TEXAS HEALTH AND HUMAN SERVICES COMMISSION

Potentially Preventable Readmissions in the Texas Medicaid Population, State Fiscal Year 2011

Public Report

November 2012

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

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TEXAS HEALTH AND HUMAN SERVICES COMMISSION

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EXECUTIVE COMMISSIONER

The purpose of this report is to provide data on the volume and rate of Potentially Preventable Readmissions (PPRs) for both fee for service and managed care clients in each Texas and out-of-state hospital that served Texas Medicaid clients during state fiscal year 2011.

House Bill (H.B.) 1218, 81st Legislature, Regular Session, 2009, requires the Health and Human Services Commission (HHSC) to identify potentially preventable readmissions (PPRs) in the Medicaid population annually and then confidentially report the results to each hospital. The law also requires each hospital to distribute the information to its care providers. Senate Bill (S.B.) 7, 82nd Legislature, Regular Session, 2011, requires HHSC to implement quality-based payments to hospitals on the basis of the results of the PPR analysis. PPR quality-based payment adjustments will become effective for hospital stays beginning with inpatient stays occurring on and after April 17, 2013. Clients in Medicaid fee-for-service (FFS) and managed care programs are included.

This is the third year for which PPR analysis has been performed and reported. Section 2.8 of this document compares the results of state fiscal year 2009, state fiscal year 2010 and state fiscal year 2011. The difference in PPR rates between state fiscal year 2009 and state fiscal year 2011 is virtually unchanged. The state fiscal year 2009 rate was 3.6 percent, state fiscal year 2010 was 3.7 percent, and state fiscal year 2011 is 3.7 percent.

Section 2 of this report shows that 3.7 percent (Table 2.1.1) of Texas Medicaid inpatient stays in state fiscal year 2011 were followed by at least one PPR. The cost to Medicaid of these PPRs was approximately $95.5 million (Table 2.1.2), or about 3.1 percent of the total Medicaid payments that were made to hospitals. The low overall rate reflects the large volume of obstetric stays (46 percent of stays within the scope of the study), where PPRs were rare (0.8 percent). The non-obstetric pediatric population's PPR rate was 4.2 percent; the non-obstetric adult population's PPR rate was 7.5 percent. Of the clients who were initially admitted for mental illness or substance abuse, 9.1 percent of pediatrics and 11.4 percent of adults were readmitted within 15 days, many were readmitted again after the 15 days. PPR rates were even higher for some individual conditions, ranging as high as 23 percent for major biliary tract procedures.

This report is based on a PPR analysis using software developed by 3M Health Information Systems.[1] The same approach is being used by other states as mentioned later in this report in more detail in Section 3 and Appendix B.5. HHSC's methodology, however, differs from the Medicare PPR methodology that most hospitals are familiar with.

HHSC's methodology and approach was adopted to better reflect the Medicaid population. The HHSC approach considers almost all medical conditions, but it only classifies a readmission as a PPR if there is a plausible clinical connection between the initial admission and the readmission. While Medicare uses a readmission "window" of 30 days in its PPR analyses, HHSC used a 15-day window to better capture those readmissions for which hospitals were more likely to have an impact. The 15-day window is more sensitive to patients transitioning from the hospital to care in the community or in a post-acute facility. The hospital, with its central role in every community's health-care system, can play a valuable role in improving that transition. Not all readmissions are preventable. The methodology for calculating PPR rates excludes readmissions that were likely planned or were otherwise unavoidable.

The wide variation in casemix-adjusted PPR rates—the Texas hospitals with the highest rates had rates three times higher than the hospitals with the lowest rates—suggests that opportunities exist for hospitals to learn from each other. (Casemix refers to the clinical characteristics of the population being served by each individual hospital.) If the number of PPRs was reduced by 10 percent, the result would be a savings of approximately $10 million a year to the Medicaid budget and, more importantly, improved health and satisfaction among the clients who are served by HHSC and the hospitals.

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

This analysis was performed for HHSC by the Texas Medicaid & Healthcare Partnership (TMHP). Statements and opinions are those of the authors and not necessarily those of the Texas Health and Human Services Commission.

HHSC is interested in improving the methodology and making the results more useful to hospitals. At any time, comments and suggestions on this topic are welcomed, and can be emailed to PPR.Report@tmhp.com.

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1 Background and Methodology

House Bill 1218 from the 81st Legislature, Regular Session 2009, requires the Texas Health and Human Services Commission (HHSC) to provide confidential information to each hospital on its performance with regard to potentially preventable readmissions (PPR). This report meets that requirement for state fiscal year (SFY) 2011 (September 1, 2010 through August 31, 2011). There are two versions of this report. The public version provides results at the statewide level and describes the methodology used. The hospital-specific version is identical to the public version except that a separate Section 4 shows confidential, hospital-specific results. Each hospital will receive a customized report showing only its own results.

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

A potentially preventable readmission is a readmission (return hospitalization within a specified readmission time interval) that is clinically related to the initial hospital admission. "Clinically related" is defined as a requirement that the underlying reason for readmission be plausibly related to the care rendered during or immediately following a prior hospital admission. A clinically related readmission may have resulted from the process of care and treatment during the prior admission (e.g., readmission for a surgical wound infection) or from a lack of post admission follow-up (lack of follow-up arrangements with a primary care physician) rather than from unrelated events that occurred after the prior admission (broken leg due to trauma) within a specified readmission time interval.

Section 1 of this report 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 study population. The analysis included inpatient stays for which Texas Medicaid was the primary payer (directly through FFS/PCCM or indirectly through MCOs) except for newborns, undocumented aliens, and patients who "spent down" to Medicaid eligibility. Newborns were excluded because the 3M PPR analytical tool used for this analysis has not been fully developed for this population. Patients with emergency Medicaid were excluded because Medicaid would have no record of any readmissions that occurred after the patients lost eligibility.

Section 1.3 provides an overview of the various methods of measuring readmissions. In particular, an approach based on identifying specific preventable readmissions is contrasted with the approach used in this PPR report, which is to focus on casemix-adjusted hospital-wide rates of PPRs. The emphasis is on *potentially*— the recognition that readmissions may occur even with optimal care but that high PPR rates across a hospital may indicate problems in quality.

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

Although the 3M PPR software identifies PPRs, it does not generate hospital-wide rates that can be compared across hospitals. Section 1.5 describes the methodology that TMHP used to compare actual PPR rates with expected PPR 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. Section 4, as noted above, is only included in the confidential reports provided to each hospital. Three appendices provide further detail on results and methodology.

1.1 Medicaid Payment for Inpatient Hospital Services

In SFY 2011 (September 2010 through August 2011), Texas Medicaid paid for 698,984 inpatient stays, which is approximately 24 percent of all of the inpatient stays in Texas. Payments to hospitals totaled $3.3 billion, which is approximately 7 percent of the industry's combined inpatient and outpatient revenue.[2]

In SFY 2011, Medicaid paid for 698,984 inpatient stays, representing about 24 percent of total inpatient stays statewide.

This report reflects Texas Medicaid inpatient hospital claims for FFS, PCCM, and managed care patients; approximately 37 percent of stays were FFS, which means that payments were made directly to the hospital by Texas Medicaid (Table 1.1.1). Another 30 percent of stays were PCCM. These clients had a designated primary care provider, typically a physician, who took responsibility for coordinating the client's care. PCCM was not at financial risk for the services that the client received. Payment for the hospital stay was made directly by Texas Medicaid, just as with traditional FFS.

The other 33 percent of stays were for managed care clients. The MCO accepted financial responsibility for the services received by the client and paid the hospital directly. The MCOs are a capitated full risk model.

Table 1.1.1 also shows stays and payments 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, 35 percent of Medicaid stays were for obstetrics, 29 percent for newborns, 14 percent for clients 17 years of age and younger (excluding newborns and obstetrics) and 22 percent for adults (excluding obstetrics).

In all three delivery methods, Medicaid clients who are 20 years of age and younger can receive an unlimited amount of medically necessary inpatient hospital care. However, there are two benefit limitations that apply to FFS and PCCM clients 21 years of age and over. First is a $200,000 inpatient cap per year. In addition, there is a 30 day "spell of illness." A "Spell of illness" is defined as 30 days of inpatient hospital care, after which an interval of at least 60 days out of the hospital must occur before inpatient benefits can once again be considered for reimbursement. In the managed care program, enhanced benefits provide waivers of the $200,000 annual inpatient cap and the 30-day spell of illness limitation for those Medicaid clients 21 years of age and older. [3]

Table 1.1.1								
Summary of Medicaid Inpatient Hospital Utilization, SFY 2011								
Medicaid Care Category	Stays				Medicaid Payments (in Millions)			
	FFS	PCCM	MCO	Total	FFS	PCCM	MCO	Total
Pediatric								
Respiratory	5,226	5,442	9,803	20,471	$59	$25	$64	$148
Other medical	12,570	11,715	17,676	41,961	$135	$62	$123	$320
Other surgical	4,643	3,330	5,675	13,648	$105	$54	$100	$259
MH/SA	6,414	5,194	7,827	19,435	$41	$23	$36	$100
Subtotal	28,853	25,681	40,989	95,523	$340	$164	$323	$828
Adult								
Circulatory	8,604	8,503	304	17,411	$86	$77	$3	$166
Other medical	46,498	45,240	2,985	94,723	$303	$228	$15	$546
Other surgical	13,866	10,790	1,662	26,318	$221	$134	$14	$369
MH/SA	4,867	4,080	9,522	18,469	$16	$13	$34	$63
Subtotal	73,835	68,613	14,473	156,921	$626	$452	$65	$1,144
Obstetrics	80,195	58,514	102,569	241,278	$191	$120	$260	$571
Newborns	75,584	56,272	71,348	203,204	$280	$177	$303	$760
Ungroupable	108	41	1,909	2,058	$6	$2	$11	$20
Total	258,575	209,121	231,288	698,984	$1,444	$916	$963	$3,323
Percent of Total	37%	30%	33%	100%	43%	28%	29%	100%

Notes:

1. FFS=fee for service; PCCM=primary care case management; MCO=managed care organization; 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. Percentage of Obstetrics stays = (241,278/698,984) * 100 = 35% (All other calculations were done similarly)

1.2 Data Included/Excluded in the Report

This analysis includes the entire Medicaid population, with four exceptions.

- ***Newborns***—The 3M PPR software was not designed for use with this population.[4] Readmissions are rare in the newborn population.

- ***Undocumented aliens***—A total of 78,923 stays were excluded because the client was an undocumented alien and therefore eligible only for emergency Medicaid. If the client was discharged and readmitted, the readmission probably would not have been captured in the Medicaid database.

The study includes all Medicaid stays except for newborns, stays for patients with emergency Medicaid, stays for dual eligibles where Medicare was the primary payer and stays for patients who "spent down" to Medicaid eligibility.

- ***Dual eligibles***—Stays for clients who were dually eligible for both Medicare and Medicaid were excluded if Medicare was the primary payer for the stay.[5]

- ***Medically needy spend-down*** —Stays for patients who "spend down" to Medicaid eligibility were excluded.

A total of 26,230 stays were also excluded from the analysis due to "categorical exclusion" and "non-event" logic in the PPR software, such as stays when patients discharged themselves against medical advice (Section 1.4). The PPR software was configured to search for initial admissions in an 11-month period and readmissions in a 12-month period. This resulted in the exclusion of 30,487 initial admissions that occurred in August 2011.

All of the results include the FFS, PCCM, and managed care populations. Hospitals were uniquely identified using their Texas Provider Identifier (TPI). Managed care plans only report the hospital's National Provider Identifier (NPI); therefore, each NPI was cross-walked to the appropriate TPI based on data received from the plan (e.g., taxonomy code and ZIP Code). A total of 204 stays were excluded from further analysis because the NPI could not be cross-walked to an appropriate TPI with a high degree of confidence.

All of the data were subject to extensive validation, including chaining together multiple claims for a single stay, verifying the bill type, examining extreme values of important data fields, and verifying diagnosis and procedure code values. In particular, the accuracy of the PPR software depends on the accuracy of diagnosis related group (DRG) assignments, which in turn depend on the accuracy and completeness of diagnosis and procedure coding. Coding completeness and accuracy were evaluated and are described in Appendix Section B.2.4. In general, there were no obvious indications of coding problems that would significantly affect the PPR analysis. The exception was that the coding performed by freestanding psychiatric hospitals appeared to be noticeably less thorough than at general acute care hospitals that provide similar care. As a result, reported PPR performance may be worse for some freestanding psychiatric hospitals than it would be if the coding were more complete. Any coding deficiencies in these hospitals would also make reported PPR performance in the general acute care hospitals better than it otherwise would be for mental health and substance abuse treatment, since statewide norms are applied to both groups of hospitals. As discussed in Appendix Section B.2.4, the magnitude of any discrepancy is unknown but believed to be modest.

Overall, of the 698,984 stays shown in Table 1.1.1, a total of 334,005 stays were excluded from the analytical dataset by design of the study. Another 18,964 stays, or 5.2 percent, were omitted because of issues in the data submitted by health plans or hospitals. As a result, the analytical dataset comprised 346,015 stays shown in Table 2.1.1, each of which was categorized as either an initial admission or as a PPR. Appendix Table B.2.1 shows a reconciliation of claim counts.

