelet Dis	169	3	1.8%	3	1.0	1.8	$23,389
662 Sickle Cell Anemia Crisis	1,398	43	3.1%	57	1.3	4.1	$469,543
663 Oth Dis of Blood & Rel Organs	1225	36	2.9%	45	1.3	3.7	$366,788
680 Maj O.R. Proc Lymphatic Neoplasm	84	4	4.8%	6	1.5	7.1	$53,315
681 Oth O.R. Proc Lymphatic Neoplasm	132	1	0.8%	1	1.0	0.8	$975
690 Acute Leukemia	132	0	0.0%	0	0.0	0.0	0
691 Lymphoma, Myeloma & Non-Ac Leuk	243	4	1.6%	6	1.5	2.5	$33,580
692 Radiothapy	15	0	0.0%	0	0.0	0.0	0
693 Chemothapy	1038	9	0.9%	9	1.0	0.9	$76,028
694 Lymphatic & Oth Malig & Neoplasms	142	4	2.8%	5	1.3	3.5	$27,071
710 Inf & Parasit Dis Incl HIV w O.R. Proc	725	93	12.8%	122	1.3	16.8	$823,520
711 Post-Op, Device Inf w O.R. Proc	317	41	12.9%	59	1.4	18.6	$428,228
720 Septicemia & Disseminated Inf	4,040	230	5.7%	283	1.2	7.0	$1,997,288
721 Post-Op, Post-Trauma, Device Inf	911	47	5.2%	55	1.2	6.0	$413,085
722 Fever	191	2	1.0%	4	2.0	2.1	51849.1
723 Viral Illness	89	3	3.4%	5	1.7	5.6	$63,546
724 Oth Inf & Parasit Diseases	191	9	4.7%	14	1.6	7.3	$113,910
740 Mental Illness Diag w O.R. Proc	13	2	15.4%	4	2.0	30.8	$22,093
750 Schizophrenia	2,620	13	0.5%	14	1.1	0.5	$87,173
751 Maj Depression	1,682	13	0.8%	13	1.0	0.8	$63,876
752 Dis of Personality	22	1	4.5%	1	1.0	4.5	$6,294
753 Bipolar Dis	2,504	15	0.6%	16	1.1	0.6	$109,090
754 Depression Exc Maj Dep	314	1	0.3%	1	1.0	0.3	$6,494
755 Adjust Dis & Neuroses Exc Dep	58	0	0.0%	0	0.0	0.0	0
756 Acute Anxiety & Delirium States	128	3	2.3%	3	1.0	2.3	$975

Appendix Table B.3 PPC Incidence by Base APR-DRG							
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg PPCs/PPC Stay	PPCs/100 Stays	PPC Cost
757 Organic Mental Health Disturb	57	2	3.5%	2	1.0	3.5	$9,450
758 Childhood Behavioral Dis	76	1	1.3%	1	1.0	1.3	$10,401
759 Eating Dis	4	0	0.0%	0	0.0	0.0	0
760 Oth Mental Health Dis	19	1	5.3%	1	1.0	5.3	$3,382
770 Drug & Alcohol Abuse, AMA	37	0	0.0%	0	0.0	0.0	0
772 Alc & Drug Dep w Rehab or Detox	7	0	0.0%	0	0.0	0.0	0
773 Opioid Abuse & Dependence	111	3	2.7%	3	1.0	2.7	$9,950
774 Cocaine Abuse & Dependence	59	0	0.0%	0	0.0	0.0	0
775 Alcohol Abuse & Dependence	230	14	6.1%	26	1.9	11.3	$271,464
776 Oth Drug Abuse & Dependence	71	5	7.0%	6	1.2	8.5	$40,699
791 O.R. Proc for Complic of Care	196	20	10.2%	34	1.7	17.3	$363,407
811 Allergic Reactions	88	2	2.3%	3	1.5	3.4	$20,920
812 Poisoning of Medicinal Agents	1,630	56	3.4%	70	1.3	4.3	$576,694
813 Oth Complics of Treatment	380	16	4.2%	25	1.6	6.6	$185,407
815 Oth Inj And Poisoning Diags	82	0	0.0%	0	0.0	0.0	0
816 Toxic Eff of Non-Medicinal Subst	407	25	6.1%	35	1.4	8.6	$343,615
841 Ext 3Rd Deg Burns w Skin Graft	5	0	0.0%	0	0.0	0.0	0
842 Full Thick Burns w Graft	16	0	0.0%	0	0.0	0.0	0
843 Ext Burns w/o Skin Graft	21	0	0.0%	0	0.0	0.0	0
844 Part Thick Burns w or w/o Graft	41	3	7.3%	4	1.3	9.8	$28,285
850 Proc w Diag of Rehab or Other	80	5	6.3%	8	1.6	10.0	$62,581
860 Rehabilitation	288	20	6.9%	23	1.2	8.0	$183,213
861 Signs, Symptoms & Oth Factors	773	22	2.8%	27	1.2	3.5	$160,205
862 Oth Aftercare & Convalescence	19	0	0.0%	0	0.0	0.0	0
890 HIV w Mult Maj Related Cond	533	0	0.0%	0	0.0	0.0	0
892 HIV w Maj Related Cond	591	0	0.0%	0	0.0	0.0	0
893 HIV w Mult Sig Related Cond	131	0	0.0%	0	0.0	0.0	0
894 HIV	362	0	0.0%	0	0.0	0.0	0
910 Craniotomy for Mult Sig Trauma	46	0	0.0%	0	0.0	0.0	0
911 Ext Trunk Procs Mult Sig Trauma	113	0	0.0%	0	0.0	0.0	0
912 Muscskl Procs Mult Sig Trauma	231	0	0.0%	0	0.0	0.0	0
930 Mult Sig Trauma w/o O.R. Proc	99	0	0.0%	0	0.0	0.0	0
950 Ext Proc Unrel To Diag	232	63	27.2%	127	2.0	54.7	$1,254,525
951 Mod Ext Proc Unrel To Diag	673	83	12.3%	135	1.6	20.1	$1,077,887
952 Nonext Proc Unrel To Diag	376	29	7.7%	40	1.4	10.6	$305,100
All DRGs	251,994	17,828	7.1%	21,774	1.2	8.6	$88,699,873

