TEXAS HEALTH AND HUMAN SERVICES COMMISSION

Potentially Preventable Complications in the Texas Medicaid Population State Fiscal Year 2012

Public Report

November 2013

Note: **Each hospital can obtain its own confidential PPC results through its secure mailbox at www.tmhp.com. This public report does not include any hospital-specific information that is confidential under Texas law.**

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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 2012 (September 1, 2011, through August 31, 2012). Clients in Medicaid fee-for-service (FFS), Primary Care Case Management (PCCM), and managed care organization (MCO) delivery models are included in this report. This is the second year for which PPC analysis has been performed and reported.[1]

Senate Bill 7 (S.B.7), 82nd Texas Legislature, First Called Session, 2011, requires the Health and Human Services Commission (HHSC) to identify 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. Quality based payment adjustments that reflect PPC results for SFY 2011 became effective November 1, 2013.[2]

This public report shows statewide PPC results, with no hospital-specific information. Each hospital can obtain its own confidential PPC results through its secure mailbox at www.tmhp.com.

This PPC analysis and reports are based on the PPC 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 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 almost 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.

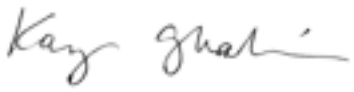
Section 2 of this report shows that 6 percent of adult stays and 5 percent of obstetric stays included at least one PPC in state fiscal year 2012. Out of 327,649 stays, a total of 17,649 stays included at least one PPC. Patients who had at least one PPC were at notable risk for additional PPCs as well. Obstetrical complications were the most common PPC category, while cardiovascular-respiratory complications and infectious complications were the most expensive categories. Overall, PPCs added an estimated $97.4 million, or 3.7 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 healthcare 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 casemix. Excluding low-volume hospitals, 39 percent of hospitals performed lower than expected while 29 percent performed higher than expected; the remaining 32 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. See, for example, the PPC report for SFY 2011 and similar analyses of potentially preventable readmissions. 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 Texas Medicaid & Healthcare Partnership (TMHP). We appreciate 3M's assistance in enabling the use of the PPC software for this study, but 3M bears no responsibility for how the software was used or the results of this study. 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.



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1 Background and Methodology

Senate Bill (SB) 7, 82nd Legislature, First 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 (PPCs). This report meets that requirement for state fiscal year (SFY) 2012 (September 1, 2011, through August 31, 2012). 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 similar to the public report except that it provides 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), Primary Care Case Management (PCCM), and managed care organization (MCO) reimbursement models of inpatient hospital care. 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 of care.

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 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 Payment for Inpatient Hospital Services

In SFY 2012 (September 1, 2011, through August 31, 2012), Texas Medicaid paid for approximately one-quarter of all inpatient stays in Texas. Payments to hospitals totaled $3.5 billion, which was approximately 7 percent of the industry's combined inpatient and outpatient revenue.[3]

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

Of all Medicaid stays, Table 1.1.1 shows that 247,758 stays, or 36 percent, were funded through the fee-for-service (FFS) delivery model. Primary Care Case Management (PCCM) accounted for 95,085 stays, or 14 percent. PCCM clients had a designated primary care coordinator, typically a physician, who took responsibility for coordinating the client's care. Managed care organizations (MCOs) funded 349,000 stays, or 50 percent. From SFY 2011 to SFY 2012 there was a significant transition to managed care, although the total volume of Medicaid stays was essentially unchanged.

Table 1.1.1

Summary of Medicaid Inpatient Hospital Utilization, State Fiscal Year 2012

	Stays				Medicaid Payments (in Millions)			
Medicaid Care Category	FFS	PCCM	MCO	Total	FFS	PCCM	MCO	Total
Pediatric								
Respiratory	7,711	6,570	14,195	28,476	$86	$25	$89	$200
Other medical	14,556	6,179	22,321	43,056	$174	$37	$192	$404
Other surgical	5,187	1,635	7,349	14,171	$137	$33	$140	$310
MH/SA	6,660	2,645	10,062	19,367	$37	$11	$46	$94
Pediatric subtotal	34,114	17,029	53,927	105,070	$434	$106	$468	$1,009
Adult								
Circulatory	6,959	4,288	5,332	16,579	$65	$33	$48	$146
Other medical	36,385	18,659	27,134	82,178	$253	$107	$172	$532
Other surgical	11,252	5,392	8,241	24,885	$185	$65	$106	$356
MH/SA	4,731	1,875	14,337	20,943	$16	$6	$49	$70
Adult subtotal	59,327	30,214	55,044	144,585	$519	$211	$374	$1,104
Obstetrics, Newborns, and Other								
Obstetrics	77,138	24,484	134,435	236,057	$184	$54	$325	$562
Newborns	77,051	23,325	103,390	203,766	$283	$62	$453	$799
MCC Ungroupable	128	33	2,204	2,365	$5	$1	$16	$22
Total	247,758	95,085	349,000	691,843	$1,425	$435	$1,636	$3,496
Percent of total	36%	14%	50%	100%	41%	12%	47%	100%

Notes:

1. FFS = fee for service; PCCM = Primary Care Case Management; MCO = managed care organizations; 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.
4. Differences from rounding may cause some totals to appear inexact.

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, 34 percent of Medicaid stays were for obstetrics, 30 percent for newborns, 15 percent for pediatric clients under age 18 (excluding newborns and obstetrics), and 21 percent for adults (excluding obstetrics).

Table 1.1.2

Medicaid Stays, State Fiscal Year 2012

Medicaid Care Category	Stays	Days	Billed Charges	Estimated Hospital Cost	Payment	Casemix	Avg. Length of Stay
Pediatric							
Respiratory	28,476	101,948	$812,482,065	$230,858,262	$199,824,209	0.84	3.6
Other medical	43,056	174,268	$1,428,779,297	$437,143,485	$403,983,665	0.96	4.0
Other surgical	14,171	85,527	$1,190,035,993	$348,194,543	$310,309,182	2.75	6.0
MH/SA	19,367	175,425	$305,265,781	$127,357,571	$94,383,270	0.59	9.1
Subtotal	105,070	537,168	$3,736,563,135	$1,143,553,861	$1,008,500,326	1.10	5.1
Adult							
Circulatory	16,579	85,677	$982,287,051	$267,608,167	$145,726,517	2.04	5.2
Other medical	82,178	440,593	$3,320,609,226	$964,679,402	$532,064,144	1.43	5.4
Other surgical	24,885	219,430	$2,376,638,668	$685,831,435	$356,403,804	3.31	8.8
MH/SA	20,943	129,379	$324,297,523	$104,014,323	$70,245,643	0.66	6.2
Subtotal	144,585	875,079	$7,003,832,468	$2,022,133,327	$1,104,440,108	1.71	6.1
Obstetrics	236,057	607,051	$3,384,492,130	$947,252,898	$562,196,038	0.53	2.6
Newborns	203,766	825,749	$3,518,872,381	$952,842,548	$798,911,888	0.56	4.1
Total	689,478	2,845,047	$17,643,760,115	$5,065,782,634	$3,474,048,360	0.88	4.1

Notes:

1. Casemix was measured using APR-DRGs Version 30 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. 691,843 stays in Table 1.1.1 minus 2,365 MCC ungroupable stays equals 689,478 total stays in this table.
5. 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.
6. Differences from rounding may cause some totals to appear inexact.

1.2 Data Included/Excluded in the Report

This analysis is based on the FFS, PCCM, and MCO Medicaid population in SFY 2012 (September 2011 to August 2012). The data used in this analysis 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.) Table 1.2.1 shows how the analytical dataset of 327,649 stays was created from the initial total of 691,843 stays shown in Table 1.1.1. The steps were as follows.

The analytical dataset for the PPC analysis comprises 327,649 inpatient stays for adult and obstetric patients.

- ***Incomplete stays.*** A total of 413 records were excluded because they appeared not to represent a complete stay, which is the clinical unit of analysis. See Appendix Section C.2.4.3.
- ***Unreliable discharge status.*** A total of 14,688 records were excluded because the discharge status received from the managed care plan appeared to be unreliable, raising the possibility that the records did not represent complete stays. See Appendix Section C.2.1.3.
- ***POA reporting issues.*** For the purpose of identifying PPCs that occurred during an inpatient stay, it is essential to have data that specifies which diagnoses were already present on admission (POA). One small managed care organization did not submit POA values, so its 1,157 stays were excluded. See Appendix Section C.2.4.4.
- ***POA-exempt hospitals.*** In SFY 2012, certain hospitals were exempt from reporting POA values. These hospitals included rural hospitals, children's hospitals, and state-owned teaching hospitals (Appendix Section C.2.4.4). Although some hospitals reported POA indicators nonetheless, all 122,384 stays at these hospitals were excluded because there was no requirement that POA values be reported completely or accurately. Effective September 1, 2012, all hospitals are required to report POA values. See Appendix Section C.2.4.4.
- ***Newborn and pediatric stays.*** The 3M PPC algorithm used in this analysis is not fully developed for the newborn and pediatric populations. A total of 224,246 pediatric and newborn stays therefore were excluded. See Section 1.2.1
- ***APR-DRG grouping errors.*** A total of 1,306 stays were excluded because they were ungroupable in the APR-DRG software. These errors typically occur because claims received from hospitals contain internally inconsistent data on age, gender, diagnoses, and procedures. See Appendix Section C.3.

The analytical dataset for this report therefore comprised 327,649 adult and obstetric stays.

Table 1.2.1						
Creation of Analytical Dataset						
Inclusion/Exclusion	Stays	Days	Charges	Cost	Payments	Casemix
Total Medicaid stays SFY 2012	691,843	2,860,164	$17,749,782,030	$5,089,749,414	$3,496,138,960	0.87
Minus the following exclusions:						
Incomplete stays	413	222	$75,001,847	$28,104,735	$16,889,887	3.17
Unreliable discharge status	14,688	48,963	299,350,824	77,022,042	65,191,125	0.59
POA reporting issues	1,157	6,307	$50,487,278	$14,879,137	$7,095,398	1.45
Stays excluded because the hospital was exempt from POA reporting (other exemptions may also exist)	122,384	602,882	$3,521,555,139	$1,287,360,353	$1,225,814,859	0.95
Newborn and pediatric stays excluded from analytical dataset	224,246	902,564	$4,309,558,917	$1,067,889,888	$814,403,534	0.64
Other exclusions due to data or APR grouping issues	1,306	10,586	$83,662,889	$17,506,930	$15,749,189	0.00
PPC analytical dataset	327,649	1,288,640	$9,410,165,137	$2,596,884,056	$1,350,994,969	1.01
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 on October 1, 2013.						
2. Medicaid payments to hospitals shown here exclude additional reimbursements made via supplemental payments (e.g. disproportionate share payments).						
3. The counts of excluded stays shown in this table depend on the order in which the analytical steps were performed.						
4. Differences from rounding may cause some totals to appear inexact. 5. Analytical data set contains stays for low volume hospitals.						

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 healthcare 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.[4] 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.[5] In 2002, patients suffered an estimated 1.9 million hospital-acquired infections, with 99,000 related deaths.[6] That same year, only 20 percent of hospitals consistently (more than 90 percent of the time) implemented certain evidence-based processes of care.[7] 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.[8]

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.[9] 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.[10] 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 healthcare 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 healthcare purchasers, gives hospitals the opportunity to submit data on 26 outcome measures, but reporting is incomplete. In Texas, for example, less than half of hospitals submit information to Leapfrog.[11]

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."[12] 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 more than 9 million stays included a HAC.[13] 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.[14] In California, 0.13 percent of stays included a HCAC and 0.02 percent of stays would change DRGs because of a HCAC.[15]

In this Texas analytical dataset, Table 2.5.1 shows that 0.09 percent of stays included a HAC (Texas uses the Medicare HAC list in addition to the PPC approach).

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."[16]

The difference between these approaches is exemplified by pneumonia, septicemia, cellulitis, and other serious infections that often are 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.[17]

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, The Joint Commission (TJC), and the National Quality Forum (NQF)	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	Medicare publishes results on website to enable hospital comparisons.	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	Multiple data sources including Medicare claims data and various hospital self-reported reporting; see www.medicare.gov/hospitalcompare/Data/Data-Sources.html.	Hospital self-reported.	Some never events can be identified through claims; others must be reported to regulators.	Specific comorbid condition or major complication or comorbity (CC/MCC) 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	N/A	N/A	Very rare	Rare	Common
Website	www.medicare.gov/hospitalcompare/Data/Measures-Selected.html	leapfroggroup.org	www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R101NCD.pdf	www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Downloads/Phase-3-State-Tracking-Report.pdf	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.
2. N/A means this category may not apply to this specific measure.

1.3.2 Reducing Potentially Preventable Complications

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.[18] The statewide Michigan initiative was based on a similar initiative at Johns Hopkins Hospital.[19] In Texas, the Seton hospitals have reported improvements in obstetric outcomes through implementation of relatively simple improvements in patient care.[20] 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.[21]

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

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.[22]

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, POA indicators, patient age, patient sex, and patient discharge status.[23] 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.

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.

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 PPCs. 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 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 the 1,258 (including two error APR-DRGs 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 10 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.

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.

Example: PPC 05-Pneumonia and Other Lung Infections
A patient has diagnosis 482.39 (Pneumonia Oth Strep) that was not present on admission

Table 1.4.1			
Examples of PPC Logic			
Patient	Clinical Scenario	PPC	Comment
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)

Table 1.4.1			
Examples of PPC Logic			
Patient	Clinical Scenario	PPC	Comment
8	Patient has other diagnosis of 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)

Table 1.4.1			
Examples of PPC Logic			
Patient	Clinical Scenario	PPC	Comment
10	Patient has other diagnosis of 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 and Severe Infections
A patient has diagnosis of 038.12 (MRSA Septicemia)

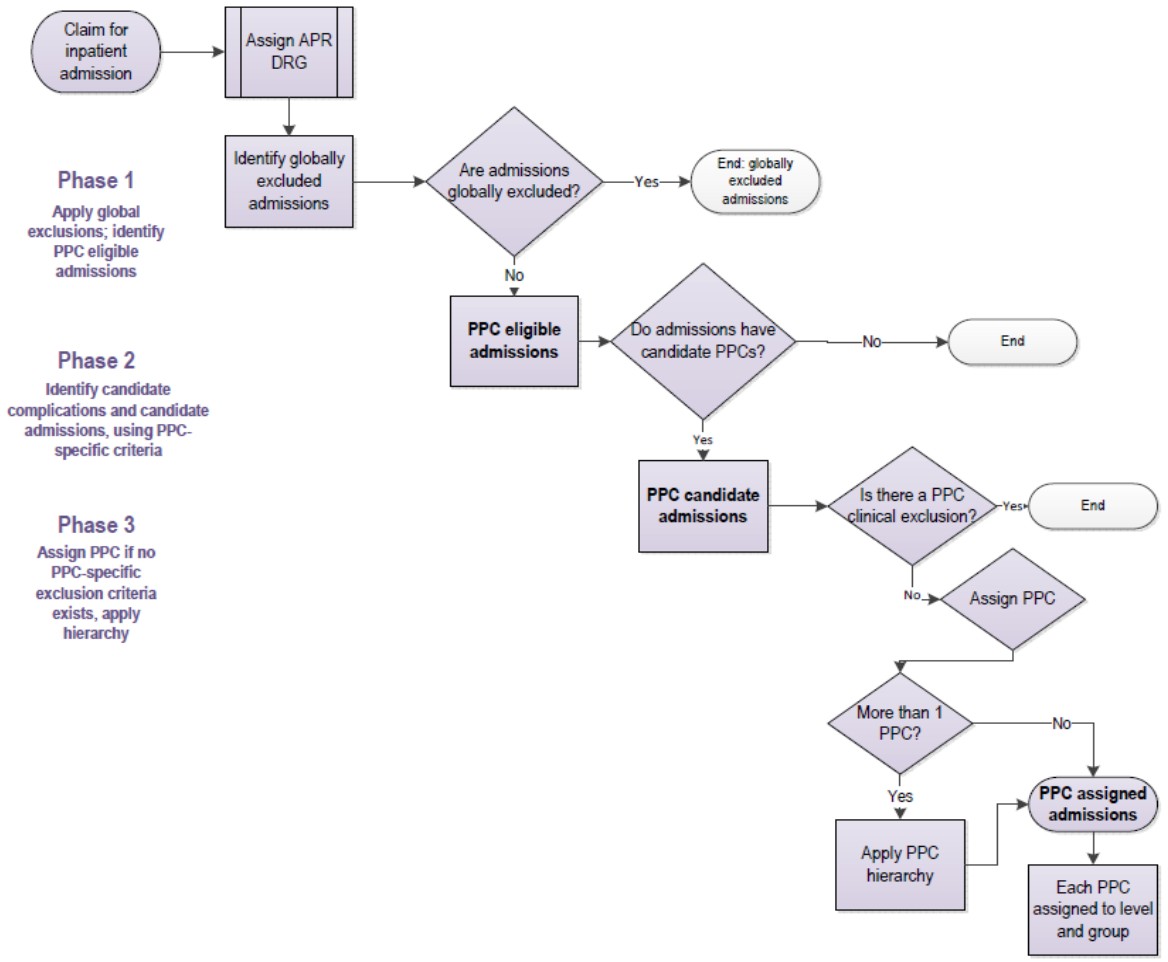
Table 1.4.1			
Examples of PPC Logic			
Patient	Clinical Scenario	PPC	Comment
12	Patient is under age 18 with a medical admission DRG	No	For this PPC, medical patients under 18 are excluded
13	Patient is under age 18 with a surgical admission DRG	Yes	
14	Patient has an infection that triggers PPC 54 (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. ** "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.
3. APR-DRG = All Patient Refined Diagnosis Related Group; MH/SA = mental health/substance abuse.
4. Source: Compiled by TMHP from Hughes et al., *PPC Definitions Manual* V.30.

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. 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.30.

- 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 for assignment 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.

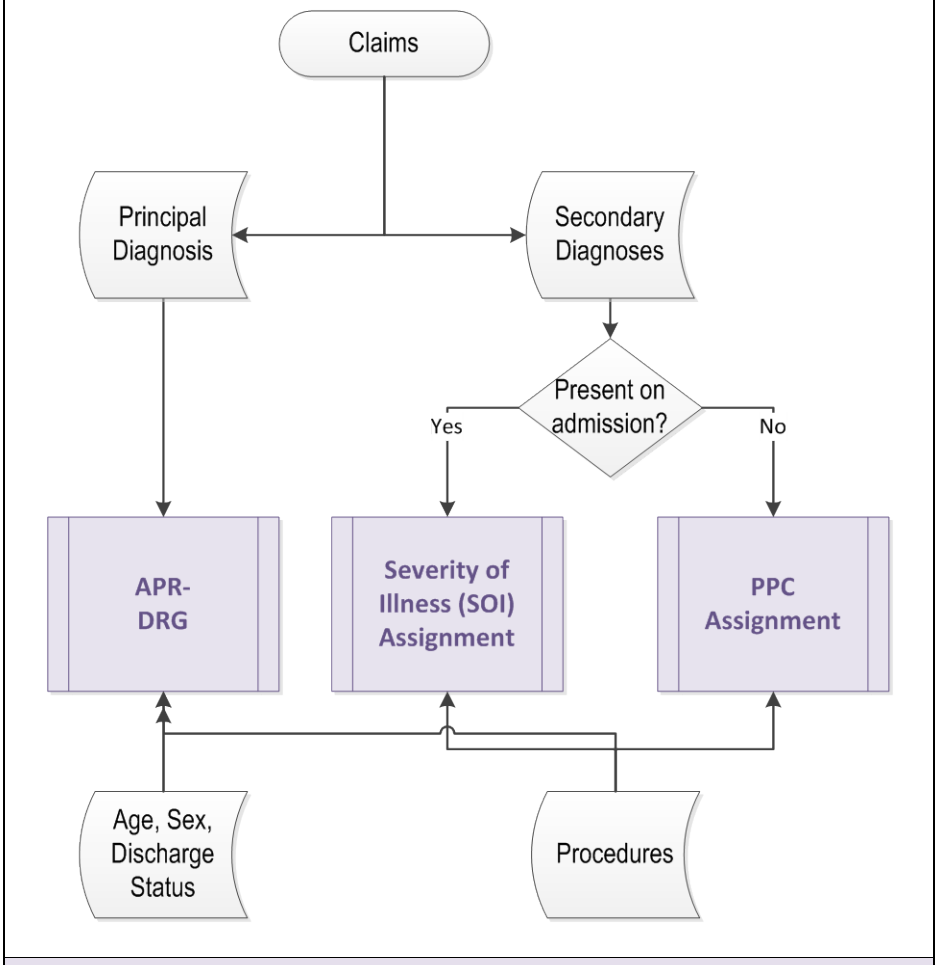
The exclusion of pediatric patients (under age 18) from almost all PPCs is of particular importance for this report. Pediatric inpatients are obviously at risk for a wide range of complications; however, the PPC algorithm is focused on adult medical, adult surgical, and obstetric patients. Although the 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 or 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, 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 2.3.4, which quantifies the effect of severity of illness on the PPC rate.