1.3 Potentially Preventable Readmissions as an Indicator of Quality

Readmissions to hospitals have long been recognized as a measure of quality of care.[6] Many Medicaid programs and other payers have policies under which they may deny payment for specific readmissions that result from sub-standard care that was provided in the initial admission. Examples include repeat admissions for asthma or admissions for post-operative bleeding. In principle, denial of payment for these specific cases motivates the hospital to bring its care up to standard.

PPR analysis focuses not on individual readmissions but on overall rates, with the goal of encouraging excellent care, especially in the transition from the hospital to the community.

In recent years, however, hospitals and payers have taken a different approach to improving quality.[7] Instead of focusing on specific events or on specific individuals, the focus is on overall performance. This approach aims for transparency and collaboration between medical providers. Dr. Guy Clifton, a former Houston neurosurgeon and health policy analyst, says quality problems "…are not about bad people but about good people working in bad systems."[8] The goal of quality improvement is also becoming more ambitious; its aim is not only to reduce quality problems, but also to enable quality successes.

Analysis of hospital-wide PPR rates fits very well with this approach. Even the best systems will have some readmissions. In situations where readmissions are likely included in the plan of care, such as chemotherapy, the PPR software excludes the readmissions entirely. In situations where the readmission is clearly unrelated, the second stay does not count as a PPR. In other situations, for example, pediatric bronchiolitis followed by a similar stay, no attempt is made to identify which specific readmissions could or could not have been prevented. Instead, the hospital-wide PPR rate is reported and compared with an appropriate norm, with the goal of focusing attention on the entire system of care and the improvement of its outcomes. All such comparisons are adjusted for differences in casemix.

The existence of PPRs does not necessarily mean there was bad care. For example, only 2 percent of PPRs were for post-surgical complications (Table 2.3.1) and some of those were presumably unpreventable. Much more commonly, readmissions appear to reflect the absence of excellent care, especially during the transition from inpatient care to care at home or in a post-acute facility. Relatively simple steps can make a real difference. These include scheduling the follow-up appointment before discharge, voice-to-voice transfer of care between the attending physician and the primary care provider, asking the patient to repeat back the discharge instructions, reconciling medication instructions, and placing a follow-up phone call several days after discharge.

For hospitals that are interested in reducing their PPR rates, Box 2.1.1 summarizes the key findings at the statewide level. Individual hospitals will receive specific details at the claim level (refer to Question 17 in Section 3). Overviews of best practices and lessons learned are available from organizations such as the Health Research and Educational Trust, the Institute for Healthcare Improvement, Academy Health, and Medicare and Medicaid quality improvement organizations. In Texas, the Texas Medical Foundation (TMF) Health Quality Institute is leading a Learning and Action Network that aims to reduce all-cause 30-day readmissions by 20 percent over the next two years. (See Question 15 in Section 3.)

1.4 Defining Potentially Preventable Readmissions

> ***PPRs are identified by comparing the APR-DRG for the initial admission with the APR-DRG for the readmission.***

The 3M PPR methodology is a computerized algorithm based on claims data submitted by hospitals that identifies readmissions where there is a plausible clinical relationship to the care rendered during or immediately following a prior hospital admission.[9] Of the many ways to define and report readmissions, the simplest approach is to count the number of all readmissions that occur within a given time period. The 3M approach used in this study is more sophisticated because it includes risk adjustment for severity of illness, and it counts only readmissions for which there was a plausible clinical connection between the reason for the initial admission and the reason for the readmission.

To put this approach into operation, every stay was assigned to an All Patient Refined (APR)-Diagnosis Related Group (DRG). There are 314 base APR-DRGs which can be thought of as the reason for admission. Each base APR-DRG has four levels of severity. APR-DRG 139-1, for example, is assigned to a patient who has uncomplicated pneumonia. A patient assigned to APR-DRG 139-2 has both pneumonia and a significant comorbidity such as congestive heart failure. At the extreme, a patient assigned to APR-DRG 139-4 may have pneumonia with multiple organ failure, which requires intensive therapy.

When comparing the reason for admission with the reason for readmission, there are 314 x 314 = 98,596 possible pairs of base APR-DRGs. A 3M panel of clinicians made a judgment about whether each admission/readmission pair represented a PPR. For some pairs, additional factors were considered, including patient age or particular diagnoses and procedures within an APR-DRG. The list of admission/readmission APR-DRG pairs defined as PPRs is available in an appendix to the 3M PPR Classification System Definitions Manual. For each pair that counts as a PPR, the readmission is also classified by the clinical reason. These reasons for the readmission are listed with examples in Table 1.4.1.

Table 1.4.1

Examples of Clinical Reasons for Potentially Preventable Readmission

Readmission Reason	Readmission DRG Example
Example: Initial admission for APR-DRG 141 -- Asthma	
1 Medical readmission—recurrence	APR-DRG 141 -- Asthma
2A Ambulatory care sensitive condition	APR-DRG 139 -- Pneumonia
2B Readmission—chronic problem	APR-DRG 053 -- Seizure
3 Medical readmission—acute problem	APR-DRG 134 -- Pulmonary embolism
6A Mental health readmission after initial admission not MH/SA	APR-DRG 751 -- Depression
6B Substance abuse readmission after initial admission MH/SA	APR-DRG 775 -- Alcohol abuse
Example: Initial admission for APR-DRG 225 -- Appendectomy	
4 Surgical readmission—recurrence	APR-DRG 221 -- Major bowel procedure
5 Surgical readmission—complication	APR-DRG 791 -- OR procedure complication
Example: Initial admission for APR-DRG 775 -- Alcohol Abuse	
6C MH/SA readmit after MH/SA admit	APR-DRG 751 -- Depression

Notes:

1. APR-DRG=All Patient Refined Diagnosis Related Group; MH/SA=mental health/substance abuse.
2. Source: 3M Health Information Systems, Potentially Preventable Readmissions Classification System Definitions Manual (Wallingford, CT: 3M HIS, October 2010), Appendix M.

The 3M software categorically excludes several types of admissions and readmissions from the PPR analysis. The most common of these in the Medicaid population are admissions for newborns. Other major examples include:

- Admissions for the medical (i.e., non-surgical) treatment of major metastatic cancer, major trauma, human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), and several less common conditions, because readmissions for these conditions was very likely to have been planned or unpreventable.
- Initial admissions for which the discharge status was “left against medical advice.”
- Initial admissions during which the patient died.
- Initial admissions that resulted in the patient being transferred to another acute care hospital. (The stay at the receiving hospital may count as an initial admission.)

Only admissions for acute care were considered for analysis. Treatment for sub-acute care, either to an acute care hospital for rehabilitation or convalescence, or to a sub-acute setting such as a nursing facility, were defined as “non-events,” that is, neither an initial admission nor a readmission.

Readmissions may be measured within different “windows” of time. The shorter the window is (e.g., seven days) the more likely that a readmission was directly related to the care that the patient received during hospitalization. The longer the window is (e.g., 30 days or longer), the more likely that a readmission may reflect deficiencies in patient compliance, in post-hospital care in the community, or in the patient’s baseline health status. The 15-day readmission “window” chosen for this analysis was intended to strike a balance. For the purposes of comparison, Section 2.7 shows readmission patterns over the course of 30 days.

1.5 Calculating PPR Rates[10]

1.5.1 Actual PPR Rate

The actual PPR rate is calculated after excluding the admissions and readmissions listed in Section 1.4. The actual PPR rate is calculated as:

Actual PPR Rate = PPR Chains / Initial Admissions

A PPR chain starts when a PPR occurs within 15 days of the discharge from the initial admission. If there is a second readmission within 15 days of the first readmission, then the chain includes two readmissions. The chain still counts only once in the numerator of the PPR rate. This approach results in a lower PPR rate than it would if every readmission counted in the numerator.

The actual PPR rates reported in this study were likely to be slightly understated for the following reasons:

The actual PPR rate is the number of readmission chains divided by the number of initial admissions, excluding readmissions that are not considered potentially preventable.

- ***Benefit limits***—The hospital benefit for adults is subject to the limits described in Section 1.1. If a patient exhausted his or her benefits and was readmitted within 15 days, the readmission would not appear in the analytical dataset. Because it is rare for clients to exhaust their hospital benefits, any understatement of the true PPR rate appears to be minimal.
- ***Enrollment churn***—Clients gain and lose eligibility to Medicaid more often than is true in the Medicare and commercially insured populations. Patients who lose or gain eligibility in the period between discharge and readmission are not fully represented in the analytical dataset. Because the PPR window is relatively short at 15 days, the change in enrollment also has minimal impact on the observed PPR rate.

1.5.2 Expected PPR Rate

Although the 3M PPR algorithm identifies a hospital stay as a PPR, it does not calculate hospital-specific PPR rates or adjust these rates for differences in patient casemix. In fact, PPR rates vary considerably depending on patient condition, so casemix adjustment is essential in generating fair comparisons across hospitals or any other patient populations. In general, hospitals treating severely ill patients will have higher expected PPR rates. A hospital with a higher PPR rate may simply treat patients who are more likely to be readmitted. Rather than reporting and comparing only actual rates, this report includes actual rates in comparison with expected rates. This step enables more equitable comparisons among hospitals by controlling for the following four clinical characteristics that have been shown to affect PPR rates (refer to Section 2.4):

The expected PPR rate shows how many readmissions a hospital would be expected to have based on its casemix.

- ***The reason for the initial admission***—The base APR-DRG indicates the principal reason why the patient was admitted to hospital, e.g., delivery of a baby or pneumonia. In general, patients with pneumonia are much more likely to be readmitted than patients who have delivered a baby.
- ***The severity of illness***—A patient in a hospital with pneumonia and multiple complications (DRG 139-4) is more likely to be readmitted than a patient with simple pneumonia (DRG 139-1).
- ***Age***—Even for the same base APR-DRG and severity of illness, patients who are 18 years of age and older are usually more likely to be readmitted than pediatric patients.

- ***Mental health/substance abuse (MH/SA) comorbidity***—Readmission is more likely if the patient has a major mental health or substance abuse condition as a secondary diagnosis, even for medical and surgical admissions.

To enable fair comparisons among hospitals, differences in base APR-DRG, severity of illness, patient age, and MH/SA comorbidity were factored into the calculation of the expected PPR rate. For this report, the expected rates were based on the experience of the Texas Medicaid population in SFY 2011.

Hospital performance was then defined as follows (lower values indicate better performance).

PPR Performance Ratio = Actual / Expected Ratio = Actual PPR Rate / Expected PPR Rate

Table 1.5.2.1 shows a simple example of how the casemix adjustment process works. For further information, see the Appendix Section B.6.

Table 1.5.2.1

Example of Calculation of Expected PPR Rate

APR-DRG	Patient Age	MH/SA Comorb.	Initial Admits	Actual PPR Chains	Actual PPR Rate	Statewide PPR Rate	MH/SA Adjustor	Expected PPR Chains	Expected PPR Rate	Actual / Expected
123-4	Pediatric	Yes	100	7	7.0%	4.3%	1.481	6.4	6.4%	1.10
123-4	Pediatric	No	75	4	5.3%	4.3%	0.989	3.2	4.3%	1.25
123-4	Adult	Yes	50	3	6.0%	5.5%	1.141	3.1	6.3%	0.96
123-4	Adult	No	100	10	10.0%	5.5%	0.976	5.4	5.4%	1.86
432-1	Pediatric	Yes	200	12	6.0%	7.8%	1.481	23.1	11.6%	0.52
432-1	Pediatric	No	250	15	6.0%	7.8%	0.989	19.3	7.7%	0.78
432-1	Adult	Yes	150	5	3.3%	9.0%	1.141	15.4	10.3%	0.32
432-1	Adult	No	175	11	6.3%	9.0%	0.976	15.4	8.8%	0.72
All Stays			1,100	67	6.1%			91.2	8.3%	0.73

Explanation:

1. A specific hospital has 1,100 initial admissions. For example, there are 100 initial admissions with APR-DRG 123-4, a mental health/substance abuse comorbidity, and pediatric patient age. (This number was made up for this example.)
2. The hospital has a total of 67 potentially preventable readmission chains, for an actual PPR rate of 67 / 1,100 = 6.1%.
3. For APR-DRG 123-4, pediatric age group, a statewide PPR rate of 4.3% is assumed for purposes of this example. If a MH/SA comorbidity is present, the MH/SA adjustor is 1.481. In the first line of the table, 100 initial admissions x 0.043 x 1.481 = 6.4 expected PPR chains.
4. Given this hospital's casemix, total expected PPR chains = 91.2, for an expected PPR rate of 91.2 / 1,100 = 8.3%.
5. The hospital's PPR performance is 6.1% / 8.3% = 0.73, that is, its PPR rate is much lower than expected for a hospital with its casemix.