Appendix C Methodology

C.1 Data Sources

This analysis is based on the fee-for-service (FFS) and primary care case management (PCCM) Medicaid population in SFY 2011 (September 2010 to August 2011). The PPC analysis began with the Claims Data File that TMHP prepares annually for use by HHSC Ratesetting staff. The file includes all paid claims from hospitals paid by DRG as well as from hospitals paid under TEFRA cost reimbursement principles. Claims for which Medicare was the primary payer and claims for patients who "spent down" to Medicaid eligibility are excluded from the Claims Data File.

C.2 Data Validation

A total of 467,789 claims were received in the Claims Data File (Table C.2.1). For purposes of the PPC analysis (and for the related analysis of potentially preventable readmissions) additional validation steps were taken that resulted in 98 claims (or 0.2 percent) being excluded before the file was run through the APR-DRG and PPC grouping algorithms. These additional steps are described below.

Of the 467,691 stays run through the APR-DRG and PPC grouping algorithms, 149 (0.03 percent) were excluded as "ungroupable." As described in Section 1.2, newborn stays, pediatric stays, and stays at hospitals that were exempt from present-on-admission reporting were also excluded. The resulting number of stays in the analytical dataset was 251,994.

Table C.2.1
Summary of Analytical Dataset Claims

Item	Claims	Claims or Stays	Section Reference
Claims Data File received	467,789	Claims	C.1
Not inpatient bill type	2	Claims	C.2.1.2
Informational claim only	34	Claims	C.2.5.1
Duplicate claim	10	Claims	C.2.1.4
Consolidated claim chain	52	Claims	C.2.1.1
Total claims grouped using PPC software	467,691		
Ungroupable	149	Stays	C.3
Removed ICN	318	Stays	
Stays excluded because the hospital was exempt from POA reporting	46,240	Stays	
Error APR- DRGs 955 and 956	104	Stays	
Newborn and pediatric stays excluded from analytical dataset	168,886	Stays	
Adult and obstetric stays included in analytical dataset	251,994		

Notes:

1. The sequence of analytical steps affects the counts shown in each row of the table. For example, a claim that showed both zero allowed days and was ungroupable would be counted within the "zero allowed days" category because that step occurred before the grouping step.
2. The PPC dataset differs from the dataset for potentially preventable readmissions by 5 claims because of differences in claim chaining.

C.2.1 Defining Complete Hospital Stays

The inpatient stay is the clinically meaningful unit of analysis. For many reasons, however, the number of claims that are paid through the claims processing system may not match the number of stays. TMHP therefore went to extensive effort to ensure that each record in the analytical dataset represented a single inpatient stay. These efforts included both steps taken in creating the Claims Data File and in adapting that file for use in the PPC analysis.

C.2.1.1 Validating Bill Types

The bill type is a three-digit field that is submitted by the hospital to the payer.[25] A value of 111, for example, is a single admit-through-discharge claim at a hospital for inpatient care. Values of 112, 113 and 114 indicate submission of interim claims, which were then chained together as explained in Section C.2.1.2.

C.2.1.2 Claim Chaining

Hospitals may submit more than one claim for a single inpatient stay, for three reasons:

- Interim claims—a hospital may submit an interim claim (indicated by bill frequency 2 or 3 and discharge status 30) while a patient remains in the hospital. When the patient is discharged, the hospital submits a final claim with bill frequency 4 and the appropriate discharge status. (Bill frequency is the third digit in the bill type field.)
- Late charges—a hospital may submit a supplementary claim for late charges without adjusting the original claim. A claim for late charges shows bill frequency 5. This can be confusing because the claims processing system then contains two valid claims for the same patient with the same dates of service.
- Adjusted claims—a hospital may resubmit ("adjust") a claim to correct information that had been submitted on the initial claim.

TMHP examined all of the situations in which there were claims with overlapping dates of service for the same patient in the same hospital. Claims that showed a one-day difference (e.g., one claim with last date of service Monday and another claim with first date of service Tuesday) were also examined. In situations where there was a one-day difference, TMHP relied on the admit date, bill type, and discharge status to determine whether the claim represented a single stay or an initial admission followed by a readmission.

"Claim chaining" is the process of combining multiple claims for a single stay into a single record in the analytical dataset. It applies to both interim claims and late charges, and it can reveal anomalies with adjusted claims. When all claims are billed as expected, claim chaining can be done systematically using a simple algorithm. Anomalies do occur, however, including internal inconsistencies (e.g., the bill frequency indicates an interim claim but the discharge status shows the patient was discharged home) and situations in which there appear to be missing claims in the chain.

The Claims Data File received for this report had already been processed through claim chaining. The file was checked for additional potential claim-chaining situations and then the claim-chaining algorithm was applied. Situations that were not handled by the algorithm were reviewed on an individual basis. In most cases, an examination of the admit dates, bill types, discharge statuses, dates of service, diagnoses, and other data allowed determination of the claim status with a high degree of confidence.