Chart 1.4.2

Interplay of Claims Data Elements to Determine PPC and SOI



Note:

1. Source: Hughes et al., *PPC Definitions Manual* V.30.

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.[24]

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

For last year's PPC report, cost estimates were calculated based on Texas Medicaid SFY 2011 data using the same methodology as in the Medicare, California, and Maryland analyses. This year, the analysis has been updated using SFY 2012 data. 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, 9 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 $78, a standard error of $165, and a t-statistic of 0.47 (=$78/$165). 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). Therefore, for these 9 PPCs, the estimated cost impact was shown as zero. For the 53 PPCs where a stable cost impact was estimated, estimates ranged as high as $55,580 (PPC 63, Post-Operative Respiratory Failure with Tracheostomy). Four PPCs had negative estimated cost impacts, with the implication that occurrence of a PPC actually lowered the cost of care. Such a result can reflect clinical reality or the effect of small numbers. (Even with a small number of stays, a result can be statistically significant if the measured effect is large enough.)

A comparison of estimated cost impacts calculated from the SFY 2011 and SFY 2012 datasets (not shown in this report) found them to be generally very similar in terms of magnitude, rank order, and statistical significance.

1.6 Reporting PPC Results

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 $16,257) + (1 x $5,337)] = $21,594 for these two PPCs combined, where $16,257 is the estimated cost impact of PPC 35 and $5,337 is the estimated cost impact of PPC 03.
- 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, PPC 24 (Renal Failure Without Dialysis) 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.

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

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.

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.

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 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 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 (Acute Pulmonary Edema and Respiratory Failure Without Ventilation) in patients with DRG 139-1 (Pneumonia) 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.)

The statewide average was used as the benchmark or norm. For example, for stays in APR-DRG 139-3, the norm was that 7.0% of stays at risk for PPC 03 would be expected to show PPC 03.

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

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	0.0%	0	0.0	0.00	$0	$0	0.00
139-2 Pneumonia	200	190	0.0%	0	0.0	0.00	$0	$0	0.00
139-3 Pneumonia	250	175	7.0%	5	12.2	0.41	$26,687	$65,330	0.41
139-4 Pneumonia	100	80	21.4%	15	17.1	0.88	$80,061	$91,498	0.88
194-1 Heart Failure	300	260	0.0%	0	0.0	0.00	$0	$0	0.00
194-2 Heart Failure	400	390	0.0%	0	0.0	0.00	$0	$0	0.00
194-3 Heart Failure	500	450	3.4%	6	15.2	0.39	$32,024	$81,293	0.39
194-4 Heart Failure	50	40	40.9%	6	16.4	0.37	$32,024	$87,339	0.37
All Stays	2,000	1,765		32	61.0	0.52	$170,797	$325,460	0.52

Notes:

1. A specific hospital has a total of 2,000 stays for pneumonia and heart failure. (The number 2,000is for illustrative purposes only).
2. The number of stays at risk for PPC 03 is 1,765. (This number is also for illustrative purposes only). 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 0.07 = 17.1.
4. The estimated cost of PPC 03 is $5,337 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 is 32, while the sum of expected PPCs is 61, for an A/E ratio of 0.52. The actual PPC cost is $170,797, while the expected PPC cost is $325,460, for an A/E ratio of 0.52. 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.
7. Differences from rounding may cause some totals to appear inexact.

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

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

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.

1.6.4 Interpretation of Results

The results in this report are the actual data for the Texas Medicaid population in SFY 2012. 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 population in SFY 2012.

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 half again as high. Two aspects of the methodology reduce 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.[25] 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 2012, a test of statistical significance can suggest whether the SFY 2012 results might also apply to a broader timeframe. 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.[26] 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

In SFY 2012, there were 22,041 potentially preventable complications (PPCs) within the analytical dataset. As discussed in Section 1.4, 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 2.1.1 through 2.5.2 refer only to the obstetric and adult populations (i.e., the "analytical dataset".)

Overall, 6% of adult stays and 5% of obstetric stays included at least one PPC.

Overall, 6 percent of adult stays and 5 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	15,092	1,505	10.0%	2,212	1.5	14.7	$15,404,469
Adult-Other medical	72,370	3,384	4.7%	4,451	1.3	6.2	$34,665,812
Adult-Other surgical	22,199	2,454	11.1%	3,955	1.6	17.8	$34,678,721
Adult-MH/SA	13,306	150	1.1%	167	1.1	1.3	$944,156
Adult subtotal	122,967	7,493	6.1%	10,785	1.4	8.8	$85,693,159
Obstetrics	204,682	10,156	5.0%	11,256	1.1	5.5	$11,681,075
Analytical dataset total	327,649	17,649	5.4%	22,041	1.2	6.7	$97,374,233

Note:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.
2. Differences from rounding may cause some totals to appear inexact.
3. MH/SA = mental health/substance abuse.
4. Analytical Dataset includes stays for low volume hospitals.

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 1.2 PPCs (Table 2.1.1.) For adult surgical patients, for example, the average number of PPCs per PPC stay was 1.4. 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 22,041 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 obstetrical 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 was PPC 55, Obstetrical Hemorrhage Without Transfusion, which accounted for 15.7 percent of all PPCs in the analytical dataset. This is not surprising, considering that 62.5 percent of the analytical dataset is for obstetrics.

In comparing results between this year's analysis of SFY 2012 and last year's analysis of SFY 2011 data, two key differences should be considered. The first difference is that managed care stays were excluded from last year's analysis and are included in this year's analysis. The second is that an anomaly in the reporting of post-partum hemorrhage affected the results last year due to the non-standard coding practices of one large hospital and these non-standard coding practices did not appear this year. As a result, the reported incidence of PPC 55 is lower this year than last year, but this decrease does not necessarily indicate an improvement in the measure. The calculation of hospital-specific performance measures last year was unaffected by the anomaly, because the statewide norms for PPC 55 were calculated after reviewing and removing outliers.

Table 2.1.2
Summary by PPC Group

PPC Group Description	PPC Count	Percent of All PPCs	PPC Cost	Percent of PPC Cost
Obstetrical Complications	10,061	46%	$4,289,005	4%
Cardiovascular-Respiratory Complications	3,282	15%	$24,895,880	26%
Infectious Complications	2,839	13%	$23,442,342	24%
Other Medical and Surgical Complications	2,620	12%	$10,282,164	11%
Extreme Complications	1,350	6%	$15,672,634	16%
Perioperative Complications	788	4%	$6,460,232	7%
Malfunctions, Reactions, etc.	621	3%	$7,092,006	7%
Gastrointestinal Complications	480	2%	$5,239,970	5%
Total	22,041	100%	$97,374,233	100%

Notes:

1. PPC groups are mutually exclusive clinical 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 Section 1.5.
3. Differences in rounding may cause some totals to appear inexact.

Table 2.1.3						
Summary of Top 25 PPCs by Frequency						
PPC	Description	Group Description	PPC Count	Percent of All PPCs	Cost per PPC	PPC Cost
55	Obstetrical Hemorrhage Without Transfusion	Obstetrical Complications	3,462	15.7%	$0	$0
57	Obstetric Lacerations and Other Trauma Without Instrumentation	Obstetrical Complications	2,361	10.7%	$0	$0
24	Renal Failure Without Dialysis	Other Medical and Surgical Complications	1,773	8.0%	$2,807	$4,976,279
65	Urinary Tract Infection	Infectious Complications	1,538	7.0%	$5,616	$8,636,947
59	Medical & Anesthesia Obstetric Complications	Obstetrical Complications	1,236	5.6%	$558	$689,935
56	Obstetrical Hemorrhage with Transfusion	Obstetrical Complications	1,107	5.0%	$2,410	$2,668,202
03	Acute Pulmonary Edema and Respiratory Failure Without Ventilation	Cardiovascular-Respiratory Complications	934	4.2%	$5,337	$4,985,132
58	Obstetric Lacerations and Other Trauma with Instrumentation	Obstetrical Complications	842	3.8%	$0	$0
35	Septicemia and Severe Infections	Infectious Complications	707	3.2%	$16,257	$11,493,558
05	Pneumonia and Other Lung Infections	Cardiovascular-Respiratory Complications	602	2.7%	$9,228	$5,555,196
09	Shock	Extreme Complications	503	2.3%	$17,653	$8,879,459
62	Delivery with Placental Complications	Obstetrical Complications	447	2.0%	$0	$0
61	Other Complications of Obstetrical Surgical and Perineal Wounds	Obstetrical Complications	406	1.8%	$1,421	$577,048
04	Acute Pulmonary Edema and Respiratory Failure with Ventilation	Extreme Complications	356	1.6%	$9,313	$3,315,392
14	Ventricular Fibrillation/Cardiac Arrest	Extreme Complications	355	1.6%	$4,247	$1,507,827
40	Post-Operative Hemorrhage and Hematoma Without Hemorrhage Control Procedure or I&D Procedure	Perioperative Complications	327	1.5%	$9,274	$3,032,565
10	Congestive Heart Failure	Cardiovascular-Respiratory Complications	301	1.4%	$2,694	$810,954
06	Aspiration Pneumonia	Cardiovascular-Respiratory Complications	277	1.3%	$6,137	$1,699,921
08	Other Pulmonary Complications	Cardiovascular-Respiratory Complications	266	1.2%	$1,717	$456,775
47	Encephalopathy	Other Medical and Surgical Complications	235	1.1%	$1,314	$308,673
52	Infection, Inflammation, and Other Complications of Devices, Implants or Grafts except Vascular Infection	Malfunctions, Reactions, etc.	227	1.0%	$7,906	$1,794,662
33	Cellulitis	Infectious Complications	216	1.0%	$5,947	$1,284,552
16	Venous Thrombosis	Cardiovascular-Respiratory Complications	216	1.0%	$9,872	$2,132,244
42	Accidental Puncture/Laceration during Invasive Procedure	Perioperative Complications	209	0.9%	$3,729	$779,424
60	Major Puerperal Infection and Other Major Obstetric Complications	Obstetrical Complications	200	0.9%	$1,769	$353,820
Top 25 PPCs			19,103	86.7%	$3,452	$65,938,564
All PPCs			22,041	100.0%	$4,418	$97,374,233

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.
3. Differences in rounding may cause some totals to appear inexact.

2.2 Impact on Hospital Cost

In addition to their impacts on patients, potentially preventable complications affect the cost of care. The word "potentially" should be emphasized. Not all complications are preventable, and therefore, it is not feasible to reduce hospital costs for PPCs to zero.

2.2.1 Hospital Cost

$97.4 million, or 3.7 percent of the $2.6 billion cost incurred by hospitals to care for Texas Medicaid clients within the scope of this analysis, was attributable to PPCs.

For the 327,649 stays within the analytical dataset, the estimated hospital cost of care was $2.6 billion (Table 2.2.1.1). This estimate was based on hospital charges and hospital-specific cost-to-charge ratios. Within this $2.6 billion, the cost attributable to PPCs was estimated at $97.4 million. The resulting ratio of 3.7 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).[27] 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 $297 per stay (Table 2.2.1.1). For adults with circulatory conditions or surgical conditions, however, it was more notable, $1,021 per circulatory stay and $1,562 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	15,092	$247,393,908	$16,392	1,505	10.0%	2,212	$15,404,469	6.2%	$1,021
Adult-Other medical	72,370	$850,888,382	$11,757	3,384	4.7%	4,451	$34,665,812	4.1%	$479
Adult-Other surgical	22,199	$622,383,629	$28,037	2,454	11.1%	3,955	$34,678,721	5.6%	$1,562
Adult-MH/SA	13,306	$60,272,324	$4,530	150	1.1%	167	$944,156	1.6%	$71
Adult subtotal	122,967	$1,780,938,243	$14,483	7,493	6.1%	10,785	$85,693,159	4.8%	$697
Obstetrics	204,682	$816,048,085	$3,987	10,156	5.0%	11,256	$11,681,075	1.4%	$57
Analytical dataset	327,649	$2,596,986,328	$7,926	17,649	5.4%	22,041	$97,374,233	3.7%	$297

Note:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.
2. Differences from rounding may cause some totals to appear inexact.

2.2.2 Medicaid Payment

It is also relevant to examine the impact on Medicaid payment. 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 2012, Texas Medicaid used MS-DRGs to calculate payment for most 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 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.

Texas Medicaid began using APR-DRGs to calculate payments to providers September 1, 2012.

Of the 17,649 PPC stays in the analytical dataset, 5,616 stays would have had a different APR-DRG if the PPC diagnoses had been ignored (Table 2.2.2.1). In 94 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 6 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 5,616 stays, the total casemix (that is the average casemix per stay times the number of stays) was 12,614 including the PPCs and 7,632 excluding PPCs (Table 2.2.2.1). For all 327,649 stays in the analytical dataset, total casemix was 330,299 including the PPCs and 325,317 excluding the PPCs. That is, if not for the PPCs, the total casemix would have been 1.5 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 $1.35 billion for the stays in the analytical dataset, approximately 1.5 percent, or $20.7 million may be thought of as reflecting the cost of PPCs in the adult and obstetric populations, excluding hospitals that were exempt from POA reporting.

Table 2.2.2.1								
PPC Incidence in Top 25 Base DRGs by Stays Where Presence of a PPC Affected APR DRG Assignment								
Base 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	1,936	-	1,936	$26,013,788	$7,359,974	$4,140,122	790	1,011
540 Cesarean Del	675	-	675	$23,391,331	$6,479,504	$2,726,050	503	802
542 Vag Del w Proc Exc Ster &/or D&C	277	266	11	$4,707,858	$1,295,432	$698,899	131	207
541 Vag Del w Ster &/or D&C	133	-	133	$3,066,823	$834,919	$304,388	73	102
194 Heart Failure	114	-	114	$6,632,467	$2,129,332	$727,101	130	231
165 Coronary Bypass w Cath	72	-	72	$17,616,419	$4,222,113	$1,909,508	425	552
221 Maj Small & Large Bowel Procs	72	-	72	$12,881,054	$3,702,096	$1,739,885	263	483
140 COPD	65	-	65	$3,383,582	$879,078	$405,680	68	98
139 Oth Pneumonia	64	-	64	$4,272,536	$1,286,676	$536,964	66	121
383 Cellulitis & Oth Bact Skin Inf	56	-	56	$3,355,051	$945,295	$357,968	55	101
566 Oth Antepartum Diags	56	-	56	$1,836,848	$473,411	$128,129	26	45
045 CVA & Precereb Occl w Infarct	49	-	49	$4,744,491	$1,172,772	$657,567	94	162
005 Trach, MV 96+ Hrs, w/o Ext Proc	47	23	24	$21,571,359	$6,280,528	$2,383,228	302	572
130 Resp Sys Diag w MV 96+ Hrs	47	22	25	$10,037,534	$2,618,479	$1,055,423	206	326
004 Trach, MV 96+ Hrs, w Ext Proc	46	29	17	$22,012,193	$7,001,348	$2,991,955	439	737
166 Coronary Bypass w/o Cath	44	-	44	$7,557,123	$2,106,461	$1,114,423	192	264
720 Septicemia & Disseminated Inf	44	-	44	$4,354,422	$1,171,900	$619,928	67	145
460 Renal Failure	40	-	40	$4,016,670	$1,269,641	$312,414	54	128
174 Percut CV Procs w AMI	39	-	39	$4,703,835	$1,261,292	$544,873	121	174
951 Mod Ext Proc Unrel To Diag	37	-	37	$5,638,568	$1,730,333	$716,604	89	189
263 Laparoscopic Cholecystectomy	35	-	35	$3,779,112	$1,043,785	$410,685	61	101
305 Amput of Lower Limb Exc Toes	33	-	33	$5,106,508	$1,373,327	$508,771	87	151
420 Diabetes	32	-	32	$1,893,584	$499,894	$175,190	27	49
302 Knee Joint Replacement	31	-	31	$2,958,765	$693,360	$424,491	82	123
173 Oth Vascular Procs	30	-	30	$5,784,534	$1,648,704	$632,794	100	177
Top 25 base DRGs with DRG change	4,074	340	3,734	$211,316,456	$59,479,656	$26,223,040	4,451	7,051
All PPC stays with DRG change	5,616	347	5,269	$375,790,759	$106,599,635	$46,752,528	7,632	12,614
All stays	327,649	347	5,269	$9,410,165,137	$2,596,884,056	$1,350,994,969	325,317	330,299

Notes:

1. Casemix was measured using Texas Medicaid relative weights for APR-DRG V.30.
2. SOI is severity of illness.
3. Medicaid payments to hospitals shown here exclude additional reimbursements made via supplemental payments (e.g. disproportionate share payments).
4. See Appendix Table B.2 for the full list of APR-DRGs where the presence of a PPC affected DRG assignment.
5. Differences from rounding may cause some totals to appear inexact.

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

- 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 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 57 percent of all stays and 50 percent of all PPCs.

The total estimated cost of PPCs was highest for APR-DRG 540, Cesarean Delivery, at $5.9 million. However, this reflected the large volume of cesarean delivery stays. The PPC rate at 4.7%, the average number of PPCs per PPC stay at 1.2, and the average cost per cesarean delivery ($95) were all lower than the average of all APR-DRGs.

In terms of added cost per stay, the two tracheostomy APR-DRGs were notable. PPCs added an estimated $10,483 to the average cost of care for a patient in APR-DRG 004 (Tracheostomy, Mechanical Ventilation over 96 Hours, With Extensive Procedure) and $7,184 to average cost of APR-DRG 005 (Tracheostomy, Mechanical Ventilation over 96 Hours, with Extensive Procedure). These patients are typically in respiratory failure, often with extensive comorbidities, which puts them at high risk for incidence of PPCs. More than one-third of ventilator patients developed a PPC, and patients who developed at least one PPC tended to develop additional PPCs as well.