1.6 Interpretation of Results

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

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

The question might be asked whether these results are accurate reflections of broader time frames, especially when results are shown for individual hospitals or other populations of interest that have small volumes of inpatient stays. For example, consider a hospital with 50 initial admissions. If it has two readmission chains, then its PPR rate would be 4 percent, about the same as the statewide rate. If it has just one additional readmission chain, then its PPR rate would be 6 percent, noticeably higher than the statewide rate.

Two aspects of our methodology lessen the potentially misleading effects of analyzing relatively small numbers of stays.

- ***Low-volume hospitals***—A hospital was defined as "low volume" if it did not have at least 40 initial admissions, at least 5 actual readmission chains, and at least 5 expected readmission chains.[11] Because readmissions are infrequent events for many common conditions, hospitals with as many as 75 or 100 initial admissions were usually defined as low-volume because they had fewer than five expected readmission chains. The results for low-volume hospitals were reported to those hospitals, but were not evaluated for statistical significance and were not included in the discussion of statewide patterns in Section 2.6.
- ***Test of statistical significance***—Although the results were only calculated for SFY 2011, a test of statistical significance can suggest whether the SFY 2011 results might also apply to a broader time frame. Statistical significance depends on two factors: the number of stays and the difference between actual readmissions and expected readmissions. 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. (The "true" rate refers to the rate from some time period broader than SFY 2011, assuming we are using SFY 2011 as a sample from that broader time period.) Similarly, there would be higher confidence in an A/E ratio that is based on 5,000 stays than on an A/E ratio that is based on 100 stays. In Section 2.6, the significance of hospital-specific A/E ratios is tested using the Cochran-Mantel-Haenszel (CMH) test of conditional independence.[12] The CMH statistic is an indicator of the likelihood that the observed A/E ratio differed from 1.00 simply by chance. The number of hospitals where the difference between the A/E ratio and 1.00 is statistically significant will also be shown using the 90 percent confidence level. If a hospital's A/E rate is statistically significant at the 90 percent confidence level, then the likelihood is less than 10 percent that the observed A/E ratio differs from 1.00 simply because of random variation in the data.

2 Statewide Results

2.1 Key Findings

The study comprised 346,015 inpatient stays, or about half of all stays where Texas Medicaid was the primary payer. The study population included FFS, PCCM, and managed care beneficiaries of all ages, except newborns. The other major exclusion was patients with emergency Medicaid eligibility. See Section 1.2 and Appendix Sections B.1 and B.2 for detail on included and excluded stays.

Section 2 presents results from the study at the statewide level. See Box 2.1.1 for a list of key findings, which are described in more detail in the remainder of Section 2.

Box 2.1.1 Key Findings About PPR Rates in the Texas Medicaid Population
• Overall, 3.7 percent of admissions were followed by a readmission chain that started within 15 days of discharge. Rates varied widely by care category: 0.8 percent for obstetrics, 4.2 percent for non-obstetric patients under age 18 and 7.5 percent for non-obstetric adults (Table 2.2.1). • Mental health and substance abuse conditions comprised 8.5 percent of initial admissions but 25.8 percent of PPRs (Table 2.2.1). Heart failure, pulmonary disease, pneumonia, sickle cell crisis, and diabetes also represented substantial numbers of PPRs (Table 2.4.1). • Overall, two-thirds of readmissions were to the same hospital and one-third to a different hospital (Table 2.2.1). • Very few readmissions appeared to reflect clear medical error. About half of the PPRs reflected the recurrence or continuation of the original condition, while another one-quarter were for an acute complaint that might be related to the original condition (Table 2.3.1). • DRGs that had notably high PPR rates included psychiatric disorders, major abdominal surgeries, liver disorders, and cardiac procedures (Table 2.4.3). • Within most DRGs, patients who had more comorbidities were at higher risk for readmission (Table 2.5.1). • Patients who had medical and surgical conditions were at higher risk for readmission if they also had a major mental health or substance abuse disorder (Table 2.5.2) • After adjustment for casemix, the worst-performing hospitals had PPR rates three times higher than the best-performing hospitals, suggesting that opportunities exist for hospitals to learn from each other (Chart 2.6.1) • The risk of readmission peaked two to three days after discharge (Chart 2.7.1)

2.2 Overall PPR Results

Excluding newborns, the PPR rate in the Medicaid population was 3.7 percent overall, 0.8 percent for obstetrics, 4.2 percent for non-obstetric pediatrics and 7.5 percent for non-obstetric adult stays.

In SFY 2011, there were 331,235 initial stays within the scope of this analysis (Table 2.2.1). These initial stays were followed by 14,780 PPRs in 12,182 PPR chains.

The overall PPR rate was 3.7 percent (12,182/331,235 = .037). About two-thirds of readmissions were to the same hospital from which the patient was originally discharged.

Medicaid payments for PPRs totaled $95.5 million or an estimated $104.2 million for the full 12 months of SFY 2011 after taking into account the exclusion of initial admissions that occurred during August 2011 (Table 2.2.2). About 3.1 percent of all Medicaid payments for hospital care were for PPRs identified in this study.[13]

This figure covers only the Medicaid payments that were made to the hospital, not the cost to the hospital, the cost of physician and other associated services, or the cost to the patient.

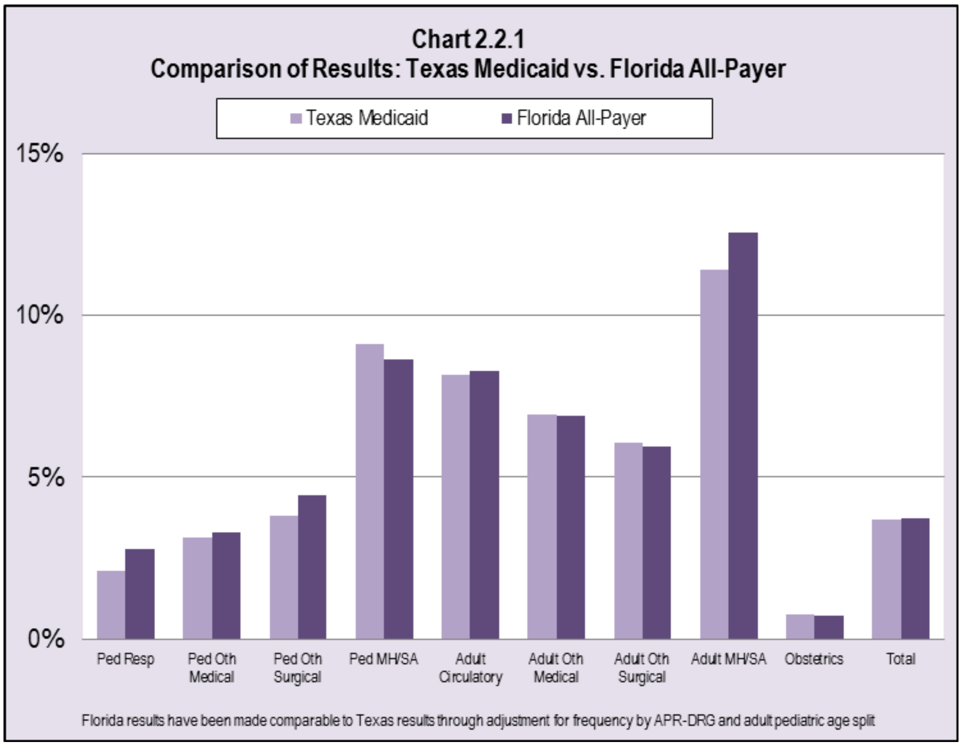
Table 2.2.1
PPR Rates Overall and by Medicaid Care Category

Medicaid Care Category	Initial Admits	Readmit Chains	Total Readmissions			PPR Rate
			Same Hospital	Other Hospital	All	
Pediatric						
Respiratory	17,425	367	295	102	397	2.1%
Other medical	31,218	979	845	289	1,134	3.1%
Other surgical	10,860	414	381	95	476	3.8%
MH/SA	15,019	1,367	964	751	1,715	9.1%
Subtotal	74,522	3,127	2,485	1,237	3,722	4.2%
Adult						
Circulatory	11,729	956	794	379	1,173	8.2%
Other medical	61,202	4,257	3,350	1,877	5,227	7.0%
Other surgical	18,976	1,150	1,020	329	1,349	6.1%
MH/SA	13,223	1,510	1,006	1,098	2,104	11.4%
Subtotal	105,130	7,873	6,170	3,683	9,853	7.5%
Obstetrics	151,583	1,182	971	234	1,205	0.8%
Total	331,235	12,182	9,626	5,154	14,780	3.7%

Notes

1. MH/SA = mental health and substance abuse.
2. 331,235 initial stays + 14,780 readmissions = 346,015 stays in the analytical dataset.
3. MH/SA stays = (15,019+13,233)/331,235 * 100 = 8.5 percent of initial admissions (All other calculations were done similarly)

Chart 2.2.1 compares Texas Medicaid's results with the results from a similar analysis that was done by the Florida Agency for Health Care Administration. The Florida analysis included not only Medicaid but other payers as well. It was based on the Florida Inpatient Discharge Dataset for discharges that occurred between January 2004 and December 2008. To improve the comparison of the Florida all-payer data with the Texas Medicaid data, TMHP recalculated the Florida data to reflect the same distribution of stays by APR-DRG and by age group that was seen in the Texas Medicaid dataset. The chart shows that the similarities between the two sets of results are much more notable than the differences, despite the differences in states, time periods, and populations. This finding implies that the patterns of readmission seen in this report were not unique to the Texas Medicaid population.



The Texas Medicaid PPR rate of 3.7 percent may seem low, especially in comparison with the widely reported finding that 20 percent of Medicare patients were readmitted within 30 days.[14] Reasons for the difference include the longer readmission window used by Medicare (30 days instead of 15 days), the broader definition of readmission (all-cause for Medicare) and the very different casemixes of the two populations. In particular, almost half of all Texas stays in this analysis are for obstetrics, where the PPR rate was very low (0.8 percent). For the non-obstetric pediatric population, the PPR rate was 4.2 percent; for the non-obstetric adult population, the PPR rate was 7.5 percent. For some DRGs, the PPR rates approached 20 percent or even 23 percent. This will be shown in Table 2.4.3.

Readmissions for people who were initially admitted with mental health or substance abuse diagnoses were particularly notable. About 9.1 percent of pediatric patients and 11.4 percent of adult patients with these conditions were back in the hospital within 15 days (Table 2.2.1). Moreover, patients in these care categories were more likely to have more than one readmission within a chain of readmissions, as shown in Table 2.2.2. Pediatric patients with at least one readmission had 1.3 readmissions on average; adults with at least one readmission had 1.4 readmissions on average.

Presence of a major mental health or substance abuse condition as a secondary diagnosis also made readmissions more likely for patients who were admitted with medical or surgical conditions, as will be shown in Section 2.5.

Table 2.2.2

Hospital Charges and Medicaid Payments for PPRs

Medicaid Care Category	PPR Chains	PPR Stays	Stays per Chain	Totals for PPR Stays: Days	Days / Stay	Hospital Charges (Millions)	Medicaid Payments (Millions)
Pediatric							
Respiratory	367	397	1.1	1,992	5.0	$15.7	$4.2
Other medical	979	1,134	1.2	6,535	5.8	$44.9	$13.2
Other surgical	414	476	1.1	3,009	6.3	$24.8	$6.6
MH/SA	1,367	1,715	1.3	21,570	12.6	$32.6	$11.8
Subtotal	3,127	3,722	1.2	33,106	8.9	$117.9	$35.9
Adult							
Circulatory	956	1,173	1.2	6,377	5.4	$46.5	$7.0
Other medical	4,257	5,227	1.2	29,780	5.7	$197.8	$31.0
Other surgical	1,150	1,349	1.2	9,274	6.9	$64.4	$10.6
MH/SA	1,510	2,104	1.4	13,584	6.5	$34.7	$7.5
Subtotal	7,873	9,853	1.3	59,015	6.0	$343.4	$56.0
Obstetrics	1,182	1,205	1.0	3,834	3.2	$24.5	$3.6
Total	12,182	14,780	1.2	95,955	6.5	$485.8	$95.5

Note:

1. Figures on stays, days, charges and payments reflect 11 months of SFY 2011 because initial admissions in August 2011 were excluded from the report in order to allow a one-month run-out period for PPRs. Extrapolating the above results to the full 12-month period would yield the following estimates of PPR stays, charges and payments for SFY 2011.

Estimated Totals for FY 2011 (12 months)	PPR Stays	Hospital Charges (Millions)	Medicaid Payments (Millions)
	104,678	$530.0	$104.2

2.3 Reasons for Potentially Preventable Readmissions

Table 2.3.1 categorizes the clinical reasons for readmission. Of the 14,780 total readmissions:

- 22 percent were medical readmissions for the recurrence or continuation of the same condition as the initial admission.
- 34 percent were medical readmissions for a different acute condition that could plausibly have had a clinical association with the initial admission.
- 25 percent were mental health or substance abuse readmissions that followed an initial admission for mental health or substance abuse.
- Only 2 percent of readmissions were for post-surgical complications.

The most common reasons for readmission, in roughly equal proportions, were medical readmissions for the same condition, medical readmissions for other acute conditions, and readmissions for mental illness or substance abuse.