C.2.1.3 Discharge Date Anomalies

Claims were excluded if they did not clearly show the discharge date. This situation typically arose when the most recent claim for a patient showed a discharge status of 30 (still a patient). These anomalies can occur because the client was still a patient when the Claims Data File was created, or because of billing errors by the hospital.

C.2.1.4 Same-Day Stays

After claim chaining, claims were identified where the patient was admitted and discharged on the same calendar day. (These stays did not include patients who were transferred between acute care hospitals.) These stays were examined to ensure that they were not outpatient claims. Same-day stays may occur because the patient died, left against medical advice, or needed only a limited amount of inpatient care. TMHP examined the bill type, billed charges, diagnoses, and procedures. Decisions were made to err on the side of caution and reclassify a discharge status to acute care transfer. In these situations, a patient was admitted and discharged from a hospital within a single day and admitted to a second hospital the same day.

C.2.1.5 Claims with Low Charges

On average, Texas hospitals charge over $7,500 for a day of inpatient care.[30] Therefore, all of the claims that included charges under $500 a day were examined to look for anomalies in total charges or in the length of stay. TMHP's concern was that the claim might not represent a complete inpatient stay or that the length of stay might have been wrong. Upon further review, no material anomalies were found.

C.2.2 Unique Identification of Patients

C.2.2.1 Patient Identifier

Patients were uniquely identified using their Texas Medicaid client identification number (PCN), which is required from hospitals on both FFS and PCCM claims.

C.2.2.2 Corrected Client Gender

If the patient's gender was listed as "U=unknown," this was not a valid value for purposes of APR-DRG grouping. If possible, these values were corrected to M or F based on other information on the claim.

C.2.3 Unique Identification of Hospitals in the Claims Data File of FFS and PCCM Stays

Hospitals are uniquely identified by the Texas Provider Identifier (TPI) in the MMIS. Each TPI comprises a seven-digit base ID and a two-digit suffix. For example, 12346*01* might be a hospital's TPI for the hospital itself while 123456*02* might be the ambulatory surgical center at the same hospital. It is not uncommon for a single hospital to have multiple TPIs. The Claims Data File consistently shows the appropriate TPI for inpatient hospital care, in large part because the TPI matters in calculating payment on claims. Each TPI is associated with a provider name and a provider specialty, e.g., "hospital, non-profit, acute, 1-50 beds."

C.2.4 Diagnosis and Procedure Coding

C.2.4.1 Importance of Coding

Complication rates depend not only on the reason for the admission, but also on the severity of the patient's condition. To be fair in comparing hospitals, it is therefore necessary to have accurate data on the patient's clinical condition. This was measured using All Patient Refined Diagnosis Related Groups (APR-DRGs), which is discussed in Section C.3. APR-DRGs depend critically on the diagnosis and procedure codes listed by the hospital on the claim and then stored in the payer's claims processing system. Diagnosis and procedure coding on claims is never perfect, but it is essential to check these data fields for major issues that could invalidate comparisons among hospitals.

C.2.4.2 Valid Values

ICD-9-CM diagnosis and procedure code values can take different formats. For example, diagnosis codes can be three, four, or five digits, including leading or trailing zeroes, with a decimal place implied after three digits for most codes but after four digits for "E" codes. Similar potential for confusion exists with the procedure codes. Almost all of the received claims had procedure codes that were listed with a leading zero, so that a four-digit procedure code was received as five digits.

Other anomalies can arise when a hospital submits a diagnosis code or procedure code that is not valid for the date of discharge. These anomalies typically arise near October 1 of each year, which is the nationwide revision date for the ICD-9-CM codeset. In cases where it was obvious what the appropriate code should have been, the code value was adjusted, usually by adding or deleting a fifth digit to a diagnosis code.

C.2.4.3 Coding Completeness

For FFS and PCCM services in SFY 2011, Texas Medicaid paid most acute care hospitals based on MS-DRGs. These hospitals have strong financial incentives to be thorough in including diagnosis and procedure codes on claims, since these codes drive the DRG assignment for the claim. Medicaid paid other hospitals on cost reimbursement principles using "TEFRA" standards, which is a reference to the federal Tax Equity and Fiscal Responsibility Act of 1982. The two main categories of TEFRA hospitals are children's hospitals and psychiatric specialty hospitals. Without the financial incentive of DRG payment, the concern is that diagnosis and procedure codes would be under-reported by children's and specialty psychiatric hospitals.

One measure of coding completeness is simply the average number of diagnosis and procedure codes per claim. This measure is useful if the casemix is very similar between DRG hospitals and TEFRA hospitals. A more careful approach would be to adjust for the differences in the types of patients seen. TMHP does a casemix-adjusted comparison, making use of the fact that every claim shows a principal diagnosis. The principal diagnosis typically drives the assignment of the base APR-DRG.[27] (In some cases, the principal operating room procedure drives the DRG assignment.) The average count of diagnoses and procedures for each base APR-DRG is calculated and used as a norm to compare DRG and TEFRA hospitals.[28]

When coding is incomplete, the average casemix of patients can be understated for a hospital causing their performance to look worse compared to the benchmark. If there is a bias (where "bias" it used in the statistical sense), then its magnitude cannot be determined without better data from these hospitals. For analysis of PPCs, any anomalies in coding completeness among TEFRA hospitals are unlikely to have a material impact on the results. The reason is that most stays at children's hospitals were outside the scope of the analysis while most stays at psychiatric hospitals were at low risk for PPCs.