Table 2.3.1								
PPC Incidence in Top 25 Base DRGs by PPC Stays								
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPCs / 100 Stays	PPC Cost	Avg. PPC Cost / Stay
560-Vaginal Del	117,474	6,138	5.2%	6,481	1.1	5.5	$2,783,937	$24
540-Cesarean Del	62,365	2,954	4.7%	3,473	1.2	5.6	$5,947,478	$95
541-Vag Del w Ster &/or D&C	5,632	488	8.7%	569	1.2	10.1	$555,217	$99
542-Vag Del w Proc Exc Ster &/or D&C	327	299	91.4%	406	1.4	124.2	$206,569	$632
194-Heart Failure	3,637	283	7.8%	359	1.3	9.9	$2,331,818	$641
720-Septicemia & Disseminated Inf	4,430	251	5.7%	319	1.3	7.2	$2,666,096	$602
460-Renal Failure	3,077	212	6.9%	289	1.4	9.4	$2,537,790	$825
221-Maj Small & Large Bowel Procs	921	208	22.6%	386	1.9	41.9	$3,758,047	$4,080
165-Coronary Bypass w Cath	404	163	40.3%	287	1.8	71.0	$1,679,278	$4,157
045-CVA & Precereb Occl w Infarct	1,576	158	10.0%	227	1.4	14.4	$1,731,189	$1,098
566-Oth Antepartum Diags	10,454	154	1.5%	179	1.2	1.7	$1,064,042	$102
005-Trach, MV 96+ Hrs, w/o Ext Proc	414	151	36.5%	306	2.0	73.9	$2,974,227	$7,184
139-Oth Pneumonia	2,662	151	5.7%	180	1.2	6.8	$1,282,784	$482
130-Resp Sys Diag w MV 96+ Hrs	524	140	26.7%	224	1.6	42.7	$1,979,544	$3,778
140-COPD	3,416	136	4.0%	157	1.2	4.6	$949,557	$278
173-Oth Vascular Procs	764	134	17.5%	202	1.5	26.4	$1,915,264	$2,507
174-Percut CV Procs w AMI	739	119	16.1%	190	1.6	25.7	$1,457,380	$1,972
133-Pulmon Edema & Resp Failure	1,540	117	7.6%	148	1.3	9.6	$1,093,105	$710
021-Craniotomy Exc for Trauma	598	115	19.2%	206	1.8	34.4	$1,938,913	$3,242
383-Cellulitis & Oth Bact Skin Inf	2,804	113	4.0%	132	1.2	4.7	$999,832	$357
420-Diabetes	2,451	103	4.2%	128	1.2	5.2	$885,833	$361
951-Mod Ext Proc Unrel To Diag	913	102	11.2%	154	1.5	16.9	$1,496,574	$1,639
710-Inf & Parasit Dis Incl HIV w O.R. Proc	728	99	13.6%	137	1.4	18.8	$1,188,538	$1,633
004-Trach, MV 96+ Hrs, w Ext Proc	270	94	34.8%	269	2.9	99.6	$2,830,363	$10,483
137-Maj Resp Inf & Inflammations	827	93	11.2%	119	1.3	14.4	$943,526	$1,141
Top 25	228,947	12,975	5.7%	15,527	1.2	6.8	$47,196,897	$206
All DRGs	327,649	17,649	5.4%	22,041	1.2	6.7	$97,374,233	$297
Top 25 as percent of all	70%	74%		70%			48%	
Note:								
1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.								
2. Differences from rounding may cause some totals to appear inexact.								

Table 2.3.2 ranks the 25 most common base DRGs, that is, the 25 most common reasons for hospitalization. These DRGs represent 77 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. The risk is shown by the column "PPCs / 100 Stays."

Table 2.3.2

PPC Incidence in Top 25 Base DRGs by Total Stays

Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPCs / 100 Stays	PPC Cost	Avg. PPC Cost / Stay
560-Vaginal Del	117,474	6,138	5.2%	6,481	1.1	5.5	$2,783,937	$24
540-Cesarean Del	62,365	2,954	4.7%	3,473	1.2	5.6	$5,947,478	$95
566-Oth Antepartum Diags	10,454	154	1.5%	179	1.2	1.7	$1,064,042	$102
541-Vag Del w Ster &/or D&C	5,632	488	8.7%	569	1.2	10.1	$555,217	$99
750-Schizophrenia	5,103	52	1.0%	56	1.1	1.1	$286,238	$56
720-Septicemia & Disseminated Inf	4,430	251	5.7%	319	1.3	7.2	$2,666,096	$602
753-Bipolar Dis	3,682	32	0.9%	35	1.1	1.0	$204,116	$55
194-Heart Failure	3,637	283	7.8%	359	1.3	9.9	$2,331,818	$641
140-COPD	3,416	136	4.0%	157	1.2	4.6	$949,557	$278
563-Threatened Abortion	3,098	17	0.5%	18	1.1	0.6	$99,914	$32
460-Renal Failure	3,077	212	6.9%	289	1.4	9.4	$2,537,790	$825
383-Cellulitis & Oth Bact Skin Inf	2,804	113	4.0%	132	1.2	4.7	$999,832	$357
751-Maj Depression	2,707	33	1.2%	36	1.1	1.3	$220,349	$81
139-Oth Pneumonia	2,662	151	5.7%	180	1.2	6.8	$1,282,784	$482
425-Electrolyte Dis Exc Hypovolemia	2,540	86	3.4%	110	1.3	4.3	$825,990	$325
463-Kidney & Urinary Tract Inf	2,470	67	2.7%	77	1.1	3.1	$547,891	$222
420-Diabetes	2,451	103	4.2%	128	1.2	5.2	$885,833	$361
561-Postpartum Diags w/o Proc	2,271	46	2.0%	51	1.1	2.2	$397,415	$175
053-Seizure	1,915	51	2.7%	67	1.3	3.5	$486,755	$254
263-Laparoscopic Cholecystectomy	1,867	86	4.6%	124	1.4	6.6	$862,240	$462
662-Sickle Cell Anemia Crisis	1,592	32	2.0%	43	1.3	2.7	$239,755	$151
045-CVA & Precereb Occl w Infarct	1,576	158	10.0%	227	1.4	14.4	$1,731,189	$1,098
812-Poisoning of Medicinal Agents	1,546	61	3.9%	79	1.3	5.1	$507,695	$328
133-Pulmon Edema & Resp Failure	1,540	117	7.6%	148	1.3	9.6	$1,093,105	$710
282-Dis of Pancreas Exc Malig	1,466	74	5.0%	101	1.4	6.9	$818,791	$559
Top 25	251,775	11,895	4.7%	13,438	1.1	5.3	$30,325,826	$120
All DRGs	327,649	17,649	5.4%	22,041	1.2	6.7	$97,374,233	$297
Top 25 as percent of all	77%	67%		61%			31%	

Note:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.
2. Differences from rounding may cause some totals to appear inexact.

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 patients in DRG 542 (Vaginal Delivery with Procedure Except Sterilization and/or D&C).

Table 2.3.3

PPC Incidence in Top 25 Base DRGs by PPC Risk

Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPCs / 100 Stays	PPC Cost	Avg. PPC Cost / Stay
542-Vag Del w Proc Exc Ster &/or D&C	327	299	91.4%	406	1.4	124.2	$206,569	$632
004-Trach, MV 96+ Hrs, w Ext Proc	270	94	34.8%	269	2.9	99.6	$2,830,363	$10,483
163-Cardiac Valve Procs w/o Cath	130	66	50.8%	128	1.9	98.5	$737,458	$5,673
162-Cardiac Valve Procs w Cath	62	30	48.4%	55	1.8	88.7	$334,233	$5,391
005-Trach, MV 96+ Hrs, w/o Ext Proc	414	151	36.5%	306	2.0	73.9	$2,974,227	$7,184
165-Coronary Bypass w Cath	404	163	40.3%	287	1.8	71.0	$1,679,278	$4,157
169-Maj Vascular Procs	142	55	38.7%	92	1.7	64.8	$729,181	$5,135
166-Coronary Bypass w/o Cath	210	76	36.2%	122	1.6	58.1	$698,380	$3,326
950-Ext Proc Unrel To Diag	271	76	28.0%	138	1.8	50.9	$1,290,892	$4,763
260-Maj Pancreas & Liver Procs	195	47	24.1%	88	1.9	45.1	$822,692	$4,219
130-Resp Sys Diag w MV 96+ Hrs	524	140	26.7%	224	1.6	42.7	$1,979,544	$3,778
221-Maj Small & Large Bowel Procs	921	208	22.6%	386	1.9	41.9	$3,758,047	$4,080
220-Maj Stomach & Esophag Procs	223	51	22.9%	89	1.7	39.9	$829,352	$3,719
120-Maj Resp & Chest Procs	151	36	23.8%	59	1.6	39.1	$625,915	$4,145
223-Oth Small & Large Bowel Procs	164	40	24.4%	60	1.5	36.6	$442,671	$2,699
401-Pituitary & Adrenal Procs	41	9	22.0%	15	1.7	36.6	$118,631	$2,893
405-Oth Procs for Metabolic Dis	82	24	29.3%	30	1.3	36.6	$294,620	$3,593
261-Maj Biliary Tract Procs	45	14	31.1%	16	1.1	35.6	$111,179	$2,471
021-Craniotomy Exc for Trauma	598	115	19.2%	206	1.8	34.4	$1,938,913	$3,242
180-Oth Circulatory Sys Procs	148	31	20.9%	49	1.6	33.1	$424,786	$2,870
161-Defib & Heart Assist Implant	269	64	23.8%	89	1.4	33.1	$636,151	$2,365
447-Oth Kidney & Urinary Procs	129	22	17.1%	37	1.7	28.7	$349,821	$2,712
305-Amput of Lower Limb Exc Toes	456	88	19.3%	123	1.4	27.0	$958,571	$2,102
173-Oth Vascular Procs	764	134	17.5%	202	1.5	26.4	$1,915,264	$2,507
262-Cholecystectomy Exc Laparo	178	29	16.3%	47	1.6	26.4	$350,979	$1,972
Top 25	7,118	2,062	29.0%	3,523	1.7	49.5	$27,037,712	$3,798.50
All DRGs	327,649	17,649	5.4%	22,041	1.2	6.7	$97,374,233	$297
Top 25 as percent of all	2%	12%		16%			27.8%	

Notes:

1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.
2. Base DRGs with fewer than 40 stays are not shown.
3. Differences from rounding may cause some totals to appear inexact.

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)						
			Level of Severity (SOI)			
Base DRG		Total	Severity 1	Severity 2	Severity 3	Severity 4
560-Vaginal Del	All Stays	117,474	79,377	32,790	5,262	45
560-Vaginal Del	PPC Rate	5.2%	2.1%	10.8%	17.1%	57.8%
540-Cesarean Del	All Stays	62,365	42,206	15,239	4,784	136
540-Cesarean Del	PPC Rate	4.7%	2.3%	6.9%	17.8%	62.5%
566-Oth Antepartum Diags	All Stays	10,454	3,803	5,177	1,410	64
566-Oth Antepartum Diags	PPC Rate	1.5%	0.5%	1.3%	4.0%	21.9%
541-Vag Del w Ster &/or D&C	All Stays	5,632	3,542	1,781	301	8
541-Vag Del w Ster &/or D&C	PPC Rate	8.7%	3.3%	14.4%	35.9%	100.0%
750-Schizophrenia	All Stays	5,103	1,941	3,020	137	5
750-Schizophrenia	PPC Rate	1.0%	0.0%	1.3%	8.8%	20.0%
720-Septicemia & Disseminated Inf	All Stays	4,430	119	848	1,596	1,867
720-Septicemia & Disseminated Inf	PPC Rate	5.7%	0.0%	2.5%	3.8%	9.1%
753-Bipolar Dis	All Stays	3,682	1,590	2,023	68	1
753-Bipolar Dis	PPC Rate	0.9%	0.2%	1.4%	1.5%	0.0%
194-Heart Failure	All Stays	3,637	356	1,720	1,312	249
194-Heart Failure	PPC Rate	7.8%	0.0%	2.2%	11.5%	38.2%
140-COPD	All Stays	3,416	600	1,737	956	123
140-COPD	PPC Rate	4.0%	0.0%	1.2%	9.2%	22.8%
563-Threatened Abortion	All Stays	3,098	2,064	954	80	0
563-Threatened Abortion	PPC Rate	0.5%	0.0%	1.3%	6.3%	N/A
460-Renal Failure	All Stays	3,077	73	627	2,199	178
460-Renal Failure	PPC Rate	6.9%	0.0%	3.0%	5.6%	39%
383-Cellulitis & Oth Bact Skin Inf	All Stays	2,804	764	1,406	571	63
383-Cellulitis & Oth Bact Skin Inf	PPC Rate	4.0%	0.3%	2.3%	9.1%	42.9%
751-Maj Depression	All Stays	2,707	926	1,683	92	6
751-Maj Depression	PPC Rate	1.2%	0.4%	1.2%	7.6%	16.7%
139-Oth Pneumonia	All Stays	2,662	265	1,185	982	230
139-Oth Pneumonia	PPC Rate	5.7%	0.4%	0.9%	9.6%	19.6%
425-Electrolyte Dis Exc Hypovolemia	All Stays	2,540	106	1,649	733	52
425-Electrolyte Dis Exc Hypovolemia	PPC Rate	3.4%	0.0%	0.8%	7.0%	40.4%

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.

39% of hospitals performed lower than expected while 29% performed higher than expected, indicating that opportunity exists for hospitals to learn from each other.

Overall, this analysis included 402 hospitals, of which 154 Texas hospitals met the threshold for high-volume providers. Another 96 Texas hospitals and 152 out-of-state hospitals were included in the analytical dataset but were considered low-volume hospitals. These counts do not include the 222 Texas hospitals and 4 out-of-state hospitals that were excluded from the analytical dataset because they were exempt from reporting present-on-admission indicators (Section 1.2).

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 considered lower than expected. If the A/E ratio was more than 1.10, then performance was considered higher than expected. Table 2.4.1 shows results for the 154 high-volume hospitals (which account for 99 percent of total stays in the analytical dataset), and excludes the 248 low-volume hospitals for which results can be unstable (see Section 1.6.4). In terms of the number of PPC stays, 60 hospitals, or 39 percent, performed lower than expected, 49 performed about as expected, and 45 hospitals performed higher than expected. In statistical terms, these were the actual results for SFY 2012, 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 2012 might be similar to those from a different period. For 65 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	Percent of All Hosps	Stat Sig Diff	PPC Count	Percent of All Hosps	PPC Cost	Percent of All Hosps
Much lower than expected	Less than 0.75	28	18%	22	30	19%	33	22%
Lower than expected	0.75 - 0.90	32	21%	15	27	18%	29	19%
About as expected	0.90 - 1.10	49	32%	0	58	38%	48	31%
Higher than expected	1.10 - 1.25	29	19%	14	27	18%	26	17%
Much higher than expected	More than 1.25	16	10%	14	12	8%	18	12%
Total Hospitals		154	100%	65	154	100%	154	100%

Notes:

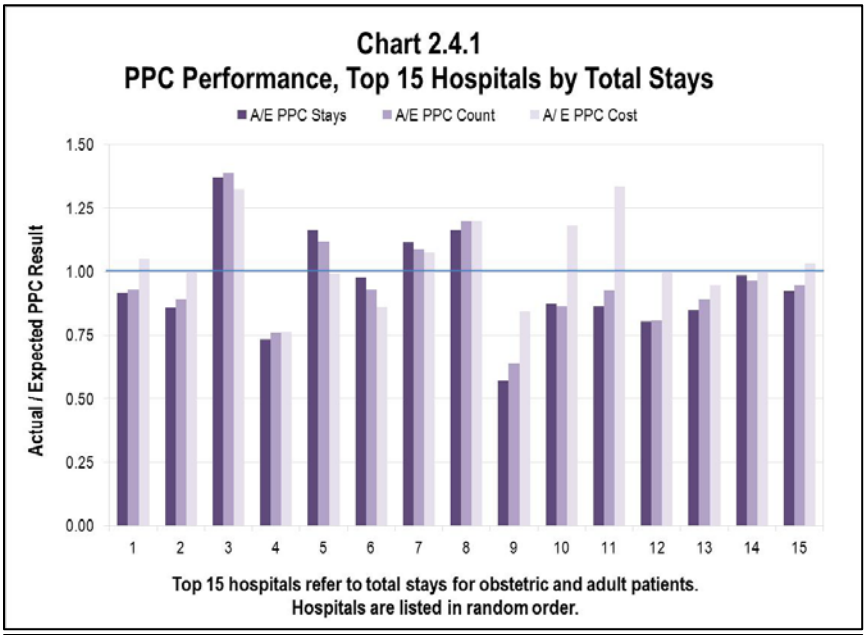
1. PPC rate refers to the number of stays with at least one PPC as a percentage of all stays. PPC count is the total number of PPCs, allowing for an individual PPC stay to have more than one PPC. PPC cost refers to the PPC count multiplied by the appropriate estimated cost impact for each PPC. Each stay 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.

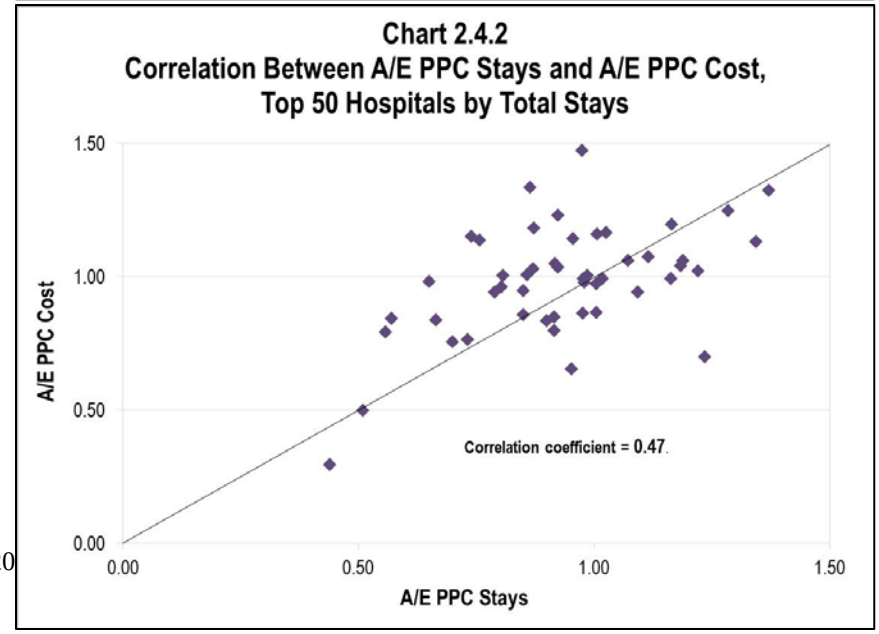
2. Low-volume hospitals are excluded.
3. "Stat Sig Diff" shows the number of hospitals where the difference from 1.00 is statistically significant at the 90% confidence level using the CMH statistic. See Section 1.6.4.
4. Differences from rounding may cause some totals to appear inexact.

Chart 2.4.1 shows results for all three measures for the top 15 hospitals, which together accounted for 35 percent of the stays in the analytical dataset.

In general, the PPC stay measure tended to be highly correlated with the PPC count measure (correlation coefficient = 0.95 for the 154 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 0.47, where 1.00 would indicate perfect correlation and 0.00 would indicate zero correlation. (For the 154 high-volume hospitals, the correlation coefficient was 0.62.) 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.