To the extent that medical error can be inferred from the diagnosis and procedure codes submitted by hospitals, these results strongly imply that the main issue in readmissions lies not in errors (e.g., leaving a sponge in a patient) but rather in fully resolving the initial medical complaint and creating an effective transition from the hospital to care in the community or a post-acute facility. The finding echoes result from Florida and elsewhere.

Table 2.3.1

Potentially Preventable Readmissions, Percentage Split by Clinical Reason

Medicaid Care Category	Potentially Preventable Readmissions	1 Medical--Recurrence or Continuation	2A Medical--Ambulatory Care Sensitive	2B Medical--Other Chronic Condition	3 Medical--Other Acute Condition	4 Surgical--Reoccurrence or Continuation	5 Surgical--Complication	6A MH--Index Admission not MH/SA	6B SA--Index Admission not MH/SA	6C MH/SA readmission after initial MH/SA admission
Pediatric										
Respiratory	397	64%	5%	10%	20%	0%	0%	1%	0%	0%
Other medical	1,134	46%	1%	12%	31%	0%	1%	8%	0%	0%
Other surgical	476	3%	1%	7%	62%	13%	11%	2%	0%	0%
MH/SA	1,715	0%	1%	1%	1%	0%	0%	0%	0%	98%
Subtotal	3,722	21%	1%	6%	20%	2%	2%	3%	0%	45%
Adult										
Circulatory	1,173	39%	6%	11%	35%	3%	2%	3%	1%	0%
Other medical	5,227	37%	7%	14%	34%	0%	1%	5%	1%	2%
Other surgical	1,349	5%	3%	9%	58%	9%	13%	2%	1%	0%
MH/SA	2,104	0%	1%	2%	4%	0%	0%	0%	0%	92%
Subtotal	9,853	25%	5%	10%	31%	2%	2%	3%	1%	21%
Obstetrics	1,205	1%	0%	0%	98%	0%	0%	0%	0%	0%
Total	14,780	22%	4%	9%	34%	2%	2%	3%	1%	25%

Notes:
1. Percentages refer to total PPRs for each row. For example, 22% of the total 14,780 PPR stays were for medical recurrence or continuation.
2. MH=mental health; SA=substance abuse

2.4 Results by APR-DRG

Tables 2.4.1, 2.4.2, and 2.4.3 show PPR rates by base APR-DRG, sorted in three different orders:

These ***three tables by DRG highlight the issues of readmissions for mental health, substance abuse, and liver disorders.***

- Declining order by total PPR count
- Declining order by total initial admissions
- Declining order by PPR risk, that is, by which APR-DRGs had the highest PPR rates

In each table, the DRG shown is the base DRG, without level of severity (e.g., APR-DRG 139 for pneumonia, not APR-DRG 139-1 for pneumonia, severity 1).

Table 2.4.1, which shows the top DRGs in terms of PPR stays, is most relevant when addressing the question of how to reduce the total number of PPRs. The importance of individual mental health DRGs is evident as these DRGs have both high PPR rates and high PPR volumes. The number of PPRs for obstetric stays, by contrast, is high only because there are so many obstetric admissions. The PPR rates themselves are very low. This table also illustrates the importance of using a PPR measurement methodology that includes conditions that are common in the Medicaid population. The table shows that heart failure and pneumonia do generate many readmissions (as in Medicare), but that mental health DRGs such as bipolar disorders, schizophrenia, and major depression are a larger PPR issue.

Table 2.4.1					
PPR Rates by APR-DRG: Top 20 APR-DRGs in Terms of Total Potentially Preventable Readmissions					
Base DRG	Initial Admits	PPR Chains	PPR Stays	PPR Stays per Chain	PPR Rate
753 Bipolar Disorders	13,540	1,370	1,804	1.3	10.1%
750 Schizophrenia	5,420	754	1,050	1.4	13.9%
540 Cesarean Delivery	46,521	655	667	1.0	1.4%
751 Major Depression	5,598	490	637	1.3	8.8%
560 Vaginal Delivery	84,973	457	466	1.0	0.5%
194 Heart Failure	2,642	313	405	1.3	11.8%
140 COPD	3,335	321	399	1.2	9.6%
139 Other Pneumonia	8,927	268	292	1.1	3.0%
662 Sickle Cell Anemia Crisis	1,651	190	285	1.5	11.5%
720 Septicemia & Disseminated Infections	2,774	246	284	1.2	8.9%
420 Diabetes	2,915	208	282	1.4	7.1%
138 Bronchiolitis & RSV Pneumonia	9,270	229	240	1.0	2.5%
053 Seizure	4,150	180	212	1.2	4.3%
460 Renal Failure	1,679	163	210	1.3	9.7%
279 Hepatic Coma & Other Major Liver Disorders	763	140	200	1.4	18.3%
383 Cellulitis & Other Bacterial Skin Infection	6413	172	195	1.1	2.7%
282 Disorder of Pancreas Except Malignant	1,460	143	190	1.3	9.8%
280 Alcoholic Liver Disease	770	133	189	1.4	17.3%
249 Non-Bacterial Gastroenteritis	4,751	162	175	1.1	3.4%
254 Other Digestive System Diagnosis	1,994	144	175	1.2	7.2%
Top 20	209,546	6,738	8,357	1.2	3.2%
All DRGs	331,235	12,182	14,780	1.2	3.7%
Top 20 as Percent of All	63%	55%	57%		

Notes:

1. The APR-DRG shown is the DRG for the initial admission.
2. COPD=chronic obstructive pulmonary disease; RSV= respiratory syncytial virus

Table 2.4.2 shows the top DRGs by initial admission count. This table is useful for understanding PPR rates for the most common reasons that Medicaid clients are admitted to the hospital. The low obstetric PPR rates are notable.

Table 2.4.2 PPR Rates by APR-DRG: Top 20 APR-DRGs in Terms of Initial Admissions					
Base DRG	Initial Admits	PPR Chains	PPR Stays	PPR Stays per Chain	PPR Rate
560 Vaginal Delivery	84,973	457	466	1.0	0.5%
540 Cesarean Delivery	46,521	655	667	1.0	1.4%
753 Bipolar Disorder	13,540	1,370	1,804	1.3	10.1%
138 Bronchiolitis & RSV Pneumonia	9,270	229	240	1.0	2.5%
139 Other Pneumonia	8,927	268	292	1.1	3.0%
566 Other Antepartum Diagnosis	8,795	7	7	1.0	0.1%
383 Cellulitis & Other Bacterial Skin Infection	6,413	172	195	1.1	2.7%
141 Asthma	5,598	490	637	1.3	8.8%
751 Major Depression	5,420	754	1,050	1.4	13.9%
750 Schizophrenia	5,408	115	131	1.1	2.1%
141 Asthma	4,839	146	168	1.2	3.0%
463 Kidney and Urinary Tract Infection	4,751	162	175	1.1	3.4%
541 Vaginal Deliver w/Sterilization and/or D&C	4,558	27	28	1.0	0.6%
53 Seizure	4,150	180	212	1.2	4.3%
113 Infection Of Upper Respiratory Tract	3,528	84	92	1.1	2.4%
225 Appendectomy	3,464	97	105	1.1	2.8%
140 COPD	3,335	321	399	1.2	9.6%
420 Diabetes	2,915	208	282	1.4	7.1%
720 Septicemia & Disseminated Infection	2,774	246	284	1.2	8.9%
563 Threatened Abortion	2,736	0	0	0.0	0.0%
Top 20	231,915	5,988	7,234	1.2	2.6%
All DRGs	331,235	12,182	14,780	1.2	3.7%
Top 20 as Percent of All	70%	49%	49%		

Notes:

1. The APR-DRG shown is the DRG for the initial admission.
2. RSV=respiratory syncytial virus; D&C=dilatation and curettage; COPD=chronic obstructive pulmonary disease

Table 2.4.3 shows the DRGs that have the highest PPR rates (so long as the DRG met the minimum volume requirements for the number of stays). A hospital would find this table useful for setting flags for readmission risk by DRG. Although the volumes of initial admissions for liver diseases, major abdominal procedures, and cardiovascular procedures were low, any patient in one of these DRGs was clearly at high risk for a PPR. Examples include the surgical DRGs that involve the biliary tract, liver, pancreas, and bladder, and the medical DRGs for liver disorders.

Table 2.4.3

PPR Rates by APR-DRG: Top 20 APR-DRGs in Terms Total Potentially Preventable Readmission Rates

Base DRG	Initial Admits	PPR Chains	PPR Stays	PPR Stays per Chain	PPR Rate
261 Major Biliary Tract Procedures	57	13	17	1.3	22.8%
279 Hepatic Coma & Other Major Liver Disorder	763	140	200	1.4	18.3%
260 Major Pancreas & Liver Procedures	135	24	31	1.3	17.8%
280 Alcoholic Liver Disease	770	133	189	1.4	17.3%
441 Major Bladder Procedures	78	13	14	1.1	16.7%
165 Coronary Bypass w/Catheterization	253	42	48	1.1	16.6%
252 Complication of GI Device or Procedure	290	41	46	1.1	14.1%
750 Schizophrenia	5,420	754	1,050	1.4	13.9%
220 Major Stomach & Esophageal Procedures	302	41	55	1.3	13.6%
206 Complication of CV Device or Procedure	182	24	28	1.2	13.2%
774 Cocaine Abuse & Dependence	92	12	18	1.5	13.0%
194 Heart Failure	2,642	313	405	1.3	11.8%
224 Peritoneal Adhesiolysis	152	18	22	1.2	11.8%
662 Sickle Cell Anemia Crisis	1,651	190	285	1.5	11.5%
264 Other Hepatobiliary & Abdominal Procedures	55	6	7	1.2	10.9%
253 Other & Unspecified GI Hemorrhage	598	65	78	1.2	10.9%
444 Renal Dialysis Access Procedure	245	26	36	1.4	10.6%
048 Nerve Disorder	595	61	91	1.5	10.3%
160 Major Vascular Procedures	236	24	29	1.2	10.2%
753 Bipolar Disorder	13,540	1,370	1,804	0.0	10.1%
Top 20	28,056	3,310	4,453	1.3	11.8%
All DRGs	331,235	12,182	14,780	1.2	3.7%
Top 20 as Percent of All	8%	27%	30%		

Notes:

1. The APR-DRG shown is the DRG for the initial admission.
2. A DRG is only included in this table if there were at least 40 initial admissions and at least five actual readmission chains.
3. CV=cardiovascular; MV=mechanical ventilation, AMI=acute myocardial infarction

2.5 The Importance of Casemix Adjustment

PPR rates are influenced by the level of severity, the patient age and the presence of a major mental health or substance abuse comorbidity.

The tables in this section demonstrate the importance of the base DRG in understanding PPR rates. Any comparison of PPR rates, for example between hospitals, managed care plans, or eligibility groups, is fundamentally flawed if it does not adjust for differences in the mix of base DRGs. As described in Section 1.5, adjustments were also made for three other aspects of casemix in comparing subsets of the analytical dataset. In each case, our findings echo those from similar analysis in Florida.[15]

- ***Severity of illness***—In general, the risk of readmission increases with the severity of illness for any given condition. Table 2.5.1 shows the top 10 base DRGs in terms of total readmissions (from Table 2.4.1.). In most cases, the PPR rates increase as the patient's severity of illness increases within the base DRG. The pattern is especially evident for certain medical DRGs, such as chronic obstructive pulmonary disease (COPD), pneumonia, and septicemia.

Table 2.5.1

Initial Admissions and PPR Rates by Level of Severity for the Top 10 Base DRGs in Terms of Total Readmissions

Base DRG		Total	Level of Severity			
			Severity 1	Severity 2	Severity 3	Severity 4
753 Bipolar Disorder	Initial Admits	13,540	5,936	7,091	507	6
	PPR Rate	10.12%	9.99%	10.03%	12.43%	50.00%
750 Schizophrenia	Initial Admits	5,420	2,303	2,771	339	7
	PPR Rate	13.91%	14.11%	13.57%	15.34%	14.29%
540 Cesarean Delivery	Initial Admits	46,521	34,295	9,448	2,659	119
	PPR Rate	1.41%	1.10%	1.97%	3.27%	5.04%
751 Major Depression	Initial Admits	5,598	1,870	3,485	241	2
	PPR Rate	8.75%	7.49%	9.38%	9.54%	0.00%
560 Vaginal Delivery	Initial Admits	84,973	59,188	22,356	3,403	26
	PPR Rate	0.54%	0.37%	0.78%	1.76%	3.85%
194 Heart Failure	Initial Admits	2,642	212	1,218	1,020	192
	PPR Rate	11.85%	13.21%	11.33%	11.96%	13.02%
140 COPD	Initial Admits	3,335	625	1,561	1,015	134
	PPR Rate	9.63%	7.68%	9.87%	10.44%	9.70%
139 Other Pneumonia	Initial Admits	8,927	3,559	3,772	1,313	283
	PPR Rate	3.00%	1.52%	2.81%	6.40%	8.48%
662 Sickle Cell Anemia Crisis	Initial Admits	1,651	701	710	220	20
	PPR Rate	11.51%	10.56%	13.24%	9.55%	5.00%
720 Septicemia & Disseminated Infection	Initial Admits	2,774	238	593	902	1,041
	PPR Rate	8.87%	2.94%	4.22%	9.31%	12.49%

Note: COPD=chronic obstructive pulmonary disease

- ***Age***—Excluding the obstetrics stays, approximately half of all stays in the present analysis were for clients who were under age 18. Even after controlling for APR-DRG, patients under age 18 tended to be readmitted less often. Chart 2.5.1 shows the same pattern for 10 DRGs that were common to both adult and pediatric populations. The pattern also holds true in general, although not for every DRG. Because of the large number of pediatric stays, statewide PPR averages for every DRG were calculated separately for the adult and pediatric populations.[16]
- ***Presence of major mental health or substance abuse co-morbidity***—Patients admitted with medical or surgical conditions were more likely to be readmitted if the claim for the initial admission also showed a secondary diagnosis of *major* mental illness or substance abuse.[17] For adults, a readmission was 83 percent more likely; for pediatric patients, it was 98 percent more likely (Table 2.5.2). For example, if the risk of a PPR was 3.00 percent for an adult patient with a specific APR-DRG, then the presence of a major MH/SA comorbidity increased the risk to 3.00 x 1.83 = 5.49 percent.