C.2.5 Other Data Validation Steps

C.2.5.1 Bill Type

One purpose of the bill type field is to identify interim claims. For example, three claims for a single stay might show bill types 112 (first interim claim), 113 (continuing interim claim), and 114 (final interim claim). When the Claims Data File is created, the claim chaining process shows the chained claim as having the bill type associated with the first claim in the chain, 112 in this example. This was adjusted to 111 so that the record in the analytical dataset would be correctly listed as admit-thru-discharge.

C.3 Grouping by APR-DRG

C.3.1 Overview

APR-DRGs are one of the DRG algorithms used to classify inpatients according to their clinical characteristics. After the Medicare Severity Diagnosis Related Group (MS-DRG) algorithm used by Medicare, the APR-DRG algorithm is probably the most widely known DRG algorithm. While Medicare DRGs were designed for use only in the Medicare population, APR-DRGs were designed for an all-patient population. In particular, APR-DRGs were designed to be more appropriate than Medicare DRGs for pediatrics, obstetrics, and various conditions that are not common in a Medicare population. APR-DRGs have been found to be suitable for a Medicaid population and are increasingly being used by Medicaid programs to calculate payment.[31]

APR-DRGs were developed by 3M Health Information Systems and the National Association of Children's Hospitals and Related Institutions.

C.3.2 Base DRG and the Severity of Illness

An advantage of APR-DRGs for analyses such as the present report is that the algorithm has a straightforward, easily understandable structure. Each APR-DRG is in the format 123-4. The first three digits represent the base DRG, which can be thought of as the reason for admission (usually the principal diagnosis, but sometimes the principal operating room procedure). The fourth digit represents the severity of illness on an ordinal scale of 1 to 4. Each inpatient stay is assigned to a single APR-DRG in an 18-step process that is documented in the APR-DRG definitions manual available from 3M Health Information Systems.

The PPC software includes logic to assign a stay to an APR-DRG. Version 29 of the combined APR-DRG and PPC software package was used for this analysis.

C.3.3 Validation of APR-DRG Assignments

About 0.03 percent of stays in the analytical dataset grouped to an error DRG, either "ungroupable" or the principal diagnosis code listed was not appropriate as a principal diagnosis. This percentage is in line with similar experience in other states. There are also three base APR-DRGs for situations where the principal diagnosis is not consistent with procedures performed. Given the wide range of care provided in modern hospitals, there can be perfectly valid reasons for such mismatches. These claims were examined for any obvious data issues, with none found.

C.4 Medicaid Care Category

Medicaid Care Category (MCC) is a categorization algorithm developed by TMHP for purposes of healthcare claims analysis. It is intended to result in a manageable list of categories (eleven) that are aligned with both the policy areas of a typical Medicaid program and the internal organization of a typical hospital. Table 1.1.1 shows the number of stays in the analytical dataset in each care category. Pediatrics was defined as under 18 years old; the categories of medical, surgical, etc. were defined by the APR-DRG; and patients in the obstetric category may be of any age. In purpose, MCCs are similar to Major Diagnostic Categories (MDCs), which are based on DRGs and used by many hospital researchers. For purposes of an analysis such as this one, the chief drawback of the MDC categorization is that it does not split out pediatric stays. The number of MCCs is also easier to work with than the number of MDCs (25).

C.5 PPC Analysis

The PPC methodology developed by 3M Health Information Systems is distinct from other methods of measuring hospital acquired complications as depicted in Table 1.3.1.1. Refer to Section 1.4 for more information, such as PPC methodology and examples. The logic for defining PPCs is well documented in John S. Hughes, Richard F. Averill, Norbert I. Goldfield, et al., *Potentially Preventable Complications (PPCs): Definitions Manual for PPC Version 29.0*, October 2011 version.

C.6 Estimating the Incremental Hospital Cost of a PPC

For this report, estimated cost impacts of each PPC were calculated based on Texas Medicaid SFY 2011 data using the same methodology that has previously been applied in other similar analyses of Medicare, California (all payer), and Maryland (all payer) data.[32] Following the same methodology enables an external check on the robustness of our results. That methodology, in brief, was as follows:

1. Start with the complete analytical dataset, grouped by APR-DRG, and identify PPCs through the application of the PPC software.
2. Estimate the hospital cost of each stay by multiplying charges for that stay times a cost-to-charge ratio (CCR) that is specific for inpatient care at that hospital. The CCRs were the most recent available from HHSC as of June 2012.[33]
3. Exclude stays that may cause misleading results. These exclusions were only for the cost impact analysis and followed precedent from earlier studies. Stays excluded from the estimation of cost impacts included those with charges under $200 or over $2 million; stays with discharge statuses of 02 (transferred to a general hospital), 05 (transferred to a children's or cancer hospital), and 20 (died); and stays with APR-DRGs that themselves had unstable coefficients (i.e., low t-statistics).[34] Overall, the cost impact analysis was based on 248,480 stays, or 3,514 stays fewer than in the analytical dataset for the report.
4. Specify a simple linear regression model that shows the cost of a stay depending on the APR-DRG (that is, the reason for admission and the severity of illness) and the PPC. The left-hand side of the equation was the cost of the stay while the right-hand side of the equation comprised 1,321 variables (i.e., 1,256 APR-DRG values plus 65 PPC values) plus the standard statistical error term. The regression was run using Minitab 16 software.
5. Analyze the results, interpreting the coefficient of each PPC as the impact on hospital cost that was incremental to the effect of the reason for admission and the severity of illness. The question was whether each coefficient was stable enough that an inference could be drawn that estimated cost impact differed from zero. For example, the estimated cost impact of PPC 01 (Stroke and Intracranial