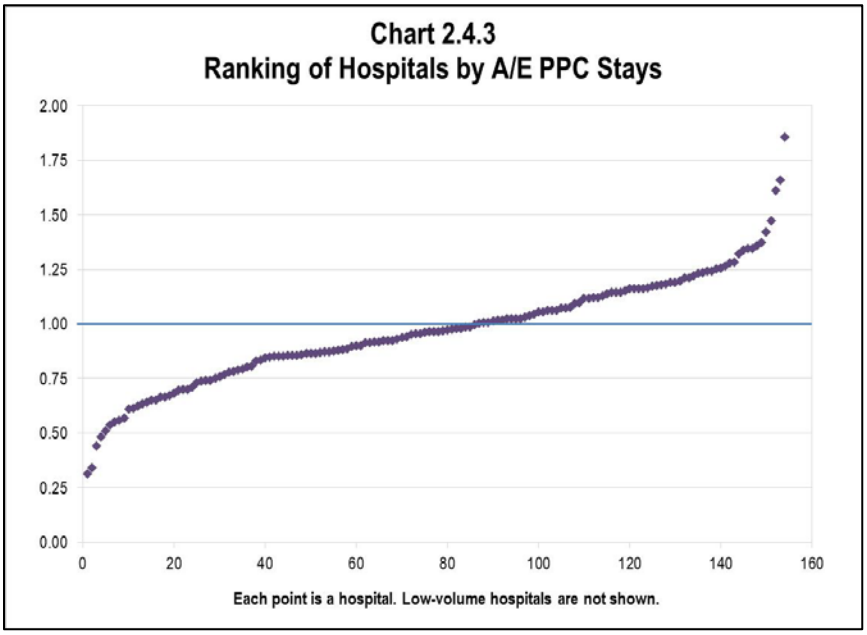


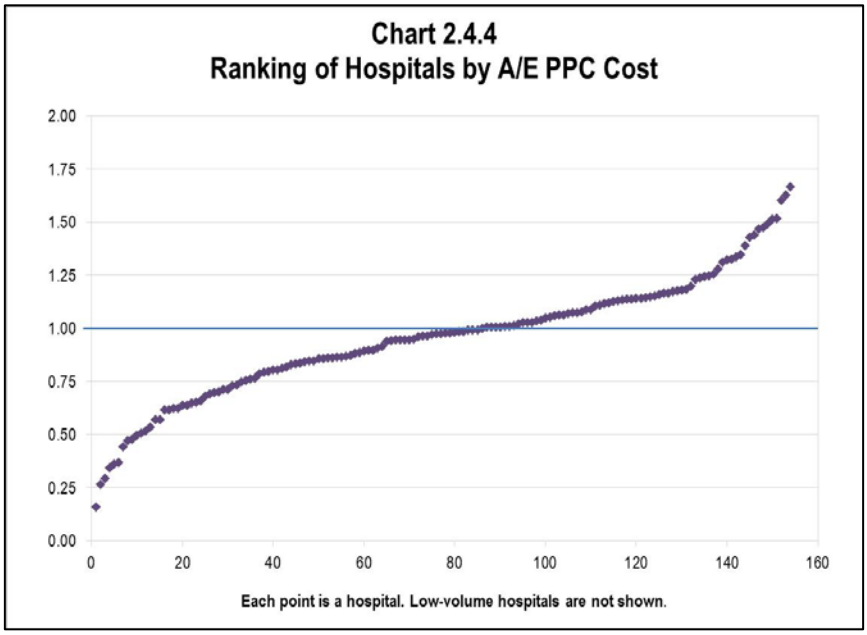


For the 154 hospitals, Chart 2.4.3 shows the range of results for A/E PPC stays and Chart 2.4.4 shows the range of results for A/E PPC cost. Each chart shows a substantial range in performance.

In terms of PPC stays, there were 28 hospitals with A/E ratios under 0.75 (much lower than expected) and 16 hospitals with A/E ratios above 1.25 (much higher than expected). 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 SFY 2012. 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 33 hospitals had A/E ratios under 0.75 while 18 had A/E ratios over 1.25.





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 5.39 percent of stays in the analytical dataset included at least one PPC while only 0.09 percent stays included at least one HAC.

The incidence of hospital-acquired conditions was 0.09%, far lower than the incidence of PPCs at 5%.

Of the 290 stays that included a HAC, 189 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 101 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	309,901	-	-	-	-
HAC criteria met, no PPC assigned	99	-	-	101	116
No HAC, one or more PPCs assigned	17,459	17,459	21,680	-	-
Both HAC and PC present	190	190	361	189	210
Total stays in analytical dataset	327,649	17,649	22,041	290	326
Percent of total stays		5.39%		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			
Stays Where Both a HAC and PPC Were Assigned			
Hospital Acquired Condition	Stays	HAC Count	PPC Count
Catheter-associated urinary tract infection (UTI)	12	22	16
Deep vein thrombosis (DVT)/pulmonary embolism (PE) with total knee replacement or hip replacement	5	5	8
Falls and trauma	20	26	26
Foreign object retained after surgery	6	6	8
Iatrogenic pneumothorax w/ venous catheterization	10	10	15
Manifestations of poor glycemic control	27	28	46
Stage III & IV pressure ulcers	23	25	51
Surgical site infection (SSI) following cardiac implantable electronic device (CIED) procedures	2	2	4
Surgical site infection - certain orthopedic procedures of spine, shoulder and elbow	1	1	1
Vascular catheter-associated infection	83	85	186
Subtotal	189	210	361

Table 2.5.2			
Incidence of HACs			
Stays Where a HAC Was Assigned but a PPC Was Not			
Hospital Acquired Condition	Stays	HAC Count	PPC Count
Stays Where a HAC Was Assigned but a PPC Was Not			
Catheter-associated urinary tract infection (UTI)	12	20	0
Falls and trauma	34	39	0
Foreign object retained after surgery	1	1	0
Iatrogenic pneumothorax w/ venous catheterization	10	11	0
Manifestations of poor glycemic control	2	2	0
Stage III & IV pressure ulcers	12	13	0
Surgical site infection - certain orthopedic procedures of spine, shoulder and elbow	2	2	0
Vascular catheter-associated infection	28	28	0
Subtotal	101	116	0
Total	290	326	361
Note:			
1. For the 189 stays where at least one HAC and at least one PPC were assigned, the HACs and PPCs may or may not have been for the same complications.			

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.30 of the PPC Classification System. 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.[28] The 3M PPC methodology was designed to be applied to APR-DRGs.

Texas Medicaid implemented the APR-DRG payment method on September 1, 2012.

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

The approaches are quite different, as summarized in Table 1.3.1.1. 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 to 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 to 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 depend 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 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. See Appendix Section C.2.4.4.

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 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 2012, not on a sampling methodology. There is no question of statistical significance so long as inferences are made only about the Texas Medicaid population in SFY 2012. In a different time period, the results might be different, especially if a hospital had a low volume of stays in SFY 2012. To assess the likelihood of this, a categorical statistic called the Cochran-Mantel-Haenszel (CMH) statistic was used. See 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. Managed care stays are reported to HHSC on encounter claims that show the hospital's National Provider Identifier, which was matched to TPI numbers.

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?

The hospital-specific version of this report shows counts of Medicaid stays for a specific hospital. (The public version of this report does not include hospital specific results.) 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. Effective November 1, 2013, a hospital's payments may be affected by its PPC rate in SFY 2011 (i.e., the results reported in last year's version of this report). Hospitals were advised of details on September 10, 2013, as required by S.B. 7, 82nd Legislature, First Called Session 2011.[29]

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.[30] 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.[31]

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

Hospital reports are confidential until one year after the report has been released.

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 was held in Austin in November 2012.

It is available at: www.tmhp.com/News_Items/2012/11-Nov/11-26-12%20PPC%20provider%20training%20presentation.pdf.

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 a 3M Health Information Systems sales representative or calling 800-367-2447. 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.30* by Hughes et al.[32] 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. For example, a hospital 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 impacts 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 SFY 2012 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. As of September 1, 2012, there are no longer any exempt hospitals. See Appendix C.2.4.4, which includes more details about exemptions.

Expected PPC Results
Expected PPC results were calculated based on statewide norms calculated from Texas Medicaid 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 Table 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. 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.30 of the PPC Classification System. 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. For documentation, see Hughes et al, *PPC Definitions Manual* V.30.

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. See Table 2.1.2 for a list of the eight PPC groups.

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 uses a hierarchy of related PPCs to preclude the assignment of the less significant candidate complication.

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 data. It is used to calculate actual/expected ratios for each hospital. 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 Texas Medicaid 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 2012 was September 1, 2011, through August 31, 2012.

Statistical Significance
Statistical significance is a way to mathematically estimate 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 SFY 2012 results might also apply to a broader time frame.

Stays at Risk
Stays at risk of a PPC include all inpatient hospital stays except those that include global exclusions or non-obstetric patients under 18 years old. If there are 100 stays for a specific APR-DRG and 10 have global exclusions, then a maximum of 90 stays are at risk for a PPC. However, 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.

T-statistic
The t-statistic is the standard error of the estimate divided by the estimate itself.

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 PPCs	Cost per PPC	PPC Cost
01	Stroke and Intracranial Hemorrhage	Cardiovascular-Respiratory Complications	194	0.9%	$19,781	$3,837,533
02	Extreme CNS Complications	Extreme Complications	83	0.4%	-$4,398	-$365,034
03	Acute Pulmonary Edema and Respiratory Failure Without Ventilation	Cardiovascular-Respiratory Complications	934	4.2%	$5,337	$4,985,132
04	Acute Pulmonary Edema and Respiratory Failure with Ventilation	Extreme Complications	356	1.6%	$9,313	$3,315,392
05	Pneumonia and Other Lung Infections	Cardiovascular-Respiratory Complications	602	2.7%	$9,228	$5,555,196
06	Aspiration Pneumonia	Cardiovascular-Respiratory Complications	277	1.3%	$6,137	$1,699,921
07	Pulmonary Embolism	Cardiovascular-Respiratory Complications	131	0.6%	$32,754	$4,290,748
08	Other Pulmonary Complications	Cardiovascular-Respiratory Complications	266	1.2%	$1,717	$456,775
09	Shock	Extreme Complications	503	2.3%	$17,653	$8,879,459
10	Congestive Heart Failure	Cardiovascular-Respiratory Complications	301	1.4%	$2,694	$810,954
11	Acute Myocardial Infarction	Cardiovascular-Respiratory Complications	191	0.9%	$3,654	$697,971
12	Cardiac Arrythmias and Conduction Disturbances	Cardiovascular-Respiratory Complications	83	0.4%	-$5,093	-$422,719
13	Other Acute Cardiac Complications	Cardiovascular-Respiratory Complications	35	0.2%	$0	$0
14	Ventricular Fibrillation/Cardiac Arrest	Extreme Complications	355	1.6%	$4,247	$1,507,827
15	Peripheral Vascular Complications Except Venous Thrombosis	Cardiovascular-Respiratory Complications	52	0.2%	$16,387	$852,124
16	Venous Thrombosis	Cardiovascular-Respiratory Complications	216	1.0%	$9,872	$2,132,244
17	Major Gastrointestinal Complications Without Transfusion or Significant Bleeding	Gastrointestinal Complications	185	0.8%	$9,727	$1,799,551
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	Gastrointestinal Complications	34	0.2%	$20,879	$709,886
19	Major Liver Complications	Gastrointestinal Complications	189	0.9%	$11,285	$2,132,789
20	Other Gastrointestinal Complications Without Transfusion or Significant Bleeding	Gastrointestinal Complications	72	0.3%	$8,302	$597,744
21	Clostridium Difficile Colitis	Infectious Complications	180	0.8%	$11,263	$2,027,286
23	GU Complications except UTI	Other Medical and Surgical Complications	116	0.5%	$2,838	$329,254
24	Renal Failure Without Dialysis	Other Medical and Surgical Complications	1,773	8.0%	$2,807	$4,976,279
25	Renal Failure with Dialysis	Extreme Complications	25	0.1%	$31,150	$778,750
26	Diabetic Ketoacidosis and Coma	Other Medical and Surgical Complications	32	0.1%	$6,437	$205,984
27	Post-Hemorrhagic and Other Acute Anemia with Transfusion	Other Medical and Surgical Complications	137	0.6%	$7,353	$1,007,388
28	In-Hospital Trauma and Fractures	Other Medical and Surgical Complications	27	0.1%	$6,336	$171,072
29	Poisonings Except from Anesthesia	Malfunctions, Reactions, etc.	38	0.2%	$0	$0
30	Poisonings Due to Anesthesia	Malfunctions, Reactions, etc.	1	0.0%	$0	$0
31	Decubitus Ulcer	Other Medical and Surgical Complications	109	0.5%	$14,615	$1,593,079
32	Transfusion Incompatibility Reaction	Malfunctions, Reactions, etc.	0	0.0%	$0	$0
33	Cellulitis	Infectious Complications	216	1.0%	$5,947	$1,284,552
34	Moderate Infections	Infectious Complications	189	0.9%	$0	$0

Appendix Table B.1						
Summary of PPCs by Frequency						
PPC	Description	Group Description	PPC Count	Percent of Total PPCs	Cost per PPC	PPC Cost
35	Septicemia and Severe Infections	Infectious Complications	707	3.2%	$16,257	$11,493,558
36	Acute Mental Health Changes	Other Medical and Surgical Complications	11	0.0%	-$12,295	-$135,245
37	Post-Operative Infection and Deep Wound Disruption Without Procedure	Perioperative Complications	114	0.5%	$15,026	$1,712,964
38	Post-Operative Wound Infection and Deep Wound Disruption with Procedure	Perioperative Complications	25	0.1%	$9,420	$235,500
39	Reopening Surgical Site	Perioperative Complications	69	0.3%	$7,868	$542,892
40	Post-Operative Hemorrhage and Hematoma Without Hemorrhage Control Procedure or I&D Procedure	Perioperative Complications	327	1.5%	$9,274	$3,032,565
41	Post-Operative Hemorrhage and Hematoma with Hemorrhage Control Procedure or I&D Procedure	Perioperative Complications	39	0.2%	$6,633	$258,687
42	Accidental Puncture/Laceration During Invasive Procedure	Perioperative Complications	209	0.9%	$3,729	$779,424
43	Accidental Cut or Hemorrhage During Other Medical Care	Other Medical and Surgical Complications	0	0.0%	$0	$0
44	Other Surgical Complication - Moderate	Other Medical and Surgical Complications	60	0.3%	$13,966	$837,960
45	Post-procedure Foreign Bodies	Perioperative Complications	5	0.0%	-$20,360	-$101,800
46	Post-Operative Substance Reaction and Non-O.R. Procedure Foreign Body	Perioperative Complications	0	0.0%	$0	$0
47	Encephalopathy	Other Medical and Surgical Complications	235	1.1%	$1,314	$308,673
48	Other Complications of Medical Care	Other Medical and Surgical Complications	95	0.4%	$9,026	$857,470
49	Iatrogenic Pneumothorax	Malfunctions, Reactions, etc.	50	0.2%	$6,709	$335,450
50	Mechanical Complication of Device, Implant, and Graft	Malfunctions, Reactions, etc.	99	0.4%	$14,538	$1,439,262
51	Gastrointestinal Ostomy Complications	Malfunctions, Reactions, etc.	56	0.3%	$17,569	$983,864
52	Infection, Inflammation, and Other Complications of Devices, Implants, or Grafts except Vascular Infection	Malfunctions, Reactions, etc.	227	1.0%	$7,906	$1,794,662
53	Infection, Inflammation, and Clotting Complications of Peripheral Vascular Catheters and Infusions	Malfunctions, Reactions, etc.	66	0.3%	$12,220	$806,520
54	Infections Due to Central Venous Catheters	Malfunctions, Reactions, etc.	84	0.4%	$20,622	$1,732,248
55	Obstetrical Hemorrhage Without Transfusion	Obstetrical Complications	3,462	15.7%	$0	$0
56	Obstetrical Hemorrhage with Transfusion	Obstetrical Complications	1,107	5.0%	$2,410	$2,668,202
57	Obstetric Lacerations and Other Trauma Without Instrumentation	Obstetrical Complications	2,361	10.7%	$0	$0
58	Obstetric Lacerations and Other Trauma with Instrumentation	Obstetrical Complications	842	3.8%	$0	$0
59	Medical and Anesthesia Obstetric Complications	Obstetrical Complications	1,236	5.6%	$558	$689,935
60	Major Puerperal Infection and Other Major Obstetric Complications	Obstetrical Complications	200	0.9%	$1,769	$353,820
61	Other Complications of Obstetrical Surgical and Perineal Wounds	Obstetrical Complications	406	1.8%	$1,421	$577,048
62	Delivery with Placental Complications	Obstetrical Complications	447	2.0%	$0	$0
63	Post-Operative Respiratory Failure with Tracheostomy	Extreme Complications	28	0.1%	$55,580	$1,556,240
64	Other In-Hospital Adverse Events	Other Medical and Surgical Complications	25	0.1%	$5,210	$130,250
65	Urinary Tract Infection	Infectious Complications	1,538	7.0%	$5,616	$8,636,947
66	Catheter-Related Urinary Tract Infection	Infectious Complications	9	0.0%	$0	$0
Total			22,041	100.0%	$4,418	$97,374,233

Notes:

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

Appendix Table B.1						
Summary of PPCs by Frequency						
PPC	Description	Group Description	PPC Count	Percent of Total PPCs	Cost per PPC	PPC Cost
2. PPC 22, Urinary Tract Infection, has been retired. It was replaced with PPC 65, Urinary Tract Infection, and PPC 66, Catheter-Related Urinary Tract Infection.						
3. Differences from rounding may cause some totals to appear inexact. 4. Negative estimates can reflect that complication actually makes further care futile or less necessary or the patient dies.						