Table 2.5.2

Adjustment for MH/SA Comorbidity

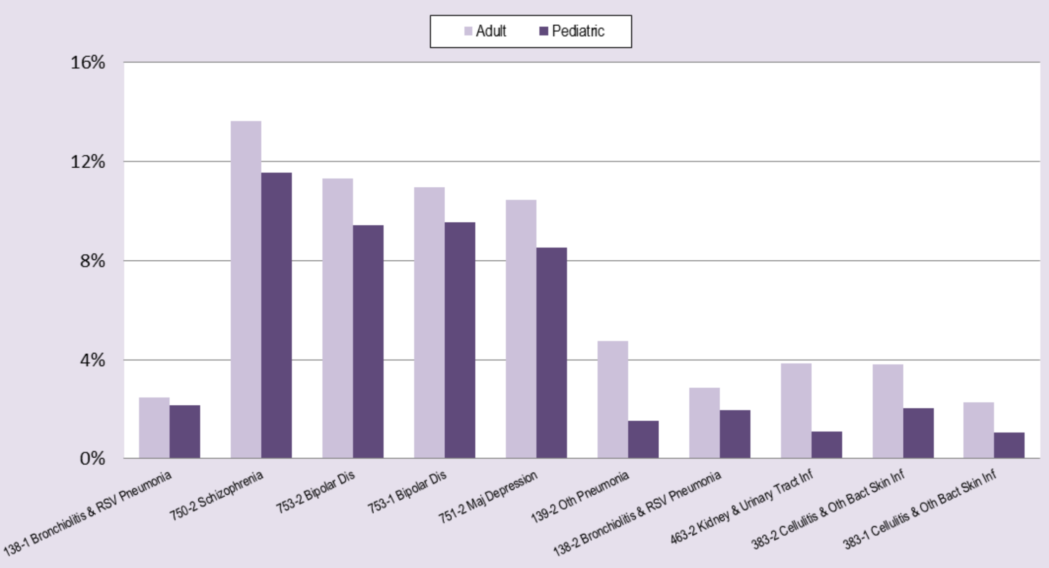
Age Category	MH/SA Comorbidity	Adj. Factor	Odds Ratio
Pediatric	No	0.9438	
Pediatric	Yes	1.8671	1.98
Adult	No	0.8885	
Adult	Yes	1.6229	1.83

Notes:

1. For pediatric patients, PPR rates were calculated for each DRG, then the population was split depending on the presence or absence of a major MH/SA comorbidity. The sub-population with a comorbidity had a PPR rate 86.7% higher than the overall pediatric population while the sub-population without a comorbidity had a PPR rate 5.6% lower than the overall pediatric population. The ratio of 1.8671 to 0.9438 yields the result that pediatric patients with a major MH/SA comorbidity were 98% more likely to have a PPR than pediatric patients without such a comorbidity, even after taking into account differences in casemix.
2. In calculating expected PPR rates, the MH/SA comorbidity adjustment factor is applied only to medical and surgical admissions, not to MH/SA or obstetric admissions.

While these factors are believed to be important for understanding the incidence of PPRs, the possibility should be noted that there are other, unmeasured factors that systematically affect the incidence of a PPR.

Chart 2.5.1
Adult and Pediatric PPR Rates for 10 Common APR-DRGs



The APR-DRGs shown are the ten most common and that also had at least 100 pediatric initial admissions.

2.6 PPR Performance by Hospital

> ***Excluding low-volume hospitals, 80 of 226 hospitals had PPR rates about as expected, while 67 hospitals had rates lower/much lower than expected and 79 hospitals had rates higher/much higher than expected.***

To compare the PPR performance of hospitals, the actual PPR rate and the expected PPR rate for each hospital were calculated, as explained in Section 1.5. Hospitals with low volumes (e.g., fewer than 40 stays) were excluded from the comparison because their PPR rates could be unstable based on the absence or presence of just one or two readmission chains.

For each of the 226 hospitals included in the comparison, the ratio of the actual number of PPR chains to the expected number was calculated. If the A/E ratio was less than 1.00, then the hospital's PPR rate was lower than would be expected for a hospital with the same casemix. That is, the result was better than expected.

Table 2.6.1 shows TMHP's interpretation of the calculated results. Of the 226 hospitals with sufficient volume to be considered, 80 had a rate within 10 percent of the expected rate, which was considered "about as expected." Another 67 hospitals had a rate below a threshold of 10 percent, which was lower than expected. There were 79 hospitals with a rate above a threshold of 10 percent, that is, higher than expected. The word "expected" is used in the sense that it reflects the calculation of the Texas overall statewide Medicaid PPR rate in SFY 2011 and then uses that rate as the norm. An alternative approach would be to define a norm that can be achieved by hospitals following best practices and then use that norm as the "expected" value.

In statistical terms, these were the actual results for SFY 2011 and they were not based on a sample. Therefore the results are accurate for every hospital. The test of statistical significance, however, can suggest the probability that the results seen in SFY 2011 might be similar to those from a different period.[18] See also Section 2.8 for a comparison of the results for SFY 2009, SFY 2010, and SFY 2011.

Table 2.6.1
Number of Hospitals by PPR Performance

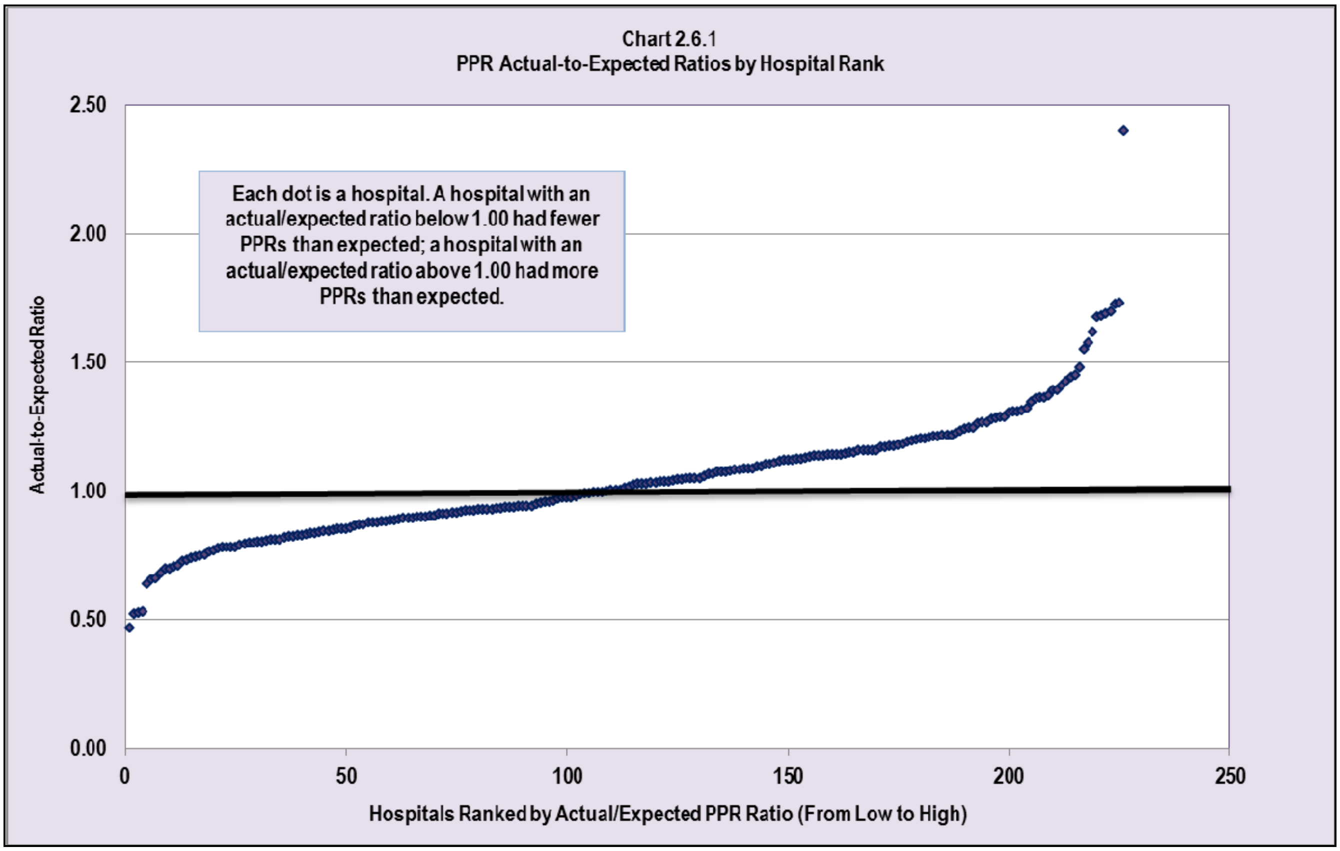
Ratio of Actual PPRs to Expected PPRs	Interpretation	Hospitals	Stat Sig Diff
Lower than 0.75	Much lower than expected	17	7
0.75 to 0.89	Lower than expected	50	8
0.90-1.10	About as expected	80	0
1.11 to 1.25	Higher than expected	45	11
Higher than 1.25	Much higher than expected	34	22
Total		226	48

Notes:

1. Low-volume hospitals are excluded. Low-volume hospitals do not meet the criteria of having at least 40 initial admissions, at least five expected readmissions, and at least five actual readmissions.
2. "Stat Sig Diff" shows the number of hospitals where the difference from 1.00 is statistically significant at the 90% confidence level.

For these 226 hospitals, Chart 2.6.1 shows the range of results. The best-performing hospitals had A/E ratios of approximately 0.50 while the worst-performing hospitals had A/E ratios approaching or even exceeding 2.00. The median hospital had an A/E ratio of 1.01. 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 2011.) However, the range in hospital performance is wide enough to suggest that hospitals can learn from each other how to reduce PPRs.

Overall, the study included 685 hospitals (490 in-state hospitals and 195 out-of-state hospitals). Of the 490 Texas hospitals, 226 are included in Table 2.6.1.

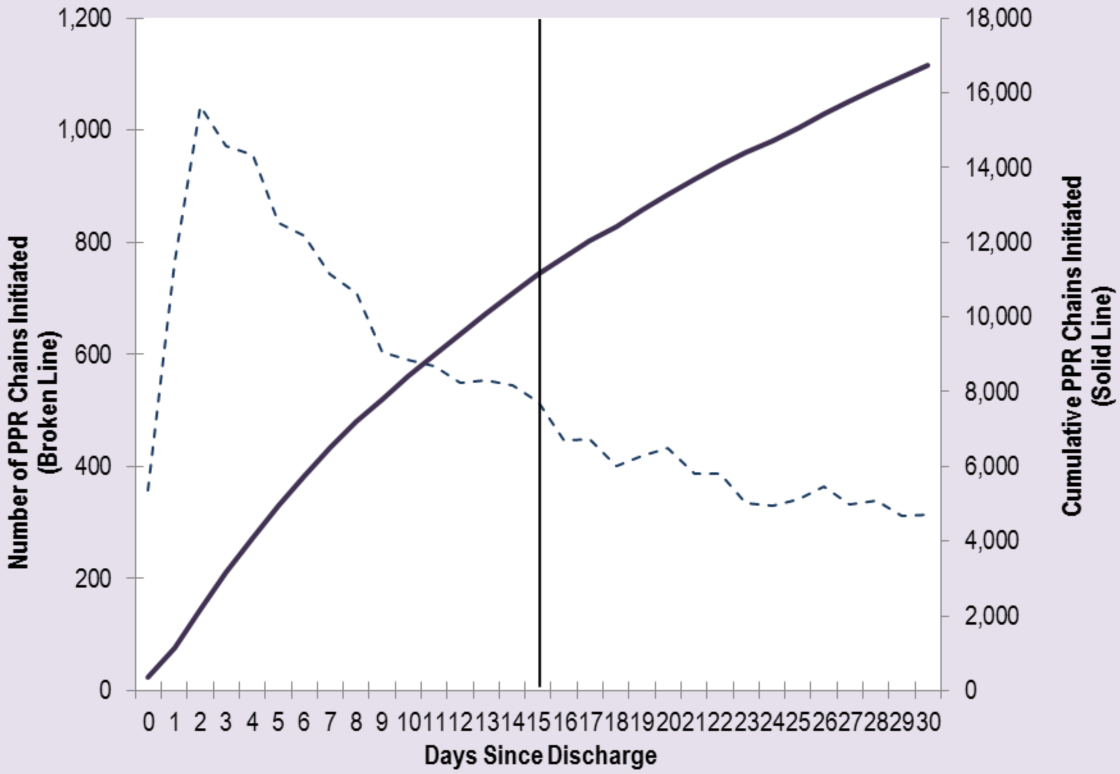


2.7 Readmission Patterns by Days from Discharge

The second and third days after discharge are the likely days for readmission.