Hemorrhage) was $16,067 with a standard error of just $787. The t statistic equaled 20.42 (=$16,067/$787), which corresponded to a negligible likelihood that the true impact was zero. That is, the estimated cost impact of $16,067 met the conventional criterion of being "highly significant." On the other hand, the estimated cost impact of PPC 55 (Obstetric Hemorrhage without Transfusion) was $75 with a standard error of $144. That is, there was a wide range of plausible estimates around the calculated value of $75. The t statistic was 0.52, indicating a real possibility that the true impact was zero. For this reason, the PPC cost estimate was described as unstable and a value of zero was used in calculating PPC cost.

Note that this analysis is in terms of hospital cost, not Medicaid payment. See Section 2.2.2 for a discussion of the difference.

Table C.6.1
Estimated Impact of a PPC on the Cost of Care, Texas FFS/PPCM Medicaid, SFY 2011

Potentially Preventable Complication	PPC Count (Regression Analysis)	PPC Cost Coefficient	Standard Error	t Statistic	P Value	Sig.	Cost Used in Study
01 Stroke & Intracranial Hemorrhage	190	$16,067	$787	20.42	0.000	***	$16,067
02 Extreme CNS Complications	79	$5,184	$1,246	4.16	0.000	***	$5,184
03 Acute Pulmonary Edema and Respiratory Failure without Ventilation	550	$6,837	$469	14.58	0.000	***	$6,837
04 Acute Pulmonary Edema and Respiratory Failure with Ventilation	349	$5,509	$613	8.99	0.000	***	$5,509
05 Pneumonia & Other Lung Infections	612	$9,249	$442	20.92	0.000	***	$9,249
06 Aspiration Pneumonia	269	$8,408	$662	12.70	0.000	***	$8,408
07 Pulmonary Embolism	105	$18,088	$1,047	17.27	0.000	***	$18,088
08 Other Pulmonary Complications	234	$4,186	$701	5.98	0.000	***	$4,186
09 Shock	385	$19,841	$580	34.22	0.000	***	$19,841
10 Congestive Heart Failure	174	$2,879	$811	3.55	0.000	***	$2,879
11 Acute Myocardial Infarction	209	$1,318	$748	1.76	0.078	*	$0
12 Cardiac Arrythmias & Conduction Disturbances	53	-$2,751	$1,538	(1.79)	0.074	*	$0
13 Other Cardiac Complications	42	$7,075	$1,641	4.31	0.000	***	$7,075
14 Ventricular Fibrillation/Cardiac Arrest	319	$6,294	$626	10.06	0.000	***	$6,294
15 Peripheral Vascular Complications Except Venous Thrombosis	46	$3,710	$1,584	2.34	0.019	**	$3,710
16 Venous Thrombosis	195	$13,465	$768	17.54	0.000	***	$13,465
17 Major Gastrointestinal Complications without Transfusion or Significant Bleeding	150	$10,401	$874	11.90	0.000	***	$10,401
18 Major Gastrointestinal Complications with Transfusion or Significant Bleeding	37	$9,041	$1,750	5.17	0.000	***	$9,041
19 Major Liver Complications	176	$17,958	$835	21.51	0.000	***	$17,958
20 Other Gastrointestinal Complications w/out Transfusion or Significant Bleeding	67	$15,075	$1,309	11.51	0.000	***	$15,075
21 Clostridium Difficile Colitis	141	$3,941	$901	4.38	0.000	***	$3,941
23 GU Complications Except UTI	44	$3,532	$1,604	2.20	0.028	**	$3,532
24 Renal Failure without Dialysis	1,577	$975	$283	3.45	0.001	***	$975
25 Renal Failure with Dialysis	39	$30,775	$1,724	17.85	0.000	***	$30,775
26 Diabetic Ketoacidosis & Coma	17	$12,003	$2,577	4.66	0.000	***	$12,003
27 Post-Hemorrhagic & Other Acute Anemia with Transfusion	157	$2,726	$856	3.19	0.001	***	$2,726
28 In-Hospital Trauma and Fractures	23	$3,723	$2,219	1.68	0.093	*	$0
29 Poisonings Except from Anesthesia	22	$1,219	$2,262	0.54	0.590		$0
30 Poisonings due to Anesthesia							
31 Decubitus Ulcer	67	$14,611	$1,305	11.19	0.000	***	$14,611