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	46	29	17	$22,012,193	$7,001,348	$2,991,955	439	737
005 Trach, MV 96+ Hrs, w/o Ext Proc	47	23	24	$21,571,359	$6,280,528	$2,383,228	302	572
021 Craniotomy Exc for Trauma	30	0	30	$8,006,591	$2,677,901	$1,014,690	166	286
022 Ventricular Shunt Procs	6	0	6	$1,843,268	$422,841	$115,151	22	49
023 Spinal Procs	5	0	5	$474,215	$250,297	$136,571	18	36
024 Extracranial Vascular Procs	8	0	8	$1,525,618	$541,006	$264,007	19	53
026 Oth Nerv Sys & Related Procs	2	0	2	$100,818	$44,845	$33,573	7	17
040 Spinal Dis & Injuries	1	0	1	$77,532	$24,810	$14,272	2	3
042 Degen Nerv Sys Dis Exc Ms	4	0	4	$190,202	$66,313	$63,092	7	14
043 Mult Sclerosis	2	0	2	$192,267	$41,159	$16,665	6	7
044 Intracranial Hemorrhage	18	0	18	$1,539,254	$509,991	$231,004	46	74
045 CVA & Precereb Occl w Infarct	49	0	49	$4,744,491	$1,172,772	$657,567	94	162
046 Nonspec CVA w/o Infarct	2	0	2	$209,850	$62,933	$68,770	3	5
047 Transient Ischemia	3	0	3	$121,029	$27,973	$12,159	3	4
048 Nerve Disorders	15	0	15	$963,965	$281,734	$117,463	15	19
049 Bact & Tub Inf of Nervous Sys	5	0	5	$970,997	$271,301	$73,273	16	30
050 Non-Bact Inf of Nerv Sys	2	0	2	$152,685	$37,495	$16,126	4	8
052 Nontraumatic Stupor & Coma	5	0	5	$305,164	$108,112	$42,858	6	14
053 Seizure	14	0	14	$809,312	$202,212	$111,622	14	26
054 Migraine & Oth Headaches	3	0	3	$189,073	$37,109	$15,822	3	3
057 Uncomplic Head Trauma	1	0	1	$62,200	$13,062	$7,516	1	2
058 Oth Dis of Nervous Sys	9	0	9	$538,215	$146,517	$72,257	11	17
070 Orbital Procs	1	0	1	$70,457	$37,342	$14,705	2	4
080 Acute Maj Eye Inf	1	0	1	$24,729	$9,397	$3,448	0	1
082 Eye Dis Exc Maj Inf	1	0	1	$25,056	$8,018	$4,487	1	2
089 Maj Cranial/Facial Bone Procs	1	0	1	$175,894	$45,733	$23,302	3	5
091 Oth Maj Head & Neck Procs	1	0	1	$103,652	$42,497	$22,124	5	8
097 Tonsil & Adenoid Procs	2	0	2	$307,556	$63,288	$28,074	2	3

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
098 Oth Ear, Nose Throat Procs	7	0	7	$548,370	$150,063	$94,418	15	33
110 Ear, Nose, Throat, Facial Malig	4	0	4	$208,422	$50,481	$61,820	5	14
111 Vertigo & Oth Labyrinth Dis	1	0	1	$15,508	$5,118	$3,696	1	1
113 Inf of Upper Resp Tract	4	0	4	$434,765	$123,296	$39,930	3	10
115 Oth Ear, Nose, Throat Diags	4	0	4	$176,253	$65,189	$27,751	4	6
120 Maj Resp & Chest Procs	22	0	22	$3,948,217	$1,388,549	$602,422	95	153
121 Oth Resp & Chest Procs	9	0	9	$983,326	$402,494	$186,082	27	50
130 Resp Sys Diag w MV 96+ Hrs	47	22	25	$10,037,534	$2,618,479	$1,055,423	206	326
131 Cystic Fibrosis - Pulmon Dis	1	0	1	$64,494	$20,638	$12,152	2	3
133 Pulmon Edema & Resp Failure	15	0	15	$2,138,626	$635,673	$166,408	25	37
134 Pulmonary Embolism	13	0	13	$948,079	$280,579	$106,010	22	32
136 Resp Malig	2	0	2	$169,142	$39,355	$24,675	3	4
137 Maj Resp Inf & Inflammations	28	0	28	$2,645,841	$746,544	$296,924	49	79
139 Oth Pneumonia	64	0	64	$4,272,536	$1,286,676	$536,964	66	121
140 COPD	65	0	65	$3,383,582	$879,078	$405,680	68	98
141 Asthma	14	0	14	$874,883	$214,698	$38,936	9	15
142 Interstitial & Alveolar Lung Dis	4	0	4	$311,825	$90,021	$45,518	7	10
143 Oth Resp Diags Exc Minor	11	0	11	$540,596	$188,008	$68,995	11	24
144 Resp Symptoms & Minor Diags	7	0	7	$284,667	$116,386	$26,189	5	9
161 Defib & Heart Assist Implant	20	0	20	$5,344,451	$1,494,343	$1,071,581	123	181
162 Cardiac Valve Procs w Cath	11	0	11	$3,486,029	$1,242,233	$457,229	76	141
163 Cardiac Valve Procs w/o Cath	29	0	29	$8,505,492	$2,056,402	$982,397	183	283
165 Coronary Bypass w Cath	72	0	72	$17,616,419	$4,222,113	$1,909,508	425	552
166 Coronary Bypass w/o Cath	44	0	44	$7,557,123	$2,106,461	$1,114,423	192	264
167 Oth Cardiothoracic Procs	3	0	3	$478,544	$130,238	$90,093	12	21
169 Maj Vascular Procs	25	0	25	$4,560,187	$1,400,138	$724,582	115	200
170 Pacemaker Impl w AMI or Shock	1	0	1	$233,301	$51,326	$19,707	4	4
171 Pacemaker Impl w/o AMI or Shock	4	0	4	$617,766	$136,566	$63,533	13	23
173 Oth Vascular Procs	30	0	30	$5,784,534	$1,648,704	$632,794	100	177
174 Percut CV Procs w AMI	39	0	39	$4,703,835	$1,261,292	$544,873	121	174
175 Percut CV Procs w/o AMI	19	0	19	$2,254,451	$611,608	$296,350	56	72
177 Pacemaker & Defib Revision	1	0	1	$80,881	$21,838	$17,904	2	2
180 Oth Circulatory Sys Procs	5	0	5	$742,185	$174,539	$77,446	14	25
190 Acute Myocardial Infarction	19	0	19	$2,475,165	$566,609	$214,635	32	52
191 Cardiac Cath Exc Ischem Disease	16	2	14	$1,415,565	$343,754	$148,140	30	49
192 Cardiac Cath for Ischem Disease	8	0	8	$590,668	$130,907	$73,250	12	15
193 Acute & Subacute Endocarditis	1	0	1	$131,810	$46,134	$19,872	2	5
194 Heart Failure	114	0	114	$6,632,467	$2,129,332	$727,101	130	231

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
197 Peripheral & Oth Vascular Dis	14	0	14	$968,788	$231,078	$90,324	17	27
198 Angina Pect & Atherosclerosis	6	0	6	$251,886	$79,671	$42,020	5	6
199 Hypertension	17	0	17	$650,105	$152,212	$69,501	14	19
200 Cardiac Structural Dis	2	0	2	$158,212	$40,059	$35,224	2	7
201 Cardiac Arrhythmias	9	0	9	$465,579	$153,160	$59,025	8	15
203 Chest Pain	10	0	10	$383,416	$98,884	$37,973	8	10
204 Syncope & Collapse	7	0	7	$264,283	$64,182	$27,579	6	8
206 Complic of CV Device or Proc	6	0	6	$464,943	$136,255	$90,031	8	13
207 Oth Circulatory Sys Diags	7	0	7	$495,257	$219,653	$58,440	10	19
220 Maj Stomach & Esophag Procs	8	0	8	$1,344,596	$356,462	$165,033	31	48
221 Maj Small & Large Bowel Procs	72	0	72	$12,881,054	$3,702,096	$1,739,885	263	483
222 Oth Stomach & Esophag Procs	5	0	5	$409,120	$108,421	$124,504	10	21
223 Oth Small & Large Bowel Procs	13	0	13	$2,293,663	$592,140	$200,159	36	60
224 Peritoneal Adhesiolysis	5	0	5	$667,370	$156,651	$62,198	10	18
225 Appendectomy	10	0	10	$1,000,509	$206,730	$113,831	18	33
226 Anal Procs	5	0	5	$406,698	$79,543	$40,571	7	14
227 Oth Hernia Procs	21	0	21	$2,816,923	$717,957	$364,785	43	71
228 Inguin, Fem & Umbil Hernia Procs	1	0	1	$24,059	$5,052	$13,845	1	2
229 Oth Digestive & Abdo Procs	4	1	3	$335,336	$121,894	$74,973	9	22
240 Digestive Malig	3	0	3	$232,482	$57,791	$33,978	5	8
241 Peptic Ulcer & Gastritis	14	0	14	$714,061	$191,540	$122,601	15	27
242 Maj Esophageal Dis	2	0	2	$88,830	$32,467	$14,520	3	8
243 Oth Esophageal Dis	6	0	6	$462,109	$127,665	$63,301	6	10
244 Diverticulitis & Diverticulosis	7	0	7	$329,080	$132,064	$33,803	7	11
245 Inflammatory Bowel Disease	3	0	3	$104,193	$36,323	$17,344	4	8
246 Gastroint Vasc Insufficiency	2	0	2	$108,677	$57,962	$12,170	2	4
247 Intestinal Obstruction	10	0	10	$609,321	$182,490	$59,530	10	16
248 Maj Gastroint & Peritoneal Inf	4	0	4	$256,720	$50,616	$20,515	5	9
249 Non-Bact Gastroenteritis, N & V	14	0	14	$544,080	$152,659	$62,630	8	14
251 Abdominal Pain	6	0	6	$255,788	$97,606	$18,354	5	7
252 Complic of Gi Device or Proc	8	0	8	$618,846	$243,064	$66,919	8	16
253 Oth & Unspec Gi Hemorrhage	13	0	13	$634,812	$250,870	$92,163	15	26
254 Oth Digestive Sys Diags	19	0	19	$1,093,537	$290,090	$170,311	17	31
260 Maj Pancreas & Liver Procs	11	0	11	$2,169,542	$757,750	$469,691	39	79
261 Maj Biliary Tract Procs	1	0	1	$127,485	$24,222	$38,608	3	4
262 Cholecystectomy Exc Laparo	12	0	12	$1,153,134	$409,151	$199,288	27	61
263 Laparoscopic Cholecystectomy	35	0	35	$3,779,112	$1,043,785	$410,685	61	101
264 Oth Hepatobiliary & Abdo Procs	2	0	2	$316,239	$91,731	$48,342	7	13

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
279 Hepatic Coma & Oth Maj Liver Dis	12	0	12	$1,067,329	$330,835	$158,879	13	29
280 Alcoholic Liver Disease	17	0	17	$1,307,108	$344,667	$121,900	20	45
281 Malig of Hepatobiliary Sys	2	0	2	$64,075	$34,601	$8,901	3	5
282 Dis of Pancreas Exc Malig	27	0	27	$1,775,102	$500,678	$195,746	34	62
283 Oth Dis of the Liver	11	0	11	$570,178	$173,956	$69,607	12	23
284 Dis of Gallbladder	8	0	8	$305,837	$97,128	$50,101	9	16
301 Hip Joint Replacement	29	0	29	$4,042,743	$1,209,375	$555,322	82	120
302 Knee Joint Replacement	31	0	31	$2,958,765	$693,360	$424,491	82	123
303 Lumb Fusion for Back Curvature	2	0	2	$405,563	$103,579	$91,276	16	24
304 Lumb Fusion Exc Back Curvature	18	0	18	$3,629,992	$935,327	$581,964	77	118
305 Amput of Lower Limb Exc Toes	33	0	33	$5,106,508	$1,373,327	$508,771	87	151
308 Hip & Femur Procs for Trauma	20	2	18	$1,881,268	$662,674	$274,326	49	83
309 Hip & Femur Procs Non-Trauma	7	0	7	$941,490	$366,547	$101,318	25	39
310 Disc Excision & Decompress	8	0	8	$661,164	$180,750	$103,526	14	23
312 Skin Graft for Connect Tis Diags	1	0	1	$158,226	$74,366	$38,855	3	4
313 Knee & Lower Leg Procs Exc Foot	22	0	22	$2,439,700	$629,235	$230,324	50	82
314 Foot & Toe Procs	13	0	13	$1,515,141	$413,328	$140,563	26	36
315 Shoulder And Arm Procs	3	0	3	$273,193	$50,596	$17,502	5	12
316 Hand & Wrist Procs	2	0	2	$467,761	$80,659	$15,750	3	6
317 Soft Tissue Procs	5	0	5	$313,269	$110,423	$70,586	11	15
320 Oth Muscskl & Connect Tis Procs	5	0	5	$524,785	$127,443	$84,744	13	18
321 Cervical Spinal Fusion	10	0	10	$1,332,506	$381,422	$200,214	30	49
340 Fracture of Femur	3	0	3	$276,640	$78,145	$14,619	3	26
342 Fx & Dislc Exc Femur, Pelvis, Back	3	0	3	$188,435	$73,929	$19,036	3	6
344 Musculoskeletal Inf	5	0	5	$363,154	$113,355	$53,547	7	11
346 Connective Tissue Dis	3	0	3	$151,288	$57,336	$21,286	4	7
347 Oth Back & Neck Dis, Fx & Injuries	10	0	10	$931,140	$258,839	$111,752	11	19
349 Complic of Ortho Device or Proc	1	0	1	$154,446	$35,522	$5,847	1	2
351 Oth Muscskl & Connect Tis Diags	13	0	13	$661,884	$186,958	$62,273	18	32
361 Skin Graft for Cutaneous Diags	8	0	8	$1,018,295	$259,529	$94,910	19	32
362 Mastectomy Procs	2	0	2	$120,969	$30,285	$11,275	3	13
363 Breast Procs Exc Mastectomy	1	0	1	$89,261	$24,993	$8,560	2	3
364 Oth Cutaneous & Related Procs	17	0	17	$1,859,846	$495,815	$172,317	33	52
380 Skin Ulcers	13	0	13	$705,047	$207,386	$205,839	15	23
381 Maj Skin Dis	2	0	2	$129,799	$49,693	$21,229	4	9
382 Malignant Breast Dis	1	0	1	$31,861	$10,196	$3,966	1	2
383 Cellulitis & Oth Bact Skin Inf	56	0	56	$3,355,051	$945,295	$357,968	55	101
384 Trauma To Cutaneous Tissue	2	0	2	$59,389	$23,377	$16,125	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
385 Oth Cutaneous Tis & Breast Dis	2	0	2	$335,091	$65,503	$16,490	2	4
401 Pituitary & Adrenal Procs	4	0	4	$761,591	$250,299	$70,765	24	30
403 Procs for Obesity	13	0	13	$2,167,191	$383,842	$144,661	26	46
404 Thyroid Procs	2	0	2	$323,637	$71,941	$12,599	5	8
405 Oth Procs for Metabolic Dis	8	0	8	$1,235,950	$339,975	$128,511	21	66
420 Diabetes	32	0	32	$1,893,584	$499,894	$175,190	27	49
421 Nutritional Dis	1	0	1	$19,349	$5,998	$5,527	1	1
422 Hypovolemia	7	0	7	$201,430	$62,760	$15,788	3	7
424 Oth Endocrine Dis	8	0	8	$515,714	$124,771	$58,007	9	13
425 Electrolyte Dis Exc Hypovolemia	27	0	27	$1,538,923	$501,488	$93,586	21	43
441 Maj Bladder Procs	3	0	3	$446,058	$146,931	$65,545	9	14
442 Kidney & Urinary Procs for Malig	8	0	8	$588,761	$147,515	$111,630	16	32
443 Kidney & Urinary Procs Nonmalig	13	0	13	$1,457,498	$513,447	$229,546	29	49
444 Renal Dialysis Access Proc	9	0	9	$961,665	$269,001	$112,136	20	31
445 Oth Bladder Procs	1	0	1	$42,948	$10,307	$13,030	1	2
446 Urethral Procs	6	0	6	$836,613	$201,573	$60,648	10	16
447 Oth Kidney & Urinary Procs	5	0	5	$625,672	$211,838	$61,378	13	54
460 Renal Failure	40	0	40	$4,016,670	$1,269,641	$312,414	54	128
462 Nephritis & Nephrosis	1	0	1	$91,998	$32,199	$9,734	2	3
463 Kidney & Urinary Tract Inf	27	0	27	$1,453,198	$386,449	$120,346	21	33
465 Urinary Stones & Obstruction	4	0	4	$136,539	$39,757	$20,718	5	7
466 Complic Genitourin Dev or Proc	9	0	9	$784,991	$188,178	$76,774	11	19
468 Oth Kidney & Urinary Diags	20	0	20	$1,100,374	$347,085	$114,378	20	32
481 Penis Procs	1	0	1	$75,395	$15,079	$6,150	2	2
483 Testes & Scrotal Procs	1	0	1	$76,155	$14,470	$7,194	1	2
501 Male Reproduct Diags Exc Malig	2	0	2	$231,596	$44,396	$9,926	2	10
510 Radical Hysterectectomy	1	0	1	$62,704	$20,065	$11,901	2	2
512 Uterine/Adnexa Procs Oth Malig	2	0	2	$82,374	$32,181	$20,161	4	8
513 Uterine/Adnexa Procs Non-Malig	17	0	17	$889,637	$233,438	$100,655	20	30
514 Fem Reproduct Reconstr Procs	1	0	1	$132,974	$37,233	$7,088	1	2
517 D&C for Non-Obstetric Diags	1	0	1	$897,906	$287,330	$6,483	3	4
518 Oth Fem Reproductive Procs	3	0	3	$255,264	$92,697	$33,484	5	10
519 Uterine/Adnexa Procs Leiomyoma	9	0	9	$942,964	$218,410	$53,577	12	25
530 Female Reproductive Sys Malig	1	0	1	$15,407	$4,930	$5,350	1	1
532 Menstrual & Oth Fem Reprod Dis	3	0	3	$175,120	$30,727	$10,682	3	4
540 Cesarean Del	675	0	675	$23,391,331	$6,479,504	$2,726,050	503	802
541 Vag Del w Ster &/or D&C	133	0	133	$3,066,823	$834,919	$304,388	73	102
542 Vag Del w Proc Exc Ster &/or D&C	277	266	11	$4,707,858	$1,295,432	$698,899	131	207

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
544 D&C for Obstetric Diags	7	0	7	$728,262	$196,772	$86,357	6	13
545 Ectopic Pregnancy Proc	2	0	2	$45,535	$17,367	$7,208	2	3
546 Oth O.R. Proc for Ob Diag Exc Del	5	1	4	$420,448	$158,731	$31,990	9	22
560 Vaginal Del	1,936	0	1,936	$26,013,788	$7,359,974	$4,140,122	790	1,011
561 Postpartum Diags w/o Proc	12	0	12	$566,638	$155,023	$33,724	9	27
563 Threatened Abortion	4	0	4	$184,592	$48,832	$18,089	2	3
564 Abortion w/o D&C	2	0	2	$251,878	$45,024	$3,996	1	3
566 Oth Antepartum Diags	56	0	56	$1,836,848	$473,411	$128,129	26	45
650 Splenectomy	1	0	1	$81,467	$13,849	$13,681	2	4
651 Oth Procs of Blood & Rel Organs	2	0	2	$513,641	$123,989	$46,831	3	16
660 Maj Hem/Immun Diag	5	0	5	$563,386	$178,842	$41,146	7	14
661 Coagulation & Platelet Dis	2	0	2	$117,029	$25,907	$24,239	2	5
662 Sickle Cell Anemia Crisis	14	0	14	$923,020	$239,974	$71,095	16	25
663 Oth Dis of Blood & Rel Organs	12	0	12	$1,067,772	$274,110	$96,103	12	23
680 Maj O.R. Proc Lymphatic Neoplasm	3	0	3	$439,391	$189,917	$53,209	12	23
681 Oth O.R. Proc Lymphatic Neoplasm	1	0	1	$148,761	$58,017	$15,769	2	5
691 Lymphoma, Myeloma & Non-Ac Leuk	3	0	3	$183,868	$53,886	$42,181	5	8
693 Chemothapy	1	0	1	$145,746	$43,724	$7,870	2	8
694 Lymphatic & Oth Malig & Neoplasms	2	0	2	$103,959	$51,777	$14,925	3	4
710 Inf & Parasit Dis Incl HIV w O.R. Proc	19	0	19	$3,213,488	$858,384	$452,632	63	131
711 Post-Op, Device Inf w O.R. Proc	12	0	12	$1,931,645	$413,181	$146,316	38	68
720 Septicemia & Disseminated Inf	44	0	44	$4,354,422	$1,171,900	$619,928	67	145
721 Post-Op, Post-Trauma, Device Inf	14	0	14	$996,113	$329,428	$117,574	21	39
722 Fever	1	0	1	$40,026	$7,205	$1,827	0	1
723 Viral Illness	1	0	1	$415,028	$107,907	$4,389	2	7
724 Oth Inf & Parasit Diseases	4	0	4	$322,029	$105,493	$39,537	6	11
750 Schizophrenia	18	0	18	$697,408	$163,459	$70,797	13	16
751 Maj Depression	15	0	15	$687,162	$208,403	$48,743	9	11
753 Bipolar Dis	13	0	13	$257,832	$93,695	$37,569	8	8
754 Depression Exc Maj Dep	1	0	1	$34,489	$4,139	$1,813	0	0
756 Acute Anxiety & Delirium States	1	0	1	$32,236	$13,217	$2,845	1	1
757 Organic Mental Health Disturb	2	0	2	$43,877	$13,076	$6,963	2	2
775 Alcohol Abuse & Dependence	5	0	5	$518,161	$129,916	$27,169	4	10
791 O.R. Proc for Complic of Care	7	0	7	$1,317,078	$295,528	$130,291	15	31
811 Allergic Reactions	2	0	2	$67,502	$22,876	$8,222	2	4
812 Poisoning of Medicinal Agents	19	0	19	$913,498	$192,199	$129,420	16	37
813 Oth Complics of Treatment	4	0	4	$298,048	$84,325	$28,582	5	7
816 Toxic Eff of Non-Medicinal Subst	2	0	2	$98,305	$36,141	$16,300	2	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
850 Proc w Diag of Rehab or Other	4	0	4	$737,801	$216,494	$67,936	10	22
860 Rehabilitation	10	0	10	$859,746	$300,021	$127,063	26	40
861 Signs, Symptoms & Oth Factors	11	0	11	$640,258	$236,266	$73,048	9	21
912 Muscskl Procs Mult Sig Trauma	1	1	0	$565,356	$158,300	$81,815	2	6
950 Ext Proc Unrel To Diag	23	0	23	$4,419,474	$1,204,276	$618,157	89	167
951 Mod Ext Proc Unrel To Diag	37	0	37	$5,638,568	$1,730,333	$716,604	89	189
952 Nonext Proc Unrel To Diag	12	0	12	$1,592,990	$401,876	$137,872	24	46
All PPC Stays	5,616	347	5,269	$375,790,759	$106,599,635	$46,752,528	7,632	12,614
All stays	327,649	347	5,269	$9,410,165,137	$2,596,884,056	$1,350,994,969	325,317	330,299
Notes:								
1. Casemix was measured using Texas Medicaid relative weights for APR-DRG V.30.								
2. SOI = severity of illness.								
3. Differences from rounding may cause some totals to appear inexact.								