As noted earlier, readmissions may be measured within different time frames. For this report, a 15-day time frame, or "window," was used. A window of 30 days is also commonly used. If this analysis had been done using a 30-day window, the result would have been a statewide PPR rate of 5.3 percent, as opposed to the 3.7 percent shown in Table 2.2.1. Chart 2.7.1 shows the patterns in PPRs by days since discharge using a 30-day window. The second and third days after discharge are the most likely days for PPRs. The likelihood of readmission then falls sharply after that (the broken line). Of all readmission chains within the 30-day window, about two-thirds start within 15 days (the solid line).

Chart 2.7.1
Patterns in PPR Initiation of Days Since Discharge



The total number of PPR Chains was 16,728 in a 30 day window. Regardless of the readmission window, the second and third day after discharge are the highest risk days for initiation of a PPR chain

2.8 Comparison between SFY 2009, SFY 2010, and SFY 2011

This is the third year in which HHSC has studied PPRs in the Texas Medicaid population. The same methodology was used for all years with the exception of the version of the 3M APR-DRG software for SFY 2011. This section compares results from the three years. The comparison is useful for understanding which findings have been stable across time and which findings appear to vary across time. In future years, such comparisons will also show whether PPR rates are increasing or decreasing.

Findings were generally very consistent between fiscal year 2009, fiscal year 2010 and fiscal year 2011 based on a substantial number of stays.

Overall, the impression is of considerable consistency across the three years. Chart 2.8.1 shows that adults had higher PPR rates than pediatric patients, that obstetrics had a very low PPR rate, and that the MH/SA categories had noticeably higher PPR rates than the medical and surgical categories. The overall rate of 3.7 percent in SFY 2011 was essentially the same as the rates of 3.6 and 3.7 percent in SFY 2009 and SFY 2010 respectively.

It should be noted that the comparison in Chart 2.8.1 does not take into account changes in casemix across years. For example, if there were a much higher proportion of obstetric stays (which have low PPR rates) in the first year and a much higher proportion of MH/SA stays (which have high PPR rates) in the second year, then an increase in the overall PPR rate could simply reflect the casemix change. In practice, the impact is likely to be minor when similar populations are compared across a short time span. The PPR rates (rounded to three decimal places) of 3.576 percent in SFY 2009, 3.704 percent in SFY 2010, and 3.678 in SFY 2011 were virtually unchanged. Between SFY 2009 and SFY 2010, for example, the casemix change accounted for 0.094 percentage points while the "real" change accounted for 0.034 percentage points. See Appendix Section B.6.3 for an explanation of how this result was calculated.

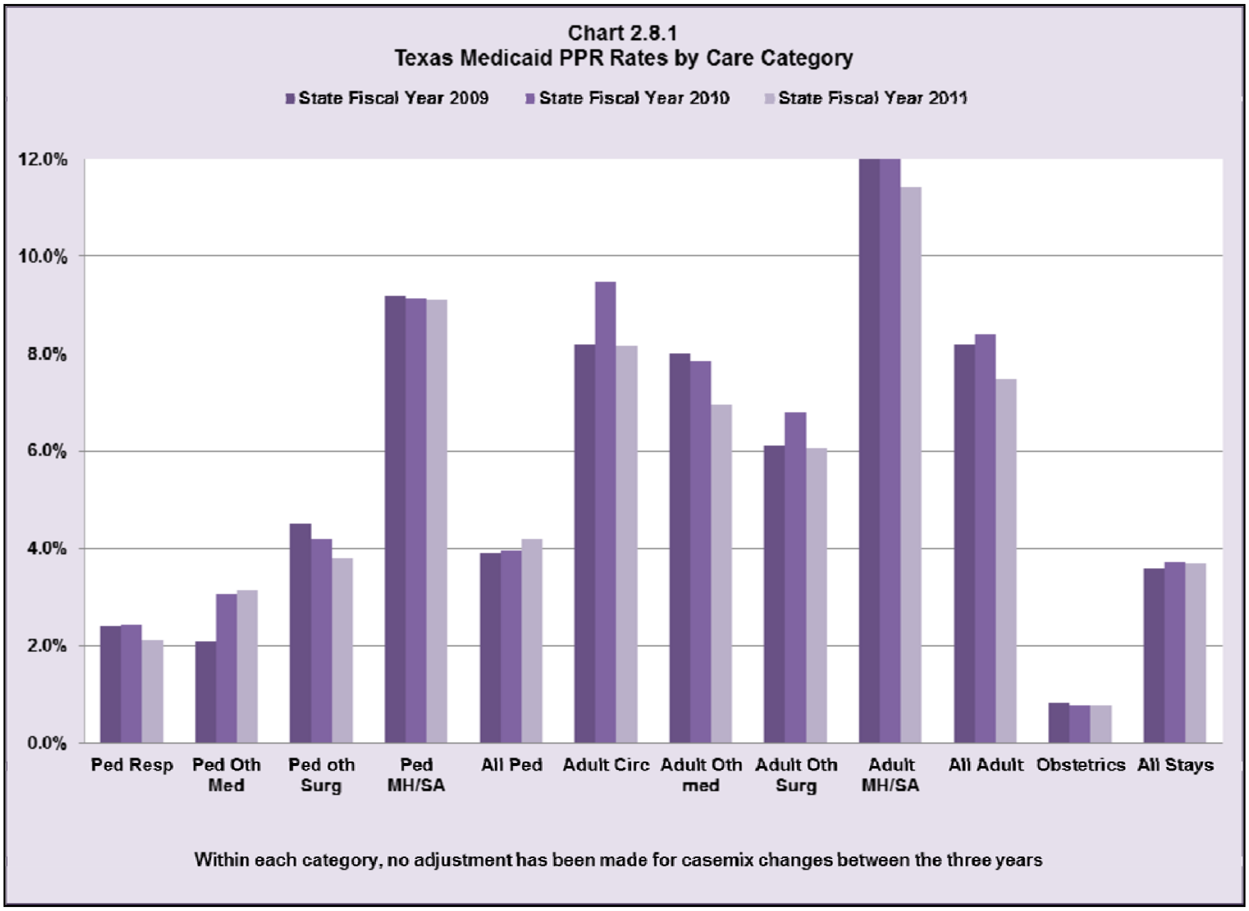


Table 2.8.1 compares the lists of the top 20 base DRGs in terms of total PPR stays. The table shows considerable consistency, both in the rank order of DRGs and in the PPR rates for the specific DRGs. This finding underscores the earlier finding that the risk of PPR varies predictably and importantly with the reason for the original admission. It also underscores the necessity of casemix adjustment in any comparison of PPR rates between different hospitals or populations.

Table 2.8.1

Top 20 Base DRGs by Total PPRs, State Fiscal Years 2009, 2010, vs 2011

SFY 2009				SFY 2010				SFY 2011			
Base DRG	Initial Admits	PPR Chains	PPR Rate	Base DRG	Initial Admits	PPR Chains	PPR Rate	Base DRG	Initial Admits	PPR Chains	PPR Rate
753 Bipolar Disorders	11,283	1,176	10.4%	753 Bipolar Disorders	12,479	1,290	10.3%	753 Bipolar Disorders	13,540	1,370	10.1%
750 Schizophrenia	5,082	745	14.7%	750 Schizophrenia	4,763	676	14.2%	750 Schizophrenia	5,420	754	13.9%
751 Major Depression	4,998	475	9.5%	540 Cesarean Delivery	39,601	612	1.5%	540 Cesarean Delivery	46,521	655	1.4%
540 Cesarean Delivery	41,035	565	1.4%	751 Major Depression	5,029	435	8.6%	751 Major Depression	5,598	490	8.8%
560 Vaginal Delivery	91,865	543	0.6%	560 Vaginal Delivery	89,895	528	0.6%	560 Vaginal Delivery	84,973	457	0.5%
194 Heart Failure	2,861	291	10.2%	194 Heart Failure	2,874	365	12.7%	194 Heart Failure	2,642	313	11.8%
140 COPD	3,188	301	9.4%	140 COPD	3,411	325	9.5%	140 COPD	3,335	321	9.6%

139 Other Pneumonia	9,990	296	3.0%	139 Other Pneumonia	11,326	312	2.8%	139 Other Pneumonia	8,927	268	3.0%
420 Diabetes	2,535	187	7.4%	662 Sickle Cell Anemia	1,640	189	11.5%	662 Sickle Cell Anemia	1,651	190	11.5%
138 Bronchiolitis	9,270	236	2.6%	420 Diabetes	2,773	215	7.8%	720 Septicemia	2,774	246	8.9%
662 Sickle Cell Anemia	1,611	177	11.0%	138 Bronchiolitis	10,335	277	2.7%	420 Diabetes	2,915	208	7.1%
720 Septicemia	2,335	192	8.2%	720 Septicemia	2,527	205	8.1%	138 Bronchiolitis	9,270	229	2.5%
053 Seizure	3,808	167	4.4%	383 Cellulitis	6,407	197	3.1%	053 Seizure	4,150	180	4.3%
249 Non-Bact Gastront	5,673	162	2.9%	282 Dis of Pancreas	1,463	143	9.8%	460 Renal Failure	1,679	163	9.7%
279 Hepatic Coma	737	139	18.9%	460 Renal Failure	1,453	153	10.5%	279 Hepatic Coma	763	140	18.3%
280 Alc Liver Disease	765	147	19.2%	053 Seizure	3,984	152	3.8%	383 Cellulitis	6,413	172	2.7%
383 Cellulitis	6,492	168	2.6%	279 Hepatic Coma	763	125	16.4%	282 Dis of Pancreas	1,460	143	9.8%
460 Renal Failure	1,431	137	9.6%	141 Asthma	5,934	133	2.2%	280 Alcoholic Liver Disease	770	133	17.3%
463 Kidney & UTI	4,572	140	3.1%	280 Alcoholic Liver Disease	717	119	16.6%	249 Non-Bact Gastroent	4,751	162	3.4%
282 Dis of Pancreas	1,338	118	8.8%	249 Non-Bact Gastront	4,614	135	2.9%	254 Oth Digestive Diagnosis	1,994	144	7.2%

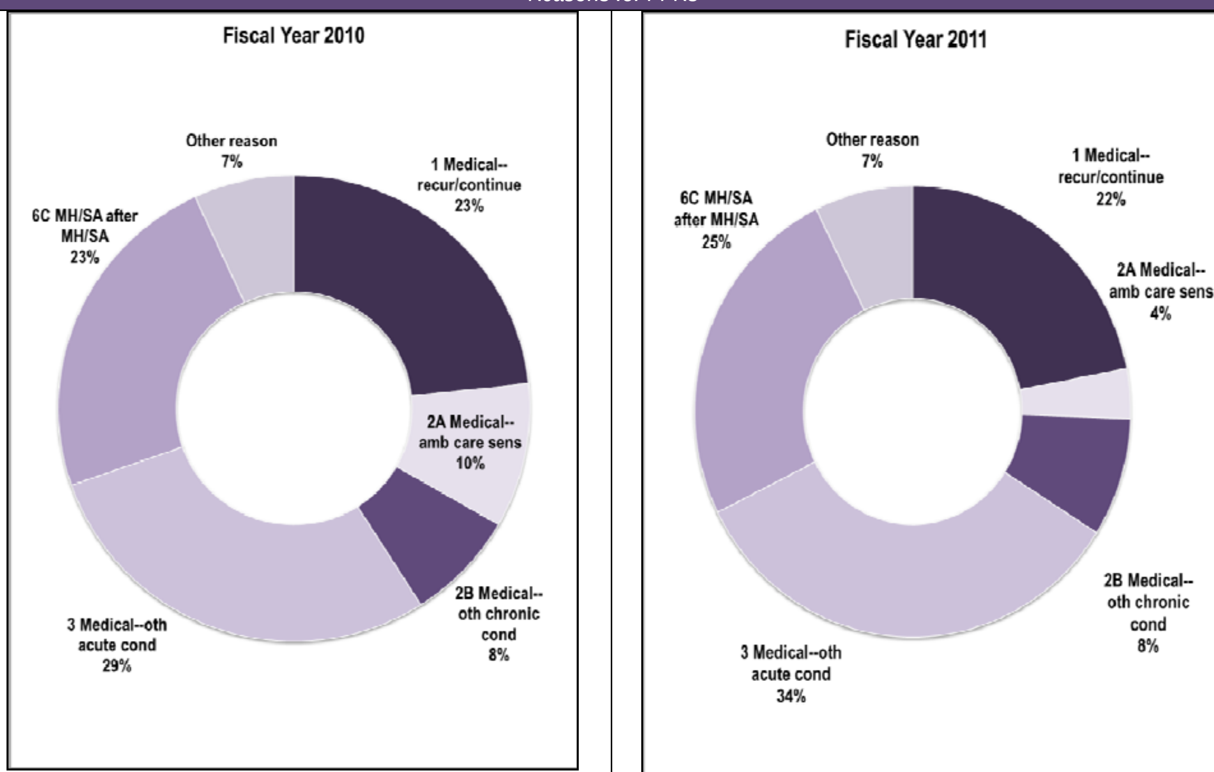
Notes:

1. The APR-DG shown is the DRG for the initial admission.

2. COPD=chronic obstructive pulmonary disease; RSV= respiratory syncytial virus; UTI= urinary tract infection

Chart 2.8.2 also shows notable consistency, this time in terms of the reasons for readmission. In both SFY 2010 and SFY 2011, about 23 percent of PPRs reflected the continuation or recurrence of the same condition (as measured by the base APR-DRG) and about one third were for acute medical conditions that could plausibly be related to the reason for the initial medical admission. About one-quarter of PPRs in each year were MH/SA readmissions after MH/SA initial admissions. The same similarity was seen between SFY 2009 and SFY 2010 (data not shown).