Table C.6.1

Estimated Impact of a PPC on the Cost of Care, Texas FFS/PPCM Medicaid, SFY 2011

Potentially Preventable Complication	PPC Count (Regression Analysis)	PPC Cost Coefficient	Standard Error	t Statistic	P Value	Sig.	Cost Used in Study
32 Transfusion Incompatibility Reaction	1	$1,641	$10,582	0.16	0.877		$0
33 Cellulitis	167	$3,457	$830	4.17	0.000	***	$3,457
34 Moderate Infections	161	$7,369	$861	8.56	0.000	***	$7,369
35 Septicemia & Severe Infections	619	$17,491	$453	38.61	0.000	***	$17,491
36 Acute Mental Health Changes	16	$7,546	$2,662	2.83	0.005	***	$7,546
37 Post-Operative Infection & Deep Wound Disruption without Procedure	73	$13,435	$1,255	10.71	0.000	***	$13,435
38 Post-Operative Wound Infection & Deep Wound Disruption with Procedure	12	$64,677	$3,073	21.04	0.000	***	$64,677
39 Reopening Surgical Site	59	$16,210	$1,402	11.56	0.000	***	$16,210
40 Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Procedure	310	$7,334	$609	12.04	0.000	***	$7,334
41 Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Procedure	45	$14,066	$1,598	8.80	0.000	***	$14,066
42 Accidental Puncture/Laceration During Invasive Procedure	198	$2,233	$762	2.93	0.003	***	$2,233
43 Accidental Cut or Hemorrhage During Other Medical Care							
44 Other Surgical Complication - Moderate	48	$14,150	$1,544	9.17	0.000	***	$14,150
45 Post-procedure Foreign Bodies							
46 Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	1	$5,451	$10,582	0.52	0.606		$0
47 Encephalopathy	198	$3,382	$774	4.37	0.000	***	$3,382
48 Other Complications of Medical Care	87	$8,523	$1,151	7.41	0.000	***	$8,523
49 Iatrogenic Pneumothrax	74	$1,689	$1,237	1.36	0.172		$0
50 Mechanical Complication of Device, Implant & Graft	74	$14,699	$1,239	11.87	0.000	***	$14,699
51 Gastrointestinal Ostomy Complications	53	$10,498	$1,469	7.15	0.000	***	$10,498
52 Inflammation & Other Complications of Devices, Implants or Grafts Except Vascular Infection	217	$11,044	$731	15.11	0.000	***	$11,044
53 Infection, Inflammation and Clotting Complications of Peripheral Vascular Catheters and Infusions	61	$2,104	$1,362	1.55	0.122		$0
54 Infections due to Central Venous Catheters	61	$22,809	$1,395	16.34	0.000	***	$22,809
55 Obstetrical Hemorrhage without Transfusion	6,305	$75	$144	0.52	0.604		$0
56 Obstetrical Hemorrhage with Transfusion	740	$1,929	$396	4.87	0.000	***	$1,929
57 Obstetric Lacerations & Other Trauma without Instrumentation	1,662	$137	$273	0.50	0.616		$0
58 Obstetric Lacerations & Other Trauma with Instrumentation	643	$204	$421	0.48	0.629		$0
59 Medical & Anesthesia Obstetric Complications	787	$48	$385	0.12	0.902		$0
60 Major Puerperal Infection and Other Major Obstetric Complications	164	$552	$851	0.65	0.517		$0
61 Other Complications of Obstetrical Surgical & Perineal Wounds	236	$892	$693	1.29	0.198		$0
62 Delivery with Placental Complications	265	$731	$652	1.12	0.263		$0
63 Post-Operative Respiratory Failure with Tracheostomy	25	$55,942	$2,178	25.68	0.000	***	$55,942
64 Other In-Hospital Adverse Events	1	-$1,275	$10,582	(0.12)	0.904		$0
65 Urinary Tract Infection	1,223	$6,494	$308	21.09	0.000	***	$6,494
66 Catheter-Related Urinary Tract Infection	9	$6,360	$3,552	1.79	0.073	*	$0
Total	20,923						

Table C.6.1

Estimated Impact of a PPC on the Cost of Care, Texas FFS/PPCM Medicaid, SFY 2011

Potentially Preventable Complication	PPC Count (Regression Analysis)	PPC Cost Coefficient	Standard Error	t Statistic	P Value	Sig.	Cost Used in Study

Notes:

1. The t statistic value equals the coefficient divided by its standard error. The P value indicates the probability the coefficient differed from 0 by chance. A value of 0.000 is not literally zero; it indicates a P value less than 0.000. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively. Coefficients with P values > 0.05 were considered unstable and no incremental cost coefficient was used in the study.
2. PPC 22 has been retired. Urinary Tract Infection (UTI) has been replaced with two other PPCs: 65 UTIs and 66 Catheter-related UTIs
3. The F statistic for the regression was 600.82, corresponding to P < 0.000. The regression was performed using Minitab software.
4. The dataset used to estimate the PPC cost impacts comprised 248,480 stays with 20,923 PPCs, or 3,514 fewer stays and 851 fewer PPCs than in the analytical dataset for the study. See point 3 in the text for the explanation.

C.7 Casemix Adjustment of PPC Rates

C.7.1 Overview

Differences among hospitals and other patient groupings were accounted for using the method of indirect standardization. Indirect standardization involves comparing an actual rate for a group of patients with an expected rate that is based on the characteristics of the group being assessed (e.g., age, type of illness) and derived from rates observed in a larger population having the same characteristics. This is commonly expressed as the ratio of the actual rate to the expected rate, called the actual-to-expected (A/E) ratio. Section C.7.2 describes how expected values were developed.

The numbers reported describe actual PPC rates for Texas Medicaid hospitals serving Texas Medicaid FFS and PCCM patients in SFY 2011. There is no statistical uncertainty. However, it is natural to generalize from experience in a single year, using it as a basis for predicting future experience. Such generalization effectively treats the 2011 experience as a sample of some larger reality. If the results are used in this way, it is important to keep in mind that the results are subject to natural, random variation. This is particularly important when assessing the rates of small hospitals or small subsets of patients (e.g., care categories) within a hospital.

This report has two features to help hospitals guard against over-interpretation of results based on small volumes. First, A/E ratios are reported only for patient groupings that meet a minimum volume test, which is discussed in Section C.7.3. Second, for each A/E ratio that is reported, TMHP has performed a statistical test of the likelihood that the actual rate observed would occur in a group of the same size and composition drawn at random from among all Texas Medicaid inpatients in state fiscal year 2011. This test was described in Section 1.6.4.