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	PPC / 100 Stays	Cost per PPC	PPC Cost
001-Liver &/or Intest Transpl	26	0	0.0%	0	0.0	0.0	$0	$0
002-Heart &/or Lung Transpl	9	0	0.0%	0	0.0	0.0	$0	$0
003-Bone Marrow Transpl	18	0	0.0%	0	0.0	0.0	$0	$0
004-Trach, MV 96+ Hrs, w Ext Proc	270	94	34.8%	269	2.9	99.6	$10,522	$2,830,363
005-Trach, MV 96+ Hrs, w/o Ext Proc	414	151	36.5%	306	2.0	73.9	$9,720	$2,974,227
020-Craniotomy for Trauma	148	0	0.0%	0	0.0	0.0	$0	$0
021-Craniotomy Exc for Trauma	598	115	19.2%	206	1.8	34.4	$9,412	$1,938,913
022-Ventricular Shunt Procs	148	19	12.8%	37	1.9	25.0	$8,890	$328,943
023-Spinal Procs	138	14	10.1%	16	1.1	11.6	$10,462	$167,385
024-Extracranial Vascular Procs	261	35	13.4%	61	1.7	23.4	$8,861	$540,513
026-Oth Nerv Sys & Related Procs	109	8	7.3%	17	2.1	15.6	$9,474	$161,062
040-Spinal Dis & Injuries	58	3	5.2%	3	1.0	5.2	$12,063	$36,188
041-Nervous Sys Malig	303	0	0.0%	0	0.0	0.0	$0	$0
042-Degen Nerv Sys Dis Exc Ms	157	9	5.7%	11	1.2	7.0	$9,024	$99,259
043-Mult Sclerosis	184	7	3.8%	8	1.1	4.3	$9,761	$78,085
044-Intracranial Hemorrhage	423	74	17.5%	99	1.3	23.4	$8,378	$829,394
045-CVA & Precereb Occl w Infarct	1,576	158	10.0%	227	1.4	14.4	$7,626	$1,731,189
046-Nonspec CVA w/o Infarct	51	5	9.8%	9	1.8	17.6	$6,621	$59,589
047-Transient Ischemia	425	6	1.4%	6	1.0	1.4	$3,811	$22,867
048-Nerve Disorders	767	37	4.8%	55	1.5	7.2	$5,834	$320,863
049-Bact & Tub Inf of Nervous Sys	96	14	14.6%	24	1.7	25.0	$9,109	$218,613
050-Non-Bact Inf of Nerv Sys	71	10	14.1%	16	1.6	22.5	$9,434	$150,949
051-Viral Meningitis	92	1	1.1%	1	1.0	1.1	$2,807	$2,807
052-Nontraumatic Stupor & Coma	355	28	7.9%	37	1.3	10.4	$7,118	$263,350
053-Seizure	1,915	51	2.7%	67	1.3	3.5	$7,265	$486,755
054-Migraine & Oth Headaches	323	4	1.2%	5	1.3	1.5	$4,664	$23,319
055-Head Trauma w Coma >1 Hr	256	0	0.0%	0	0.0	0.0	$0	$0
056-Complic Skull Fx, Coma <1 Hr	63	2	3.2%	4	2.0	6.3	$7,825	$31,300
057-Uncomplic Head Trauma	48	2	4.2%	2	1.0	4.2	$4,211	$8,422
058-Oth Dis of Nervous Sys	510	23	4.5%	26	1.1	5.1	$7,175	$186,561
070-Orbital Procs	20	1	5.0%	1	1.0	5.0	$2,807	$2,807
073-Eye Procs Exc Orbit	25	0	0.0%	0	0.0	0.0	$0	$0
080-Acute Maj Eye Inf	37	1	2.7%	1	1.0	2.7	$1,314	$1,314
082-Eye Dis Exc Maj Inf	96	3	3.1%	3	1.0	3.1	$4,895	$14,686
089-Maj Cranial/Facial Bone Procs	83	4	4.8%	5	1.3	6.0	$5,680	$28,400
090-Maj Larynx & Trachea Procs	23	1	4.3%	1	1.0	4.3	$9,274	$9,274
091-Oth Maj Head & Neck Procs	21	1	4.8%	1	1.0	4.8	$5,337	$5,337
092-Facial Bone Procs Exc Major	102	4	3.9%	5	1.3	4.9	$8,716	$43,578

Appendix Table B.3								
PPC Incidence by Base APR DRG								
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPC / 100 Stays	Cost per PPC	PPC Cost
093-Sinus & Mastoid Procs	16	0	0.0%	0	0.0	0.0	$0	$0
095-Cleft Lip & Palate Repair	1	0	0.0%	0	0.0	0.0	$0	$0
097-Tonsil & Adenoid Procs	62	3	4.8%	4	1.3	6.5	$10,318	$41,272
098-Oth Ear, Nose Throat Procs	121	8	6.6%	12	1.5	9.9	$9,348	$112,172
110-Ear, Nose, Throat, Facial Malig	141	7	5.0%	9	1.3	6.4	$10,523	$94,708
111-Vertigo & Oth Labyrinth Dis	90	3	3.3%	4	1.3	4.4	$3,481	$13,926
113-Inf of Upper Resp Tract	233	8	3.4%	11	1.4	4.7	$8,444	$92,887
114-Dental & Oral Conditions	166	3	1.8%	4	1.3	2.4	$10,188	$40,754
115-Oth Ear, Nose, Throat Diags	216	11	5.1%	15	1.4	6.9	$6,461	$96,909
120-Maj Resp & Chest Procs	151	36	23.8%	59	1.6	39.1	$10,609	$625,915
121-Oth Resp & Chest Procs	257	26	10.1%	49	1.9	19.1	$9,759	$478,182
130-Resp Sys Diag w MV 96+ Hrs	524	140	26.7%	224	1.6	42.7	$8,837	$1,979,544
131-Cystic Fibrosis - Pulmon Dis	160	6	3.8%	7	1.2	4.4	$4,539	$31,773
133-Pulmon Edema & Resp Failure	1,540	117	7.6%	148	1.3	9.6	$7,386	$1,093,105
134-Pulmonary Embolism	537	35	6.5%	50	1.4	9.3	$5,766	$288,324
135-Maj Chest & Resp Trauma	140	1	0.7%	1	1.0	0.7	$5,616	$5,616
136-Resp Malig	516	16	3.1%	18	1.1	3.5	$8,256	$148,616
137-Maj Resp Inf & Inflammations	827	93	11.2%	119	1.3	14.4	$7,929	$943,526
138-Bronchiolitis & RSV Pneumonia	7	0	0.0%	0	0.0	0.0	$0	$0
139-Oth Pneumonia	2,662	151	5.7%	180	1.2	6.8	$7,127	$1,282,784
140-COPD	3,416	136	4.0%	157	1.2	4.6	$6,048	$949,557
141-Asthma	687	22	3.2%	24	1.1	3.5	$6,498	$155,962
142-Interstitial & Alveolar Lung Dis	132	8	6.1%	13	1.6	9.8	$6,834	$88,838
143-Oth Resp Diags Exc Minor	592	33	5.6%	46	1.4	7.8	$7,490	$344,537
144-Resp Symptoms & Minor Diags	577	17	2.9%	19	1.1	3.3	$7,928	$150,625
160-Maj Repair of Heart Anomaly	4	2	50.0%	2	1.0	50.0	$4,016	$8,032
161-Defib & Heart Assist Implant	269	64	23.8%	89	1.4	33.1	$7,148	$636,151
162-Cardiac Valve Procs w Cath	62	30	48.4%	55	1.8	88.7	$6,077	$334,233
163-Cardiac Valve Procs w/o Cath	130	66	50.8%	128	1.9	98.5	$5,761	$737,458
165-Coronary Bypass w Cath	404	163	40.3%	287	1.8	71.0	$5,851	$1,679,278
166-Coronary Bypass w/o Cath	210	76	36.2%	122	1.6	58.1	$5,724	$698,380
167-Oth Cardiothoracic Procs	39	14	35.9%	24	1.7	61.5	$10,452	$250,853
169-Maj Vascular Procs	142	55	38.7%	92	1.7	64.8	$7,926	$729,181
170-Pacemaker Impl w AMI or Shock	13	3	23.1%	3	1.0	23.1	$3,287	$9,861
171-Pacemaker Impl w/o AMI or Shock	128	15	11.7%	19	1.3	14.8	$9,052	$171,993
173-Oth Vascular Procs	764	134	17.5%	202	1.5	26.4	$9,482	$1,915,264
174-Percut CV Procs w AMI	739	119	16.1%	190	1.6	25.7	$7,670	$1,457,380
175-Percut CV Procs w/o AMI	562	52	9.3%	78	1.5	13.9	$6,069	$473,355
176-Pacemaker & Defib Replacement	26	1	3.8%	1	1.0	3.8	$2,807	$2,807
177-Pacemaker & Defib Revision	39	5	12.8%	8	1.6	20.5	$6,318	$50,547

Appendix Table B.3								
PPC Incidence by Base APR DRG								
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPC / 100 Stays	Cost per PPC	PPC Cost
180-Oth Circulatory Sys Procs	148	31	20.9%	49	1.6	33.1	$8,669	$424,786
190-Acute Myocardial Infarction	785	81	10.3%	117	1.4	14.9	$7,690	$899,778
191-Cardiac Cath Exc Ischem Disease	555	65	11.7%	83	1.3	15.0	$6,132	$508,995
192-Cardiac Cath for Ischem Disease	802	28	3.5%	32	1.1	4.0	$8,373	$267,944
193-Acute & Subacute Endocarditis	46	3	6.5%	4	1.3	8.7	$24,957	$99,827
194-Heart Failure	3,637	283	7.8%	359	1.3	9.9	$6,495	$2,331,818
196-Cardiac Arrest	58	0	0.0%	0	0.0	0.0	$0	$0
197-Peripheral & Oth Vascular Dis	1,018	60	5.9%	80	1.3	7.9	$7,201	$576,067
198-Angina Pect & Atherosclerosis	931	24	2.6%	28	1.2	3.0	$6,239	$174,698
199-Hypertension	535	27	5.0%	31	1.1	5.8	$5,688	$176,326
200-Cardiac Structural Dis	53	7	13.2%	9	1.3	17.0	$5,916	$53,247
201-Cardiac Arrhythmias	987	36	3.6%	51	1.4	5.2	$6,490	$330,971
203-Chest Pain	1,009	23	2.3%	25	1.1	2.5	$6,377	$159,437
204-Syncope & Collapse	451	12	2.7%	13	1.1	2.9	$3,249	$42,240
205-Cardiomyopathy	30	1	3.3%	2	2.0	6.7	$13,129	$26,259
206-Complic of CV Device or Proc	175	9	5.1%	11	1.2	6.3	$6,982	$76,807
207-Oth Circulatory Sys Diags	341	16	4.7%	18	1.1	5.3	$5,583	$100,501
220-Maj Stomach & Esophag Procs	223	51	22.9%	89	1.7	39.9	$9,319	$829,352
221-Maj Small & Large Bowel Procs	921	208	22.6%	386	1.9	41.9	$9,736	$3,758,047
222-Oth Stomach & Esophag Procs	46	6	13.0%	10	1.7	21.7	$4,652	$46,524
223-Oth Small & Large Bowel Procs	164	40	24.4%	60	1.5	36.6	$7,378	$442,671
224-Peritoneal Adhesiolysis	106	18	17.0%	22	1.2	20.8	$8,054	$177,184
225-Appendectomy	618	24	3.9%	37	1.5	6.0	$9,325	$345,008
226-Anal Procs	177	9	5.1%	11	1.2	6.2	$8,089	$88,980
227-Oth Hernia Procs	349	43	12.3%	55	1.3	15.8	$8,053	$442,893
228-Inguin, Fem & Umbil Hernia Procs	121	16	13.2%	24	1.5	19.8	$8,837	$212,089
229-Oth Digestive & Abdo Procs	158	13	8.2%	24	1.8	15.2	$10,622	$254,939
240-Digestive Malig	437	5	1.1%	6	1.2	1.4	$7,253	$43,520
241-Peptic Ulcer & Gastritis	900	35	3.9%	46	1.3	5.1	$6,490	$298,562
242-Maj Esophageal Dis	195	10	5.1%	15	1.5	7.7	$7,076	$106,139
243-Oth Esophageal Dis	362	12	3.3%	14	1.2	3.9	$7,433	$104,059
244-Diverticulitis & Diverticulosis	392	16	4.1%	21	1.3	5.4	$6,371	$133,798
245-Inflammatory Bowel Disease	333	10	3.0%	10	1.0	3.0	$8,441	$84,411
246-Gastroint Vasc Insufficiency	73	7	9.6%	16	2.3	21.9	$8,050	$128,794
247-Intestinal Obstruction	861	25	2.9%	30	1.2	3.5	$7,734	$232,018
248-Maj Gastroint & Peritoneal Inf	594	36	6.1%	44	1.2	7.4	$7,484	$329,284
249-Non-Bact Gastroenteritis, N & V	1,136	27	2.4%	35	1.3	3.1	$6,169	$215,918
251-Abdominal Pain	656	12	1.8%	15	1.3	2.3	$6,530	$97,945
252-Complic of Gi Device or Proc	306	20	6.5%	25	1.3	8.2	$6,230	$155,746
253-Oth & Unspec Gi Hemorrhage	822	41	5.0%	61	1.5	7.4	$8,046	$490,780

Appendix Table B.3								
PPC Incidence by Base APR DRG								
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPC / 100 Stays	Cost per PPC	PPC Cost
254-Oth Digestive Sys Diags	1,241	58	4.7%	73	1.3	5.9	$8,426	$615,076
260-Maj Pancreas & Liver Procs	195	47	24.1%	88	1.9	45.1	$9,349	$822,692
261-Maj Biliary Tract Procs	45	14	31.1%	16	1.1	35.6	$6,949	$111,179
262-Cholecystectomy Exc Laparo	178	29	16.3%	47	1.6	26.4	$7,468	$350,979
263-Laparoscopic Cholecystectomy	1,867	86	4.6%	124	1.4	6.6	$6,954	$862,240
264-Oth Hepatobiliary & Abdo Procs	67	9	13.4%	17	1.9	25.4	$8,941	$151,991
279-Hepatic Coma & Oth Maj Liver Dis	1,464	53	3.6%	75	1.4	5.1	$10,381	$778,565
280-Alcoholic Liver Disease	1,097	86	7.8%	130	1.5	11.9	$8,571	$1,114,249
281-Malig of Hepatobiliary Sys	484	6	1.2%	8	1.3	1.7	$7,674	$61,393
282-Dis of Pancreas Exc Malig	1,466	74	5.0%	101	1.4	6.9	$8,107	$818,791
283-Oth Dis of the Liver	824	40	4.9%	54	1.4	6.6	$8,283	$447,257
284-Dis of Gallbladder	561	26	4.6%	38	1.5	6.8	$8,060	$306,282
301-Hip Joint Replacement	496	58	11.7%	100	1.7	20.2	$7,529	$752,884
302-Knee Joint Replacement	683	59	8.6%	86	1.5	12.6	$6,488	$557,956
303-Lumb Fusion for Back Curvature	18	5	27.8%	7	1.4	38.9	$6,925	$48,478
304-Lumb Fusion Exc Back Curvature	543	51	9.4%	61	1.2	11.2	$7,338	$447,630
305-Amput of Lower Limb Exc Toes	456	88	19.3%	123	1.4	27.0	$7,793	$958,571
308-Hip & Femur Procs for Trauma	402	43	10.7%	56	1.3	13.9	$8,362	$468,299
309-Hip & Femur Procs Non-Trauma	157	17	10.8%	35	2.1	22.3	$8,447	$295,651
310-Disc Excision & Decompress	295	15	5.1%	19	1.3	6.4	$8,053	$152,998
312-Skin Graft for Connect Tis Diags	35	8	22.9%	12	1.5	34.3	$10,755	$129,063
313-Knee & Lower Leg Procs Exc Foot	638	55	8.6%	73	1.3	11.4	$6,467	$472,115
314-Foot & Toe Procs	559	65	11.6%	79	1.2	14.1	$6,859	$541,857
315-Shoulder And Arm Procs	268	13	4.9%	16	1.2	6.0	$10,826	$173,214
316-Hand & Wrist Procs	99	5	5.1%	7	1.4	7.1	$5,584	$39,091
317-Soft Tissue Procs	218	20	9.2%	20	1.0	9.2	$7,499	$149,979
320-Oth Muscskl & Connect Tis Procs	170	15	8.8%	32	2.1	18.8	$9,150	$292,802
321-Cervical Spinal Fusion	447	26	5.8%	34	1.3	7.6	$5,799	$197,181
340-Fracture of Femur	64	8	12.5%	11	1.4	17.2	$8,074	$88,814
341-Fx of Pelvis or Dislocation of Hip	49	0	0.0%	0	0.0	0.0	$0	$0
342-Fx & Dislc Exc Femur, Pelvis, Back	165	9	5.5%	11	1.2	6.7	$5,848	$64,326
343-Muscskl Malig & Pathol Fx	205	2	1.0%	2	1.0	1.0	$2,982	$5,965
344-Musculoskeletal Inf	429	26	6.1%	28	1.1	6.5	$9,057	$253,605
346-Connective Tissue Dis	388	32	8.2%	48	1.5	12.4	$9,662	$463,778
347-Oth Back & Neck Dis, Fx & Injuries	508	21	4.1%	26	1.2	5.1	$6,804	$176,911
349-Complic of Ortho Device or Proc	205	12	5.9%	18	1.5	8.8	$7,641	$137,530
351-Oth Muscskl & Connect Tis Diags	595	28	4.7%	32	1.1	5.4	$7,164	$229,245
361-Skin Graft for Cutaneous Diags	175	25	14.3%	30	1.2	17.1	$9,178	$275,348
362-Mastectomy Procs	350	6	1.7%	6	1.0	1.7	$8,657	$51,945
363-Breast Procs Exc Mastectomy	113	7	6.2%	10	1.4	8.8	$7,099	$70,993