Chart 2.8.2
Reasons for PPRs



Note: See Table 2.3.1 for the full list of PPR reasons for SFY 2011.

Chart 2.8.3 shows the PPR performance in SFY 2010 and SFY 2011 for the top 50 hospitals in terms of Medicaid volume in SFY 2011, which together account for about half of all stays in the analytical dataset. “Performance” was measured by the A/E PPR rates, with lower values indicating better performance.

In general, hospital performance in 2010 correlated with hospital performance in 2011. (The correlation coefficient was 0.46, where 0.00 would indicate no correlation and 1.00 would indicate perfect correlation.) There were notable exceptions, however; these hospitals were those furthest from the diagonal line in the chart. For all 226 hospitals that met the minimum volume threshold, the correlation coefficient was 0.52.

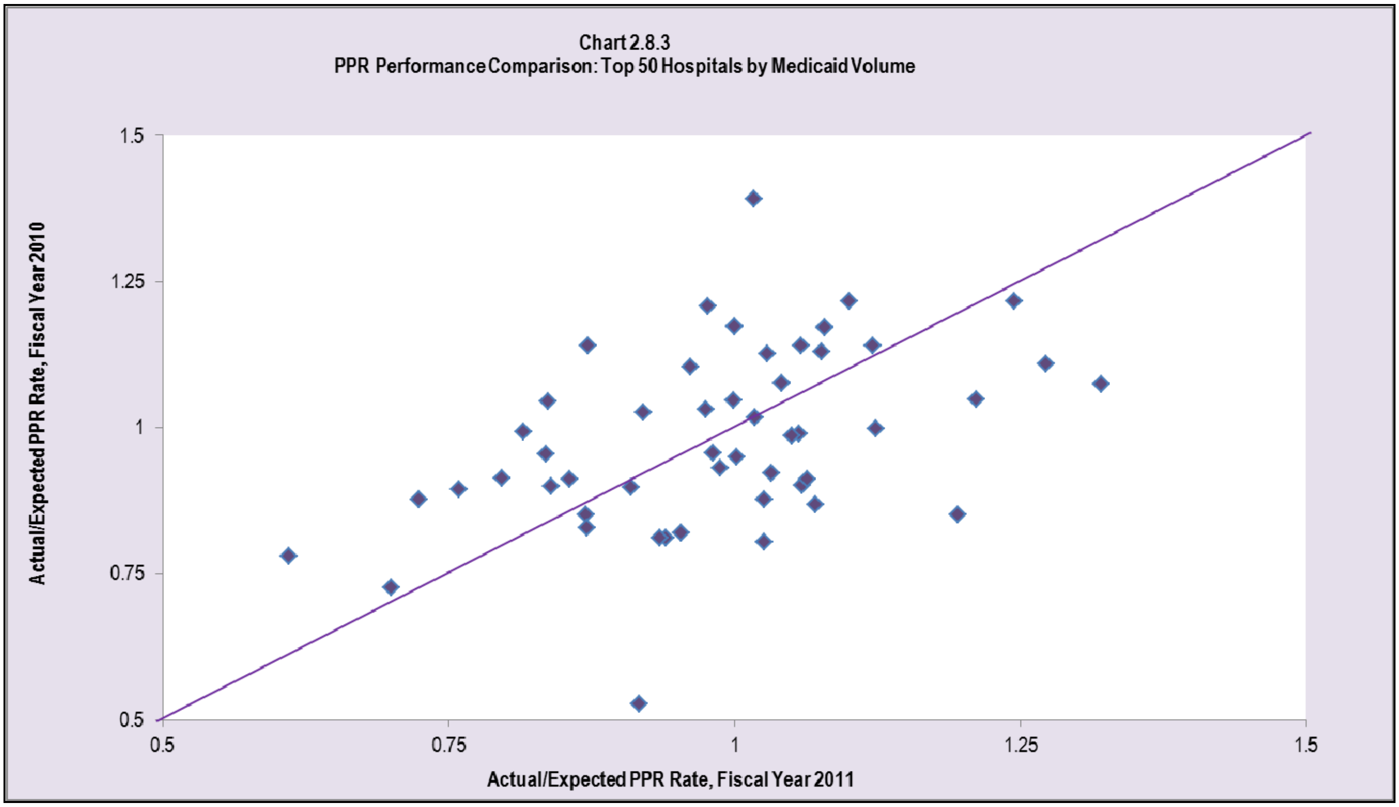
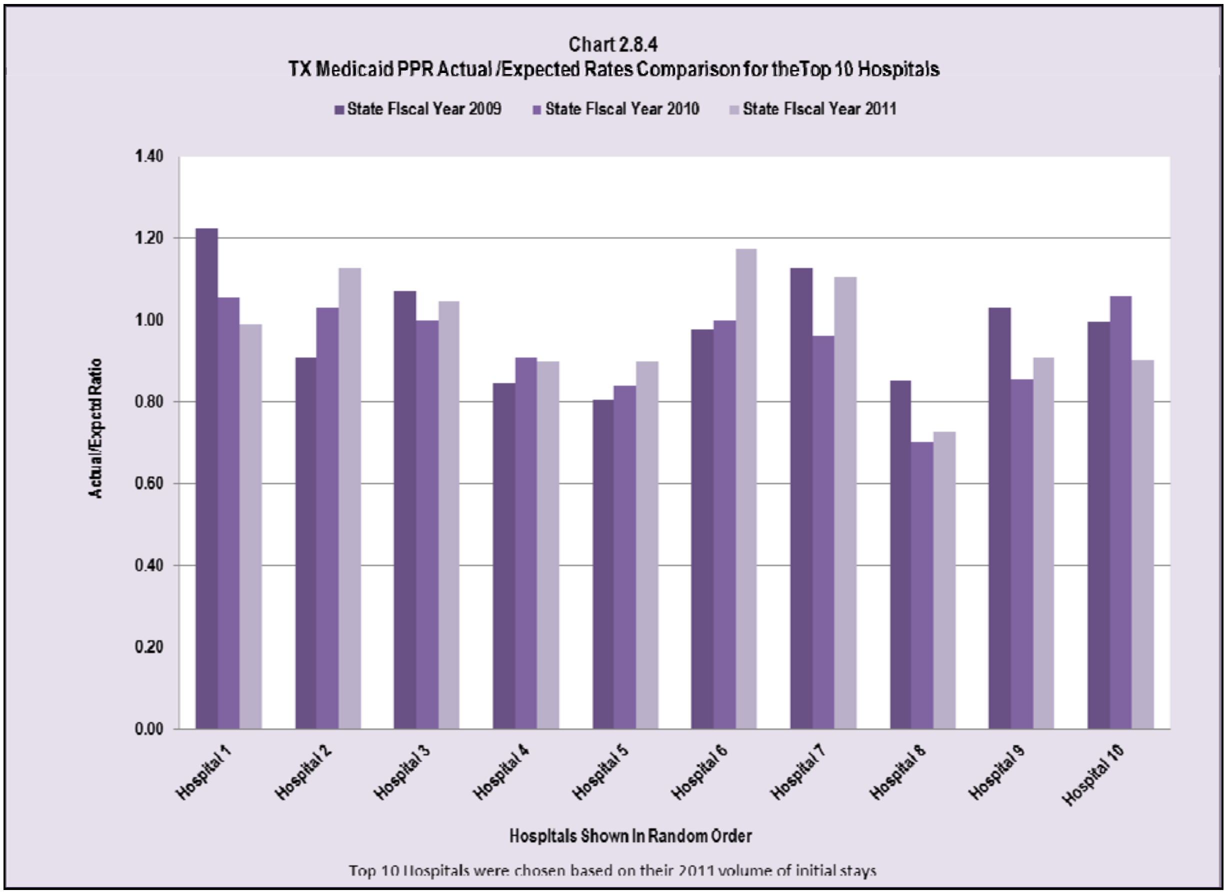


Chart 2.8.4 compares the PPR rates across state fiscal years 2009, 2010, and 2011 for the top 10 hospitals. The hospitals were chosen based on the highest volume of initial admissions in state fiscal year 2011.



3 Frequently Asked Questions

1. What counts as a PPR?

A PPR is a readmission that has a plausible clinical connection to the initial admission and could potentially have been prevented. This definition includes not only readmissions for the same conditions and for surgical complications but also readmissions that are sensitive to ambulatory care outside the hospital, including care for mental health and substance abuse conditions. Readmissions do not count as PPRs if they are likely to have been planned (e.g., major metastatic cancer), likely to have been unavoidable (e.g., HIV/AIDS), clearly involved patient compliance issues (e.g., self-discharge against medical advice), or were clearly unrelated (e.g., hip fracture after heart attack). The PPR count includes both readmissions to the same hospital and readmissions to a different hospital.

2. 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.[19] The APR- DRG algorithm was designed for use with an all-patient population and fits a Medicaid population well. The 3M PPR methodology was designed to be applied to APR-DRGs.

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

The two approaches and the context in which they are applied are quite different, as summarized in Table 3.1. The four main reasons why this approach was chosen were:

- The Texas Legislature specifically required the use of a measure that focuses on "potentially preventable" readmissions, as opposed to readmissions from all causes.
- The PPR methodology used for this report is applicable across multiple conditions, whereas the Medicare method focuses on one condition at a time and has been developed for only three conditions: heart attack, heart failure, and pneumonia.

Table 3.1
Principal Differences Between Medicare and Texas Medicaid Approaches to Measuring Readmissions

	Medicare	Texas Medicaid
Population	Fee-for-service Medicare age 65 and over	Fee for service and managed care Medicaid, all ages except newborns
Readmission window	30 days	15 days
Results based on	July 2007-June 2010	September 2010-August 2011 (SFY 2011)
Conditions included	Heart attack, heart failure, pneumonia	All (with minor exceptions)
Readmissions included	All	Only those with a plausible clinical connection to the initial admission
Methodology	Multivariate regression	Categorical
Methodology developed by	Team of researchers from Yale University research center, for the Centers for Medicare and Medicaid Services (CMS)	3M Health Information Systems
Adjustments for casemix	Age, gender, comorbidities at time of initial admission, medical history within the past year	Base APR-DRG, APR-DRG severity of illness, presence of a major MH/SA comorbidity, age
Availability of results	Hospital-specific data available at www.hospitalcompare.gov	Hospital-specific data provided confidentially only to each hospital

Note: Details of the Medicare methodology are available at www.hospitalcompare.hhs.gov/staticpages/for-professionals/ooc/calculation-of-30-day-risk.aspx and at www.qualitynet.org.

- The Medicare methodology was designed for a Medicare population in terms of the conditions studied, the casemix adjustors applied, and the nature of the data used. The three conditions for which the Medicare methodology was developed are not the most important conditions for a Medicaid population.
- The PPR methodology provides individual hospitals with specific stay-level results that are more useful and easier for non-statisticians to understand than the Medicare methodology.

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

PPRs are identified by comparing the base APR-DRG for the initial stay with the base APR-DRG for the readmission. The risk of readmission, and therefore the hospital's performance in comparison with the statewide average, also depends on the APR-DRG severity of illness 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 therefore advised to code each claim thoroughly so that the APR-DRG assignment is as accurate as possible. Hospitals are not required to list the DRG on the claim as the APR-DRG assignment is done by TMHP as part of the PPR analysis.