C.7.2 Development of Expected Rates

The 3M PPC software calculates identifies inpatient stays that include PPCs. That is, it calculates the actual PPC results. It does not, however, calculate expected PPC rates. This step was done by TMHP following precedent set by previous PPC studies. Expected rates were based on the incidence of PPCs within the dataset of all Texas Medicaid FFS and PCCM inpatient stays in SFY 2011, subject to the exclusions described in Sections C.1 and C.2. Two important characteristics that are strongly correlated with the incidence of PPCs were taken into account:

- ***APR-DRG:*** The principal condition for which the patient was treated and important procedures performed, as categorized by the 3M software (see Section C.3.1).
- ***Severity of illness (SOI):*** A four-level scale based on all conditions for which the patient was treated, as categorized by the 3M software (see Section C.3.2).

C.7.3 Minimum Volume Test

For very low volumes, the A/E ratio for PPC stays is subject to large swings resulting from random events. Table C.7.3.1 shows several scenarios. The first case is a group of 40 stays for which the number of PPC stays would be expected to be 2, based on statewide data. A chance difference of one PPC stay changes the A/E ratio by 50 percent, from 1.0 to 0.5 in the case of reduction or 1.0 to 1.5 in the case of an increase. There are no intermediate possibilities; it is impossible for this group to have an A/E ratio of 0.9 or 1.1.

The second and third examples show how the expected number of PPC stays also can affect the degree of volatility in the A/E ratio. This is why the number of PPC stays is part of the minimum volume test. The

fourth example shows a hospital whose volume just barely meets the minimum volume test. One more or one less PPC stay still has a noticeable impact on the hospital's A/E ratio, but the impact is less than in examples 1, 2, or 3. As the volume of stays increases or as the expected or actual numbers of PPC stays increase, it is apparent that one more or one fewer PPC has less and less impact on the stability of the A/E ratio.

Since it is useful for a hospital to see its complete data, the hospital-specific reports show all stays. Results should be viewed very cautiously if all three of the following conditions were met: (1) the group of stays included at least 40 stays, (2) there were at least 5 actual PPC stays, and (3) there were at least 5 expected PPC stays. These levels follow precedents established in the previous analysis of potentially preventable readmissions in the Texas Medicaid population, which in turn reflected guidelines commonly used in analysis of categorical data.[35]

Appendix Table C.7.3.1
Scenarios Illustrating Fluctuation of A/E Ratio When Volume is Low

Total Stays	Expected PPC Stays	Actual PPC Stays	A/E PPC Stays
Example 1: 40 stays and an expected PPC rate of 5%			
40	2	1	0.5
		2	1
		3	1.5
Example 2: 50 stays and an expected PPC rate of 2%			
50	1	0	0
		1	1
		2	2
Example 3: 50 stays and an expected PPC rate of 8%			
50	4	2	0.5
		3	0.75
		4	1
		5	1.25
		6	1.5
Example 4: 100 stays and an expected PPC rate of 5%			
100	5	2	0.4
		3	0.6
		4	0.8
		5	1
		6	1.2

Notes

[1] In 2010, net patient revenue (both inpatient and outpatient) for the Texas hospital industry was $49.9 billion. The comparable figure for 2011 is not yet available. American Hospital Association, *Hospital Statistics 2012* (Chicago: AHA, 2012), p. 137. The comparison of discharges takes into account the exclusion of normal newborns in the AHA definition of a discharge.

[2] For further information on implications for Medicaid, see Kevin Quinn and Connie Courts, *Sound Practices in Medicaid Payment for Hospital Care*, Center for Health Care Strategies (Hamilton, NJ: CHCS, November 2010).

[3] Institute of Medicine, *To Err Is Human: Building a Safer Health System* (Washington, DC: IOM, 1999).

[4] R.M. Klevens, J.R. Edwards., C.L. Richards, Jr., T.C. Horan et al., "Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002," *Public Health Reports* 122, No. 2 (2007), p. 160-66.

[5] M.R. Chassin, J.M. Loeb, S.P. Schmaltz and R.M. Wachter, "Accountability Measures—Using Measurement to Promote Quality Improvement," *New England Journal of Medicine*, 363:7 (Aug, 12, 2010), p. 687.

[6] R.L. Fuller, E.C. McCullough, M.Z. Bao and R.F. Averill, "Estimating the Costs of Potentially Preventable Hospital Acquired Complications," *Health Care Financing Review*, 30, No. 4 (2009).

[7] Institute of Medicine, *To Err Is Human* (Washington, DC: IOM, 1999); Donald M. Berwick, *Escape Fire: Designs for the Future of Health Care* (San Francisco: Jossey Bass, 2004).

[8] Guy L. Clifton, *Flatlined: Resuscitating American Medicine* (New Brunswick, NJ: Rutgers University Press, 2009), p. xi.

[9] Jordan Rau, "Lots of "C"s as Hospitals get Graded for Patient Safety", 2012, June 6, Kaiser Health News. http://capsules.kaiserhealthnews.org/index.php/2012/06/lots-of-cs-as-hospitals-get-graded-for-patient-safety/?referrer=search

[10] Centers for Medicare and Medicaid Services (CMS), "Medicaid Program; Payment Adjustment for Provider-Preventable Conditions Including Health Care-Acquired Conditions," *Federal Register*, final rule, 76:108 (June 6, 2011), p. 32817. Though the citation is to a Medicaid rule, the reference is to a Medicare HAC.