Appendix Table B.3								
PPC Incidence by Base APR DRG								
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPC / 100 Stays	Cost per PPC	PPC Cost
364-Oth Cutaneous & Related Procs	385	52	13.5%	69	1.3	17.9	$7,414	$511,559
380-Skin Ulcers	502	34	6.8%	43	1.3	8.6	$8,199	$352,544
381-Maj Skin Dis	69	5	7.2%	8	1.6	11.6	$7,774	$62,194
382-Malignant Breast Dis	117	2	1.7%	2	1.0	1.7	$2,004	$4,008
383-Cellulitis & Oth Bact Skin Inf	2,804	113	4.0%	132	1.2	4.7	$7,574	$999,832
384-Trauma To Cutaneous Tissue	150	7	4.7%	10	1.4	6.7	$10,159	$101,590
385-Oth Cutaneous Tis & Breast Dis	271	8	3.0%	13	1.6	4.8	$7,694	$100,028
401-Pituitary & Adrenal Procs	41	9	22.0%	15	1.7	36.6	$7,909	$118,631
403-Procs for Obesity	295	15	5.1%	34	2.3	11.5	$9,591	$326,091
404-Thyroid Procs	141	9	6.4%	15	1.7	10.6	$8,690	$130,351
405-Oth Procs for Metabolic Dis	82	24	29.3%	30	1.3	36.6	$9,821	$294,620
420-Diabetes	2,451	103	4.2%	128	1.2	5.2	$6,921	$885,833
421-Nutritional Dis	78	3	3.8%	6	2.0	7.7	$7,390	$44,342
422-Hypovolemia	381	15	3.9%	18	1.2	4.7	$5,998	$107,955
423-Inborn Errors of Metabolism	57	4	7.0%	4	1.0	7.0	$8,276	$33,104
424-Oth Endocrine Dis	351	20	5.7%	28	1.4	8.0	$7,446	$208,493
425-Electrolyte Dis Exc Hypovolemia	2,540	86	3.4%	110	1.3	4.3	$7,509	$825,990
440-Kidney Transpl	6	0	0.0%	0	0.0	0.0	$0	$0
441-Maj Bladder Procs	35	11	31.4%	13	1.2	37.1	$7,147	$92,912
442-Kidney & Urinary Procs for Malig	119	14	11.8%	25	1.8	21.0	$5,762	$144,044
443-Kidney & Urinary Procs Nonmalig	301	25	8.3%	36	1.4	12.0	$9,526	$342,928
444-Renal Dialysis Access Proc	300	29	9.7%	33	1.1	11.0	$9,616	$317,331
445-Oth Bladder Procs	31	5	16.1%	6	1.2	19.4	$8,183	$49,096
446-Urethral Procs	170	13	7.6%	20	1.5	11.8	$8,489	$169,782
447-Oth Kidney & Urinary Procs	129	22	17.1%	37	1.7	28.7	$9,455	$349,821
460-Renal Failure	3,077	212	6.9%	289	1.4	9.4	$8,781	$2,537,790
461-Kidney & Urinary Tract Malig	73	1	1.4%	2	2.0	2.7	$12,742	$25,485
462-Nephritis & Nephrosis	34	3	8.8%	5	1.7	14.7	$7,200	$35,998
463-Kidney & Urinary Tract Inf	2,470	67	2.7%	77	1.1	3.1	$7,115	$547,891
465-Urinary Stones & Obstruction	354	7	2.0%	8	1.1	2.3	$6,858	$54,864
466-Complic Genitourin Dev or Proc	623	25	4.0%	33	1.3	5.3	$11,354	$374,674
468-Oth Kidney & Urinary Diags	813	57	7.0%	67	1.2	8.2	$7,668	$513,765
480-Maj Male Pelvic Procs	29	1	3.4%	1	1.0	3.4	$7,906	$7,906
481-Penis Procs	25	1	4.0%	1	1.0	4.0	$2,807	$2,807
482-Transurethral Prostatectomy	31	1	3.2%	2	2.0	6.5	$10,230	$20,460
483-Testes & Scrotal Procs	38	5	13.2%	6	1.2	15.8	$8,905	$53,429
484-Oth Male Reproductive Procs	10	0	0.0%	0	0.0	0.0	$0	$0
500-Malig, Male Reproductive Sys	39	1	2.6%	1	1.0	2.6	$2,838	$2,838
501-Male Reproduct Diags Exc Malig	157	9	5.7%	10	1.1	6.4	$4,756	$47,561
510-Radical Hysterectectomy	65	3	4.6%	7	2.3	10.8	$9,261	$64,830

Appendix Table B.3								
PPC Incidence by Base APR DRG								
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPC / 100 Stays	Cost per PPC	PPC Cost
511-Procs for Uterine/Adnexa Malig	39	0	0.0%	0	0.0	0.0	$0	$0
512-Uterine/Adnexa Procs Oth Malig	91	11	12.1%	13	1.2	14.3	$6,650	$86,455
513-Uterine/Adnexa Procs Non-Malig	1,186	52	4.4%	61	1.2	5.1	$6,687	$407,910
514-Fem Reproduct Reconstr Procs	53	4	7.5%	5	1.3	9.4	$4,975	$24,877
517-D&C for Non-Obstetric Diags	46	2	4.3%	6	3.0	13.0	$8,903	$53,416
518-Oth Fem Reproductive Procs	157	7	4.5%	10	1.4	6.4	$6,914	$69,141
519-Uterine/Adnexa Procs Leiomyoma	466	32	6.9%	44	1.4	9.4	$8,545	$375,970
530-Female Reproductive Sys Malig	179	3	1.7%	5	1.7	2.8	$6,692	$33,461
531-Female Reproductive Sys Inf	258	4	1.6%	5	1.3	1.9	$7,905	$39,523
532-Menstrual & Oth Fem Reprod Dis	289	8	2.8%	14	1.8	4.8	$7,745	$108,428
540-Cesarean Del	62,365	2,954	4.7%	3,473	1.2	5.6	$1,712	$5,947,478
541-Vag Del w Ster &/or D&C	5,632	488	8.7%	569	1.2	10.1	$976	$555,217
542-Vag Del w Proc Exc Ster &/or D&C	327	299	91.4%	406	1.4	124.2	$509	$206,569
544-D&C for Obstetric Diags	943	23	2.4%	33	1.4	3.5	$7,320	$241,573
545-Ectopic Pregnancy Proc	729	12	1.6%	14	1.2	1.9	$6,691	$93,671
546-Oth O.R. Proc for Ob Diag Exc Del	363	21	5.8%	27	1.3	7.4	$9,323	$251,721
560-Vaginal Del	117,474	6,138	5.2%	6,481	1.1	5.5	$430	$2,783,937
561-Postpartum Diags w/o Proc	2,271	46	2.0%	51	1.1	2.2	$7,792	$397,415
563-Threatened Abortion	3,098	17	0.5%	18	1.1	0.6	$5,551	$99,914
564-Abortion w/o D&C	846	4	0.5%	5	1.3	0.6	$7,908	$39,538
565-False Labor	180	0	0.0%	0	0.0	0.0	$0	$0
566-Oth Antepartum Diags	10,454	154	1.5%	179	1.2	1.7	$5,944	$1,064,042
650-Splenectomy	18	1	5.6%	1	1.0	5.6	$5,337	$5,337
651-Oth Procs of Blood & Rel Organs	35	7	20.0%	12	1.7	34.3	$8,222	$98,660
660-Maj Hem/Immun Diag	599	14	2.3%	24	1.7	4.0	$7,533	$180,800
661-Coagulation & Platelet Dis	173	4	2.3%	4	1.0	2.3	$7,931	$31,722
662-Sickle Cell Anemia Crisis	1,592	32	2.0%	43	1.3	2.7	$5,576	$239,755
663-Oth Dis of Blood & Rel Organs	1,170	33	2.8%	43	1.3	3.7	$9,045	$388,917
680-Maj O.R. Proc Lymphatic Neoplasm	87	4	4.6%	7	1.8	8.0	$6,136	$42,950
681-Oth O.R. Proc Lymphatic Neoplasm	116	1	0.9%	1	1.0	0.9	$32,754	$32,754
690-Acute Leukemia	154	0	0.0%	0	0.0	0.0	$0	$0
691-Lymphoma, Myeloma & Non-Ac Leuk	196	6	3.1%	9	1.5	4.6	$9,089	$81,805
692-Radiothapy	12	0	0.0%	0	0.0	0.0	$0	$0
693-Chemothapy	956	9	0.9%	12	1.3	1.3	$7,191	$86,290
694-Lymphatic & Oth Malig & Neoplasms	127	4	3.1%	5	1.3	3.9	$10,393	$51,964
710-Inf & Parasit Dis Incl HIV w O.R. Proc	728	99	13.6%	137	1.4	18.8	$8,675	$1,188,538
711-Post-Op, Device Inf w O.R. Proc	279	30	10.8%	46	1.5	16.5	$8,450	$388,715
720-Septicemia & Disseminated Inf	4,430	251	5.7%	319	1.3	7.2	$8,358	$2,666,096

Appendix Table B.3								
PPC Incidence by Base APR DRG								
Base DRG	Total Stays	PPC Stays	PPC Rate	PPC Count	Avg. PPCs / PPC Stay	PPC / 100 Stays	Cost per PPC	PPC Cost
721-Post-Op, Post-Trauma, Device Inf	999	58	5.8%	77	1.3	7.7	$9,511	$732,376
722-Fever	187	5	2.7%	6	1.2	3.2	$5,708	$34,250
723-Viral Illness	68	3	4.4%	4	1.3	5.9	$9,517	$38,068
724-Oth Inf & Parasit Diseases	156	12	7.7%	19	1.6	12.2	$8,303	$157,766
740-Mental Illness Diag w O.R. Proc	12	0	0.0%	0	0.0	0.0	$0	$0
750-Schizophrenia	5,103	52	1.0%	56	1.1	1.1	$5,111	$286,238
751-Maj Depression	2,707	33	1.2%	36	1.1	1.3	$6,121	$220,349
752-Dis of Personality	9	0	0.0%	0	0.0	0.0	$0	$0
753-Bipolar Dis	3,682	32	0.9%	35	1.1	1.0	$5,832	$204,116
754-Depression Exc Maj Dep	436	4	0.9%	4	1.0	0.9	$1,404	$5,616
755-Adjust Dis & Neuroses Exc Dep	76	0	0.0%	0	0.0	0.0	$0	$0
756-Acute Anxiety & Delirium States	166	4	2.4%	5	1.3	3.0	$5,721	$28,606
757-Organic Mental Health Disturb	78	3	3.8%	3	1.0	3.8	$4,947	$14,841
758-Childhood Behavioral Dis	109	0	0.0%	0	0.0	0.0	$0	$0
759-Eating Dis	1	0	0.0%	0	0.0	0.0	$0	$0
760-Oth Mental Health Dis	24	0	0.0%	0	0.0	0.0	$0	$0
770-Drug & Alcohol Abuse, AMA	98	0	0.0%	0	0.0	0.0	$0	$0
772-Alc & Drug Dep w Rehab or Detox	6	0	0.0%	0	0.0	0.0	$0	$0
773-Opioid Abuse & Dependence	236	3	1.3%	3	1.0	1.3	$5,726	$17,178
774-Cocaine Abuse & Dependence	110	4	3.6%	4	1.0	3.6	$7,376	$29,505
775-Alcohol Abuse & Dependence	355	15	4.2%	21	1.4	5.9	$6,557	$137,706
776-Oth Drug Abuse & Dependence	98	0	0.0%	0	0.0	0.0	$0	$0
791-O.R. Proc for Complic of Care	207	24	11.6%	32	1.3	15.5	$9,465	$302,882
811-Allergic Reactions	83	7	8.4%	9	1.3	10.8	$6,395	$57,553
812-Poisoning of Medicinal Agents	1,546	61	3.9%	79	1.3	5.1	$6,427	$507,695
813-Oth Complics of Treatment	325	15	4.6%	19	1.3	5.8	$7,415	$140,890
815-Oth Inj And Poisoning Diags	74	2	2.7%	2	1.0	2.7	$10,116	$20,231
816-Toxic Eff of Non-Medicinal Subst	432	26	6.0%	38	1.5	8.8	$8,265	$314,056
841-Ext 3Rd Deg Burns w Skin Graft	16	0	0.0%	0	0.0	0.0	$0	$0
842-Full Thick Burns w Graft	26	0	0.0%	0	0.0	0.0	$0	$0
843-Ext Burns w/o Skin Graft	15	0	0.0%	0	0.0	0.0	$0	$0
844-Part Thick Burns w or w/o Graft	39	0	0.0%	0	0.0	0.0	$0	$0
850-Proc w Diag of Rehab or Other	99	10	10.1%	15	1.5	15.2	$8,407	$126,104
860-Rehabilitation	422	43	10.2%	50	1.2	11.8	$7,563	$378,126
861-Signs, Symptoms & Oth Factors	921	20	2.2%	25	1.3	2.7	$6,360	$159,006
862-Oth Aftercare & Convalescence	20	0	0.0%	0	0.0	0.0	$0	$0
890-HIV w Mult Maj Related Cond	572	0	0.0%	0	0.0	0.0	$0	$0
892-HIV w Maj Related Cond	585	0	0.0%	0	0.0	0.0	$0	$0
893-HIV w Mult Sig Related Cond	144	0	0.0%	0	0.0	0.0	$0	$0
894-HIV	329	0	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	PPC / 100 Stays	Cost per	PPC Cost
910-Craniotomy for Mult Sig Trauma	56	0	0.0%	0	0.0	0.0	$0	$0
911-Ext Trunk Procs Mult Sig Trauma	129	1	0.8%	1	1.0	0.8	-$20,360	-$20,360
912-Muscskl Procs Mult Sig Trauma	189	1	0.5%	2	2.0	1.1	$5,837	$11,673
930-Mult Sig Trauma w/o O.R. Proc	126	0	0.0%	0	0.0	0.0	$0	$0
950-Ext Proc Unrel To Diag	271	76	28.0%	138	1.8	50.9	$9,354	$1,290,892
951-Mod Ext Proc Unrel To Diag	913	102	11.2%	154	1.5	16.9	$9,718	$1,496,574
952-Nonext Proc Unrel To Diag	381	37	9.7%	55	1.5	14.4	$7,972	$438,478
All DRGs	327,649	17,649	5.4%	22,041	1.2	6.7	$4,418	$97,374,233
Note:								
1. PPC cost refers to the estimated impact of a PPC on the hospital cost of care. See Section 1.5.								
2. Differences from rounding may cause some totals to appear inexact.								

Appendix C Methodology

C.1 Data Sources

This analysis is based on the fee-for-service (FFS), Primary Care Case Management (PCCM), and managed care Medicaid population in SFY 2012 (September 2011 to August 2012). (See Section 1.2.) The PPC analysis began with the Claims Data File that TMHP prepares annually for use by HHSC rate-setting 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. A similar file was created from encounter data submitted to HHSC by the managed care plans.

C.2 Data Validation

For this analysis, a total of 701,399 records were received (Table C.2.1). FFS/PCCM claims in particular had already gone through data validation procedures. For purposes of the PPC analysis (and for the related analysis of potentially preventable readmissions),[33] additional validation steps were taken for both FFS/PCCM and managed care encounter records, as described below.

In some cases, records received did not indicate a unique inpatient stay. For example, a single inpatient stay might be billed with multiple individual claims that had to be chained together. After deduction of 9,556 claims that did not indicate a unique inpatient stay, the result was the total of 691,843 stays shown in Table 1.1.1. After deduction of 346,630 stays excluded by design of the study and 17,564 stays with data issues, the result was the PPC analytical dataset of 327,649 stays shown in Table 1.2.1.

Appendix Table C.2.1					
Summary of Analytical Dataset Claims					
Item	Adjustment Category	Ref.	FFS/PCCM	Encounter	Total Claims
Records received		C.1	342,993	358,406	701,399

Not inpatient bill type	Not unique inpatient stay	C.2.1.2	0	0	0
Informational claim only	Not unique inpatient stay	C.2.5.1	38	0	38
Duplicate claim	Not unique inpatient stay	C.2.1.4	75	6,835	6,910
Consolidated within claim chains	Not unique inpatient stay	C.2.1.1	37	2,571	2,608
Incomplete stay	Data issue	C.2.4.3	413	0	413
Unreliable discharge status	Data issue	C.2.1.3	0	14,688	14,688
APR-DRG grouping errors	Data issue	C.3.3	138	1,168	1,306
POA reporting issue (one MCO)	Data issue	C.2.4.4	0	1,157	1,157
Newborn and pediatric stays	Study design	C.4	112,760	111,486	224,246
Hospital exempt from POA reporting	Study design	C.2.4.4	61,193	61,191	122,384
Analytical dataset			168,339	159,310	327,649
Subtotal—not unique inpatient stay			*150*	*9,406*	*9,556*
Subtotal—study design			*173,953*	*172,677*	*346,630*
Subtotal—data issue			*551*	*17,013*	*17,564*

Notes:

1. Claims could be excluded from the analytical dataset for more than one reason. Record counts for each exclusion reason therefore would differ depending on the order in which claims were excluded.
2. 701,399 records received minus 9,556 records that did not represent a unique inpatient stay equals 691,843 stays as shown in Table 1.1.1.

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. 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.
- 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 data for this report were processed through the claim chaining algorithm. 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.[34] 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 Medicaid Stays

C.2.3.1 Fee for Service/Primary Care Case Management

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, 123456701 might be a hospital's TPI for the hospital itself while 123456702 might be the ambulatory surgical center at the same hospital. It is not uncommon for a single hospital to have multiple TPIs. For FFS/PCCM stays, 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.2.3.2 Managed Care

The managed care plans do not use the TPI in claims adjudication and do not transmit it to the Texas Medicaid data warehouse. Instead, they transmit the National Provider Identifier (NPI). For the purposes of this report, the NPI was mapped to a TPI based on the NPI and supplementary data received from the MCO, such as type of bill, provider taxonomy code, tax ID, provider address, and benefit code. For 403 claims, a TPI could not be assigned to an NPI with a high degree of confidence. These encounters were omitted from the analysis before the dataset of 701,399 claims shown in Table C.2.1 was created.

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. Similar to diagnosis codes, procedure codes also vary in length and also include an implied decimal.

C.2.4.3 Coding Completeness

For FFS and PCCM services in SFY 2012, Texas Medicaid paid most acute care hospitals based on MS-DRGs. These hospitals had 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. A similar concern occurs on the managed care side, where DRG-style payment methods that reward complete coding are believed to be rarely used in calculating payment for children's and specialty psychiatric hospitals.