[11] Centers for Medicare and Medicaid Services (CMS), "Medicare Program; Hospital Inpatient Prospective Payment Systems for Acute Care Hospitals and the Long-Term Care Hospital Prospective Payment System Changes and FY2011 Rates," final rule, *Federal Register* 75:157 (Aug. 16, 2010), p. 50080-50101.

[12] Xerox State Healthcare LLC, *South Carolina Hospital Inpatient Payment Method: Policy Design Document* (Columbia, SC: Xerox, April 27, 2011), p. 39. Information shared with approval from the Department of Health and Human Services.

[13] Xerox State Healthcare LLC, *Medi-Cal DRG Project: Policy Design Document* (West Sacramento, CA: Xerox, May 1, 2011), p. 85. Information shared with approval from the Department of Health Care Services.

[14] R.L. Fuller, E.C. McCullough and R.F. Averill, "A New Approach to Reducing Payments Made to Hospitals with High Complication Rates," *Inquiry* 48 (Spring 2011), p. 69.

[15] Fuller et al., "Estimating the Costs of Potentially Preventable Hospital Acquired Complications," pp. 21, 24. See also J.S. Hughes, R.F. Averill, N.I. Goldfield et al., "Identifying Potentially Preventable Complications Using a Present on Admission Indicator," *Health Care Financing Review* 27:3 (Spring 2006), p. 63-82.

[16] Agency for Healthcare Research and Quality, "Intensive Care Units Participating in Hospital Collaborative Implement Multiple Improvement Strategies, Leading to Fewer Deaths and Lower Costs," 11/2/11.

[17] Peter Pronovost, Needham, S. Berenholtz et al., "An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU," *New England Journal of Medicine* 355 (December 28, 2006), pp. 2725-2732.

[18] Frank Mazza, Judy Kitchens, Mark Akin et al., "The Road to Zero Preventable Birth Injuries," Joint Commission Journal on Quality and Patient Safety 34:4(April 2008), pp. 201-205.

[19] As reported on the PR Newswire, "I-PASS: Standardizing patient 'Handoffs' to reduce medical errors", April 29, 2012. http://www.marketwatch.com/story/i-pass-standardizing-patient-handoffs-to-reduce-medical-errors-2012-04-29.

[20] "Maryland Hospital Acquired Conditions (MHAC) Trends and Data Analysis for FY 2010 and FY2009," memo from Sule Calikoglu to HSCRC Commissioners, January 26, 2011.

[21] The following is a summary of the PPC methodology developed by 3M Health Information Systems. No changes were made to the methodology for this analysis. Detailed information about the methodology is available in John S. Hughes, Richard F. Averill, Norbert I. Goldfield, et al., *Potentially Preventable Complications (PPCs): Definitions Manual for PPC Version 29.0*, October 2011 version, which is available to Texas hospitals that contact 3M at gmperfetto@mmm.com.

[22] R.L. Fuller et al., "A New Approach"

[23] Alan Agresti, *An Introduction to Categorical Data Analysis* (Hoboken, NJ: John Wiley & Sons, 2007), pp. 114-115. For more information on the application of the CMH statistic to potentially preventable complications, see also Maryland Health Services Cost Review Commission, *PPC and APR DRG Statistical Methods* (Baltimore: HSCRC, October 2009), available at www.hscrc.state.md.us/documents/HSCRC_Initiatives/QualityImprovement/MHAC/2011/01-21-11/PPC_APR-DRG_Statistical Methods.pdf.

[24] Optum, *EncoderPro.com for Payers (*online resource at www.encoderprofp.com)

[25] R.L. Fuller, E.C. McCullough and R.F. Averill, "A New Approach to Reducing Payments Made to Hospitals with High Complication Rates," Fuller et al, "Estimating the Costs of Potentially Preventable Hospital Acquired Complications" (re Maryland, California).

[26] Quinn and Courts, *Sound Practices,* p. 6-7.

[27] Amir A. Ghaferi, J.D. Birkmeyer, and J.B. Dimick, "Variation in Hospital Mortality Associated with Inpatient Surgery," *New England Journal of Medicine* 361:14 (October 1, 2009), p. 1368-1375.

[28] For example, see Berwick, *Escape Fire*; P. Pronovost and E. Vohr, *Safe Patients, Smart Hospitals;* A. Gawande, *The Checklist Manifesto*

[29] Results were produced using data obtained through the use of proprietary computer software created, owned and licensed by the 3M Company. All copyrights in and to the 3M™ Software are owned by 3M. All rights reserved.

[30] AHA, *Hospital Statistics 2012*, p. 137.

[31] Quinn and Courts, *Sound Practices,* p. 6-7.

[32] Fuller et al., "Estimating the Costs of Potentially Preventable Hospital Acquired Complications," pp. 20-21.

[33] Texas Health and Human Services Commission, *Inpatient RCC Rates*, available at http://www.hhsc.state.tx.us/rad/hospital-svcs/inpatient.shtml. Downloaded June 13, 2012. For hospitals without cost-to-charge ratios, the Texas inpatient urban CCR (operating plus capital) most recently reported by Medicare was used.

[34] The specific APR-DRGs were 113-1 (24 stays); 565-1 (55); 722-1 (28); 755-1 (29); 774-2 (2) and 776-2 (29). Because no PPCs were associated with these APR-DRGs, exclusion of these APR-DRGs had no effect on the PPC estimated cost impacts.

[35] Alan Agresti, *An Introduction to Categorical Data Analysis*, second edition (Hoboken, NJ: John Wiley & Sons, 2007), p. 40.