When coding is incomplete, the average casemix of patients can be understated for a hospital, causing its performance to look higher compared to the benchmark. If there is a bias (where "bias" is 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.2.4.4 Present on Admission Coding

The present on admission (POA) indicator is critical in identifying hospital acquired conditions (HACs) and PPCs. With few exceptions, a PPC is only assigned to a stay if the diagnosis was not present on admission. (An exception would be the PPC for re-opening a surgical site.) Therefore, the reliability of PPC assignment depends on the reliability of POA reporting. POA values are submitted by hospitals on

Medicaid claims and show whether each diagnosis was present on admission or was acquired during the stay.

As with all other aspects of data reporting, individual hospitals may be more or less accurate in how they code POA values. In particular, a tendency to count secondary infections and other potential complications as "present on admission," "clinically undetermined," or exempt from POA reporting might make the hospital's calculated PPC rate lower than its true rate.

As of September 1, 2012, Texas Medicaid requires all hospitals and managed care plans to submit POA values on all claims (certain conditions will continue to be exempt).[35] During the period covered by this report (September 1, 2011 through August 31, 2012), only hospitals paid under the Texas Medicaid prospective payment system were required to report POA values. Hospitals exempt from POA reporting values included rural hospitals, children's hospitals, state-owned teaching hospitals, and certain other hospitals.[36] The list of exempt hospitals as of September 1, 2011, is on the TMHP website.[37] Although some exempt hospitals reported POA values voluntarily, there was no requirement that the reporting be complete or accurate. Stays at these hospitals therefore were excluded from the analytical dataset shown in Table 1.2.1. For the stays remaining in the dataset, a verification was also done of POA reporting by individual hospitals and individual managed care plans. One small managed care reported no POA values, so its 1,157 stays were excluded from the analytical dataset. These stays represented 0.4 percent of the analytical dataset. Data from all other managed care plans were deemed within reasonable ranges.

For the 327,649 stays in the final analytical dataset, there were 1,948,784 diagnoses, an average of 5.9 diagnoses per stay (Table C.2.4.4). Of this total, 427,240 diagnoses (22 percent) were exempt from POA reporting. Common examples were diagnosis codes that indicated childbirth, vaccination, supervision of pregnancy, or history of previous illness.

Of the 1,521,544 diagnoses where a POA value was expected, 83 percent of diagnoses were present on admission and 14 percent were not present on admission. Another 3 percent of diagnoses were reported as exempt from reporting even though reference tables showed that neither the hospital nor the diagnosis was exempt from reporting. Almost all of these 42,005 anomalies were on managed care encounter claims. If some of these diagnoses actually would have triggered a PPC, then the statewide PPC results in this report would be slightly understated. Because these 42,005 POA values were spread across 208 different hospitals and 1,879 different diagnosis codes, it is very unlikely that these anomalies had a material impact on the measurement of any individual hospital's PPC performance.

Table C.2.4.4					
Summary of POA Values in Analytical Dataset					
	FFS/PCCM	Managed Care	Total	As Percent of All Diagnoses	As Percent of All Diagnoses Exempt from POA Reporting
Diagnoses exempt from POA reporting	209,062	218,178	427,240	21.9%	
Diagnoses not exempt from POA reporting					
Y = Present on admission	752,456	507,658	1,260,114	64.7%	82.8%
N = Not present on admission	122,917	85,310	208,227	10.7%	13.7%
U = Insufficient data for reporting	1,065	7,575	8,640	0.4%	0.6%
W = Clinically undetermined	962	1,595	2,557	0.1%	0.2%
Blank = Exempt from POA reporting	35	37,785	37,820	1.9%	2.5%
1 = Exempt from POA reporting	9	4,176	4,185	0.2%	0.3%
Error value	1	0	1	0.0%	0.0%
Subtotal - Diagnoses not exempt	877,445	644,099	1,521,544	78.1%	100.0%
All diagnoses	1,086,507	862,277	1,948,784	100.0%	
Note:					
1. The analytical dataset included 168,339 FFS/PPCM stays and 159,310 managed care stays. The average number of diagnoses per stay was 6.5 for FFS/PCCM stays and 5.4 for managed care stays.					
2. Differences from rounding may cause some totals to appear inexact.					

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.[38]

APR-DRGs were developed by 3M Health Information Systems and the Children's Hospital Association (formerly 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 30 of the combined APR-DRG and PPC software package was used for this analysis.

C.3.3 Validation of APR-DRG Assignments

About 0.3 percent of stays run through the APR-DRG and PPC grouping algorithms 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 11 categories 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 30.0,* October 2012.

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 similar analyses of Medicare, California (all payer), and Maryland (all payer) data.[39] The methodology was identical to that used in last year's analysis of Texas Medicaid SFY 2011 data.

Following the same methodology as in the Medicare, California, and Maryland analyses 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 each hospital. The CCRs were the most recent available from HHSC as of October 1, 2013.[40]
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).[41] Overall, the cost impact analysis was based on 324,162 stays, or 3,487 stays fewer than in the analytical dataset for this year's 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 $19,781 with a standard error of just $728. The t statistic equaled 27.17

(=$19,781/$728), which corresponded to a negligible likelihood that the true impact was zero. That is, the estimated cost impact of $19,781 met the conventional criterion of being "highly significant." On the other hand, the estimated cost impact of PPC 55 (Obstetric Hemorrhage Without Transfusion) was $78 with a standard error of $165. That is, there was a wide range of plausible estimates around the calculated value of $78, including zero. The t statistic was 0.47, 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.

Appendix Table C.6.1								
Estimated Impact of a PPC on the Cost of Care								
	Potentially Preventable Complication	PPC Count (Regression Analysis)	PPC Cost Coefficient	Standard Error	t Statistic	P Value	Sig.	Cost Used in Study
01	Stroke and Intracranial Hemorrhage	179	$19,781	$728	27.17	0.000	***	$19,781
02	Extreme CNS Complications	73	-$4,398	$1,160	-3.79	0.000	***	-$4,398
03	Acute Pulmonary Edema and Respiratory Failure w/o Ventilation	808	$5,337	$354	15.08	0.000	***	$5,337
04	Acute Pulmonary Edema and Respiratory Failure with Ventilation	304	$9,313	$581	16.04	0.000	***	$9,313
05	Pneumonia and Other Lung Infections	548	$9,228	$418	22.07	0.000	***	$9,228
06	Aspiration Pneumonia	253	$6,137	$608	10.09	0.000	***	$6,137
07	Pulmonary Embolism	116	$32,754	$889	36.83	0.000	***	$32,754
08	Other Pulmonary Complications	249	$1,717	$606	2.83	0.005	**	$1,717
09	Shock	421	$17,653	$493	35.78	0.000	***	$17,653
10	Congestive Heart Failure	290	$2,694	$563	4.78	0.000	***	$2,694
11	Acute Myocardial Infarction	177	$3,654	$727	5.03	0.000	***	$3,654
12	Cardiac Arrhythmias and Conduction Disturbances	79	-$5,093	$1,141	-4.46	0.000	***	-$5,093
13	Other Cardiac Complications	33	-$2,398	$1,660	-1.45	0.148		$0
14	Ventricular Fibrillation/Cardiac Arrest	329	$4,247	$546	7.78	0.000	***	$4,247
15	Peripheral Vascular Complications Except Venous Thrombosis	46	$16,387	$1,421	11.54	0.000	***	$16,387
16	Venous Thrombosis	197	$9,872	$690	14.31	0.000	***	$9,872
17	Major Gastrointestinal Complications w/o Transfusion or Significant Bleeding	172	$9,727	$729	13.35	0.000	***	$9,727
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	33	$20,879	$1,658	12.59	0.000	***	$20,879
19	Major Liver Complications	169	$11,285	$747	15.12	0.000	***	$11,285
20	Other Gastrointestinal Complications w/o Transfusion or Significant Bleeding	68	$8,302	$1,163	7.14	0.000	***	$8,302
21	Clostridium Difficile Colitis	158	$11,263	$761	14.8	0.000	***	$11,263
23	GU Complications Except UTI	109	$2,838	$911	3.12	0.002	***	$2,838
24	Renal Failure w/o Dialysis	1,646	$2,807	$245	11.47	0.000	***	$2,807
25	Renal Failure with Dialysis	25	$31,150	$1,922	16.21	0.000	***	$31,150
26	Diabetic Ketoacidosis and Coma	29	$6,437	$1,763	3.65	0.000	***	$6,437
27	Post-Hemorrhagic and Other Acute Anemia with Transfusion	126	$7,353	$853	8.62	0.000	***	$7,353
28	In-Hospital Trauma and Fractures	26	$6,336	$1,869	3.39	0.001	***	$6,336
29	Poisoning Except from Anesthesia	38	$23	$1,540	0.01	0.988		$0
30	Poisonings Due to Anesthesia	1	$479	$9,498	0.05	0.960		$0
31	Decubitus Ulcer	101	$14,615	$951	15.37	0.000	***	$14,615
32	Transfusion Incompatibility Reaction	0	-	-	-	-		-
33	Cellulitis	209	$5,947	$660	9.01	0.000	***	$5,947
34	Moderate Infections	180	$854	$716	1.19	0.233		$0
35	Septicemia and Severe Infections	626	$16,257	$402	40.42	0.000	***	$16,257
36	Acute Mental Health Changes	11	-$12,295	$2,871	-4.28	0.000	***	-$12,295
37	Post-Operative Infection and Deep Wound Disruption w/o Procedure	102	$15,026	$959	15.67	0.000	***	$15,026
38	Post-Operative Infection and Deep Wound Disruption with Procedure	23	$9,420	$2,007	4.69	0.000	***	$9,420

Appendix Table C.6.1								
Estimated Impact of a PPC on the Cost of Care								
	Potentially Preventable Complication	PPC Count (Regression Analysis)	PPC Cost Coefficient	Standard Error	t Statistic	P Value	Sig.	Cost Used in Study
39	Reopening Surgical Site	66	$7,868	$1,183	6.65	0.000	***	$7,868
40	Post-Operative Hemorrhage and Hematoma w/o Hemorrhage Control Procedure or I&D Procedure	301	$9,274	$553	16.78	0.000	***	$9,274
41	Post-Operative Hemorrhage and Hematoma with Hemorrhage Control Procedure or I&D Procedure	34	$6,633	$1,635	4.06	0.000	***	$6,633
42	Accidental Puncture/Laceration During Invasive Procedure	184	$3,729	$708	5.27	0.000	***	$3,729
43	Accidental Cut or Hemorrhage During Other Medical Care	0	-	-	-	-		-
44	Other Surgical Complication - Moderate	55	$13,966	$1,293	10.8	0.000	***	$13,966
45	Post-Procedure Foreign Bodies	4	-$20,360	$4,747	-4.29	0.000	***	-$20,360
46	Post-Operative Substance Reaction and Non-O.R. Procedure Foreign Body	0	-	-	-	-		-
47	Encephalopathy	211	$1,314	$669	1.96	0.050	**	$1,314
48	Other Complications of Medical Care	90	$9,026	$1,008	8.96	0.000	***	$9,026
49	Iatrogenic Pneumothrax	48	$6,709	$1,374	4.88	0.000	***	$6,709
50	Mechanical Complication of Device, Implant, and Graft	88	$14,538	$1,018	14.28	0.000	***	$14,538
51	Gastrointestinal Ostomy Complications	54	$17,569	$1,303	13.49	0.000	***	$17,569
52	Inflammation and Other Complications of Devices, Implants, or Grafts Except Vascular Infection	213	$7,906	$660	11.98	0.000	***	$7,906
53	Infection, Inflammation, and Clotting Complications of Peripheral Vascular Catheters and Infusions	62	$12,220	$1,210	10.1	0.000	***	$12,220
54	Infections Due to Central Venous Catheters	73	$20,622	$1,130	18.25	0.000	***	$20,622
55	Obstetrical Hemorrhage w/o Transfusion	3,459	$78	$165	0.47	0.638		$0
56	Obstetrical Hemorrhage with Transfusion	1,100	$2,410	$290	8.3	0.000	***	$2,410
57	Obstetric Lacerations and Other Trauma w/o Instrumentation	2,355	-$8	$204	-0.04	0.971		$0
58	Obstetric Lacerations and Other Trauma with Instrumentation	842	$139	$329	0.42	0.674		$0
59	Medical and Anesthesia Obstetric Complications	1,228	$558	$274	2.04	0.042	**	$558
60	Major Puerperal Infection and Other Major Obstetric Complications	193	$1,769	$705	2.51	0.012	**	$1,769
61	Other Complications of Obstetrical Surgical and Perineal Wounds	406	$1,421	$474	3	0.003	***	$1,421
62	Delivery with Placental Complications	447	$780	$449	1.74	0.082	*	$0
63	Post-Operative Respiratory Failure with Tracheostomy	25	$55,580	$1,963	28.31	0.000	***	$55,580
64	Other In-Hospital Adverse Events	25	$5,210	$1,897	2.75	0.006	**	$5,210
65	Urinary Tract Infection	1,471	$5,616	$251	22.36	0.000	***	$5,616
66	Catheter-Related Urinary Tract Infection	8	$6,025	$3,360	1.79	0.073	*	$0
Total		20,996						

Notes:

1. PPC 22, Urinary Tract Infection, has been retired. It was replaced with PPC 65, Urinary Tract Infection, and PPC 66, Catheter-Related Urinary Tract Infection.

2. The t statistic equals the coefficient divided by its standard error. The P value indicated the probability the coefficient differed from 0 by chance. A value of 0.000 is not literally zero; it indicated a P value less than 0.000. *, **, and *** indicate a statistical significance at the 10%, 5%, and 1% levels, respectively. Coefficients with P values greater than 0.05 were considered unstable and no incremental cost coefficient was used in the study.

3. The F statistic for the regression was 848.41, corresponding to P < 0.000. The regression was performed using Minitab software.

4. The dataset used to estimate the PPC cost impact comprised 324,162 stays with 20,996 PPCs, or 3,487 stays and 1,045 fewer PPCs than in the analytical dataset for the study. See Point 3 in the text for the explanation.

5. Differences from rounding may cause some totals to appear inexact.

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 patients in SFY 2012. 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 2012 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 SFY 2012. 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 inpatient stays in SFY 2012, 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 four examples. The first example is a hospital with 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 hospital 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 not 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.[42]

Appendix Table C.7.3.1			
Scenarios Illustrating Fluctuation of A/E Ratio When Volume is Low			
Example 1: 40 stays and an expected PPC rate of 5%			
Total Stays	Expected PPC Stays	Actual PPC Stays	A/E PPC Stays
40	2	1	0.50
40	2	2	1.00
40	2	3	1.50

Appendix Table C.7.3.1			
Scenarios Illustrating Fluctuation of A/E Ratio When Volume is Low			
Example 2: 50 stays and an expected PPC rate of 2%			
Total Stays	Expected PPC Stays	Actual PPC Stays	A/E PPC Stays
50	1	0	0.00
50	1	1	1.00
50	1	2	2.00

Appendix Table C.7.3.1			
Scenarios Illustrating Fluctuation of A/E Ratio When Volume is Low			
Example 3: 50 stays and an expected PPC rate of 8%			
Total Stays	Expected PPC Stays	Actual PPC Stays	A/E PPC Stays
50	4	2	0.50
50	4	3	0.75
50	4	4	1.00
50	4	5	1.25
50	4	6	1.50

Appendix Table C.7.3.1			
Scenarios Illustrating Fluctuation of A/E Ratio When Volume is Low			
Example 4: 100 stays and an expected PPC rate of 5%			
Total Stays	Expected PPC Stays	Actual PPC Stays	A/E PPC Stays
100	5	2	0.40
100	5	3	0.60
100	5	4	0.80
100	5	5	1.00
100	5	6	1.20

Notes

[1] The PPC report for SFY 2010 as well as similar annual analyses of potentially preventable readmissions are available on the HHSC website at www.hhsc.state.tx.us under the "Reports" section.

[2] TMHP, *Payment Adjustments to Hospitals Based on PPR and PPC Analysis Effective November 1, 2013*, www.tmhp.com/News_Items/2013/09-Sept/09-10-13%20Payment%20Adjustments%20to%20Hospitals%20Based%20on%20PPR%20and%20PPC%20Analysis%20Effective%20November%201.pdf.

[3] In 2010, net patient revenue (both inpatient and outpatient) for the Texas hospital industry was $49.9 billion. 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. Statewide data for 2012 would be similar to 2010.

[4] 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).

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

[6] 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.

[7] 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.

[8] 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).

[9] 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).

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

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

[12] 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.

[13] 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.

[14] 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.

[15] 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.

[16] 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.

[17] 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.

[18] Sam Watson and Chris Goeschel, Agency for Healthcare Research and Quality, "Intensive Care Units Participating in Hospital Collaborative Implement Multiple Improvement Strategies, Leading to Fewer Deaths and Lower Costs," November 2, 2011.

[19] Peter Pronovost, Dale 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.

[20] 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.

[21] As reported on the PR Newswire, "I-PASS: Standardizing patient 'Handoffs' to reduce medical errors", April 29, 2012. http://www.prnewswire.com/news-releases/i-pass-standardizing-patient-handoffs-to-reduce-medical-errors-149398955.html.

[22] Sule Calikoglu, Robert Murray, and Diane Feeney. "Hospital Pay-for-Performance Programs in Maryland Produced Strong Results, Including Reduced Hospital Acquired Conditions," *Health Affairs*, December 2012, Vol. 31 No. 12.

[23] 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 30.0*, October 2012.

[24] R.L. Fuller et al., "A New Approach to Reducing Payments Made to Hospitals with High Complication Rates," *Inquiry*, Spring 2011, 48(1), pp.68-83.

[25] A minimum of five actual events and five expected events is a rule of thumb commonly used in analysis of categorical data. See Alan Agresti, *An Introduction to Categorical Data Analysis*, second edition (Hoboken, NJ: John Wiley & Sons, 2007), p. 40.

[26] Agresti, *An Introduction to Categorical Data Analysis*, 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.

[27] R.L. Fuller et al, "Estimating the Costs of Potentially Preventable Hospital Acquired Complications," *Health Care Financing Review*, Summer 2009, Vol. 30 No. 4.

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

[29] TMHP, *Payment Adjustments to Hospitals Based on PPR and PPC Analysis Effective November 1, 2013*, www.tmhp.com/News_Items/2013/09-Sept/09-10-13%20Payment%20Adjustments%20to%20Hospitals%20Based%20on%20PPR%20and%20PPC%20Analysis%20Effective%20November%201.pdf

[30] 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.

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

[32] 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.

[33] The PPC report is available at www.hhsc.state.tx.us under "reports."

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

[35] TMHP, *Present on Admission (POA),* www.tmhp.com/Pages/Medicaid/Hospital_POA.aspx.

[36] TMHP, *Present on Admission Reporting Required on Hospital Claims Beginning September 1, 2010,* posted August 13, 2010, www.tmhp.com/News_Items/2010/08-13-10%20Present%20on%20Admission%20Reporting.pdf.

[37] TMHP, *TEFRA-Qualified Hospitals—September 1, 2011,* dated September 9, 2011, www.tmhp.com/Pages/Medicaid/Medicaid_hosp_reimb.aspx.

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

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

[40] Texas Health and Human Services Commission, *Inpatient Ratio of Cost to Charges (RCC Rates), October 1, 2013;* available at http://www.hhsc.state.tx.us/rad/hospital-svcs/inpatient.shtml.

[41] The specific APR-DRGs were 501-1 (22 stays); 565-2 (23); 770-1 (41); and 811-1 (22). Because no PPCs were associated with these APR-DRGs, exclusion of these APR-DRGs had no effect on the PPC estimated cost impacts.

[42] Agresti, *An Introduction to Categorical Data Analysis*, p. 40.