Refer to Appendix Section B.2.4 for a discussion of coding completeness in the analytical dataset. A review of the claims data used for this analysis found no obvious issues in coding completeness, except that specialty psychiatric hospitals may not be as thorough in assigning diagnosis and procedure codes as general hospitals serving similar patients.

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

The likelihood of readmission is influenced by the reason for the initial admission, the severity of the patient's condition, the presence or absence of a major mental health or substance abuse comorbidity, and the patient's age (18 and under or 18 years of age and older). Comparisons of subsets of the analytical dataset (e.g., across hospitals) were adjusted for these differences in casemix. Refer to Section 1.5 and Appendix B.6.

6. My hospital provides only pediatric services. How can our PPR rate be compared with that of other hospitals?

One reason why the 3M PPR methodology was used was because of the large volume of pediatric, obstetric and young adult inpatient stays in the Texas Medicaid population. APR-DRGs, which were developed by 3M and the National Association of Children's Hospitals and related institutions, are a highly valid measure of pediatric casemix. The PPR methodology also adjusts for statewide differences in PPR rates between clients 18 and under and adults.

7. Are the results statistically significant?

Results are based on the complete data for SFY 2011, not on a sampling methodology. There is no question of statistical significance so long as inferences are made only about the Texas Medicaid population in SFY 2011. In a different time period, the results might be different, especially if a hospital had a small volume of stays in SFY 2011. To assess the likelihood of this, a categorical statistic called the Cochran-Mantel-Haenszel (CMH) statistic was used. Refer to Section 1.5 and Appendix Section B.6.

8. Why was a multivariate regression analysis not used? Medicare follows this approach.

Both categorical analysis (this approach) and multivariate regression analysis (the Medicare approach) are valid ways to analyze readmissions. A categorical approach is considered by many to be more accessible to people not trained in statistics, enabling a broader understanding and acceptance of the information. This understanding helps hospitals reduce their readmission rates.

9. **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 TMHP on behalf of HHSC. (In some cases, two TPIs for the same hospital were consolidated into a single TPI for purposes of this analysis, for example if the hospital received a new TPI part-way through SFY 2011) Managed care encounters show the hospital's National Provider Identifier (NPI) rather than the Texas TPI. Each managed care encounter was mapped to the appropriate TPI, using data fields such as the NPI, taxonomy, type of bill, and ZIP Code. In the SFY 2011 analysis, there were 204 claims where an appropriate TPI assignment could not be made with a high degree of confidence. These 204 claims, representing less than 1 percent of the managed care encounters in the analytical dataset, were excluded from further analysis.

10. **Can my hospital appeal the finding of individual readmissions being potentially preventable?**

    No. In the approach taken here, what matters is a hospital's overall rate of PPRs, not any particular readmission. This approach recognizes that some readmissions will occur, and focuses instead on the hospital's casemix-adjusted PPR rate in comparison with an appropriate norm.

11. **Why should my hospital be blamed if a readmission results from the fact that the patient or the physician in the community did not comply with the follow-up instructions?**

    The purpose of the analysis is not to assign blame, but rather to inform hospitals about possible quality issues stemming either from inpatient care or from the transfer of care from the hospital to the community. As a primary component in the health-care system of each community, hospitals can help reduce readmission rates and improve quality throughout the continuum of care.

12. **Why is the number of Medicaid stays reported in Section 4 different from the number of Medicaid stays in my hospital's database?**

    There are several possible reasons. 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 were newborns, undocumented aliens, and stays in August 2011 that were not part of a readmission chain that began in the September-July period. In addition, a small number of cases had to be excluded because of data issues. The Excel PPR report being provided to each hospital shows the specific claims that were included and excluded from analysis for each hospital. On a statewide basis, the reasons for excluding claims are discussed in Section 1.2 and Appendix Sections B.1 and B.2.

13. **What are the consequences of having a high PPR rate? Will payment be affected?**

    A high PPR rate is an indication of opportunities to improve the quality of patient care, and in particular, the management of the discharge process and the transition to caregivers in the community. A hospital's rate of PPRs will affect payments starting September 1, 2012, as required by S.B. 7, 82nd Legislature, Special Session.

14. **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.

15. **What can a hospital do to reduce its PPR rate?**

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

    - Health Research and Educational Trust, *Health Care Leader Action Guide to Reduce Avoidable Readmissions* (Chicago: HRET, 2010), available at www.hret.org/care/projects/guide-to-reduce-readmissions.shtml.

- Jenny Minott, *Reducing Hospital Readmissions* (Washington, DC: AcademyHealth, 2008), available at www.academyhealth.org/files/publications/Reducing_Hospital_Readmissions.pdf
- The Institute for Healthcare Improvement has done several reports surveying the literature on reducing readmissions, especially in the adult medical/surgical population. More information is available at www.ihi.org.
- In Texas, the TMF Health Quality Institute is leading a Learning and Action Network that aims to reduce avoidable all cause 30-day readmissions by 20 percent over the next two years. For more information visit http://texasqio.tmf.org/Networks/Readmissions.aspx.

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

The hospital-specific reports are confidential information and will only be shared with authorized personnel at each hospital, per statute H.B. 1218, 81st Legislature, Regular Session.

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

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

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

Section 4 of the hospital specific report, which is not included in the public version of this PPR report, includes hospital-specific data in the same format as Tables 2.2.1, 2.3.1, and 2.4.1. In addition, each hospital will receive a MicrosoftExcel® file that includes detailed information on the claims and encounters that were included and excluded from the analysis.

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

Educational presentations and examples can be downloaded from www.tmhp.com/Pages/Education/Ed_Matl.aspx. Because the same methodology has been used in this year's report as in the previous two years, these materials remain applicable.

20. Who developed the PPR methodology? Who else uses it?

The specific PPR methodology used in this analysis was developed by 3M Health Information Systems. It has also been used by the Florida Agency for Health Care Administration (www.floridahealthfinder.gov), the Utah Department of Health (www.health.utah.gov), the Maryland Health Services Cost Review Commission, the New York Medicaid Program, and the Medicare Payment Advisory Commission.

21. I disagree that seizure should be considered a PPR when the patient was initially admitted for asthma. How do I make my point?

An advantage of the PPR methodology is its transparency, which enables clinicians to understand in detail what circumstances do and do not count as a PPR. In particular, Appendix M of the 3M *PPR Classification System Definitions Manual* lists the admission/readmission APR-DRGs pairs that are considered to be PPRs. 3M Health Information Systems welcomes suggestions to refine the methodology. These may be sent to Gregg Perfetto at gmperfetto@mmm.com.

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

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

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

Yes. The PPR analysis will be repeated annually, as directed by the Health and Human Services Commission and mandated by HB 1218, 81st Legislature, Regular Session.

Appendix A: Terminology[20]

Actual to Expected (A/E) Ratio

The ratio of the actual number of PPR chains compared to the expected number of PPR chains, where the expected number depends on the base APR-DRG, the severity of illness, the patient age, and the presence or absence of a major mental health or substance abuse comorbidity. See Appendix Section B.6.2.

Actual PPR Rate

The actual PPR rate is the number of readmission chains divided by the number of initial admissions, excluding readmissions that are not considered potentially preventable. See Section 1.5.1 and Appendix Section B.5.

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 (generally, the reason for admission) and the fourth digit indicates the severity of illness. See Appendix Section B.3.

Casemix

The casemix refers to a 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, sometimes augmented in PPR analysis with information on patient age and/or the presence of a major MH/SA comorbidity.

Clinically Related

“Clinically related” is defined as a requirement that the underlying reason for readmission be plausibly related to the care rendered during or immediately following a prior hospital admission. A clinically related readmission may have resulted from the process of care and treatment during the prior admission (e.g., readmission for a surgical wound infection) or from a lack of post admission follow-up (lack of follow-up arrangements with a primary care physician) rather than from unrelated events that occurred after the prior admission (broken leg due to trauma) within a specified readmission time interval.

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. See Appendix Section B.6.5.

Comorbidity

Comorbidity is defined either as the presence of one or more disorders or diseases in addition to a primary disease or disorder or as the effect of such additional disorders or diseases.

Expected PPR Rate

The expected rates were based on the PPR experience of all Texas Medicaid patients in SFY 2011. Four important characteristics that are strongly correlated with the incidence of PPRs were taken into account. See Section 1.5.2 and Appendix Section B.6.2.

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 Texas Medicaid.

State Fiscal Year (SFY)

The Texas state fiscal year is September through August.

Health and Human Services Commission (HHSC)

The Texas Health and Human Services Commission is the agency that administers Texas Medicaid.

Initial Admission

For purposes of this analysis, an initial admission is either an admission followed by one or more PPRs or an admission that was not followed by a PPR. Note that this definition differs slightly from that given in the 3M *PPR Classification System Definitions Manual.*

Indirect Rate Standardization

An analytic technique, borrowed from epidemiology, for comparing rates in two or more sub-populations in a way that adjusts for the differences between the sub-populations. For example, in Appendix Section B.2.4.3 the technique is used to compare the number of diagnosis and procedure codes that are billed by freestanding psychiatric hospitals and general hospitals for mental health stays.

Major Mental Health/Substance Abuse (MH/SA) Comorbidity

MH/SA Comorbidities are a list of 218 ICD-9-CM secondary diagnoses that are defined by 3M as indicating a major mental health or substance abuse comorbidity. Examples include schizophrenia, depression, bipolar disease, and alcohol or substance abuse withdrawal or dependence. See Appendix K of the 3M *PPR Classification System Definitions Manual.*

Managed Care Organization (MCO)

A managed care organization is an umbrella term for health plans that provide health care in return for a predetermined monthly fee. Care is typically coordinated through a defined network of physicians and hospitals.

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 B.4.

Minimum Volume Test

In this analysis, groups of stays (e.g., at a particular hospital) were considered low-volume if any of the following three conditions were not met: (1) at least 40 initial admissions; (2) at least five actual PPR chains; and (3) at least five expected PPR chains. See Appendix Section B.6.4.

Medicaid Management Information System (MMIS)

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

Medicare Severity Diagnosis Related Group (MS-DRG)

The Medicare Severity (MS) Diagnosis Related Group is 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 MSDRG algorithm is used by the Medicare program to group Medicare patients. It is a three digit format and does not reflect a fourth digit for severity of illness.

Newborn

For the purposes of this analysis, newborns were defined as all babies that were 0 to 7 days old on the date of admission, as well as a subset of babies' age 8 to 14 days old who had a low birth weight and who may still have complications originating in the prenatal period.

National Provider Identifier (NPI)

The National Provider Identifier is a unique identifier that is assigned by the federal government to hospitals and other providers. It is included on managed care encounters that are submitted by managed care plans to HHSC. It was mapped to the appropriate TPI for the purposes of this analysis. See Appendix Section B.2.3.2.

Patient Control Number (PCN)

The PCN is the unique Medicaid client identifier that is used in this report.

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 that are received by the client are made directly by TMHP on behalf of HHSC.

Pediatric

For purposes of this analysis, "pediatric" was defined as 18 and under. Different definitions may be used for other purposes within Texas Medicaid.

Potentially Preventable Readmission (PPR)

A potentially preventable readmission is a readmission (return hospitalization within the specified readmission time interval) that is clinically related (as defined above) to the initial hospital admission.

PPR Exclusion

An excluded admission is an admission that is excluded from consideration as either an initial admission or a readmission. For example, patients who have a discharge status that indicates that they left against medical advice would be excluded. See Appendix Section B.5.4.

PPR Non-Event

A "non-event" is an admission to a non-acute care facility (e.g., a nursing facility) or an admission to an acute care hospital for sub-acute care (e.g., convalescence). Non-events are ignored by the PPR assignment logic. See Appendix Section B.5.4.

Readmission

A readmission is a return hospitalization to an acute care hospital that follows a prior admission from an acute care hospital. Intervening admissions to non-acute care facilities (e.g., a skilled nursing facility) are not considered readmissions and do not affect the designation of an admission as a readmission.

Readmission Chain

A readmission chain is a sequence of PPRs that are all clinically related (as defined above) to the initial admission. A readmission chain may contain an initial admission and only one PPR, which is the most common situation, or it may contain multiple PPRs following the initial admission.

Readmission Time Interval

The readmission time interval is the time period within which a second admission to the hospital may be considered a readmission. This report used a readmission time interval of 15 days that was chosen by HHSC.

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.

Texas Medicaid & Healthcare Partnership (TMHP)

The Texas Medicaid & Healthcare Partnership (TMHP), a coalition of contractors headed by Xerox Government Healthcare Solutions, carries out the Medicaid FFS and PCCM claims 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 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 analysis. See Appendix Section B.2.3.1.

Appendix B: Methodology

Note: This appendix provides additional information on the methodology used in this report to supplement Section 1.

B.1 Data Sources

The analysis combined FFS, PCCM claims, and managed care encounters.

The criteria for selecting stays were as follows:

- Inpatient hospital claims and encounters
- Date of inpatient admission was SFY 2011 (September 1, 2010 to August 31, 2011)
- Claim or encounters was paid by February 28, 2012
- Paid claims and encounters only
- Final adjusted claims only
- In state and out-of-state hospitals
- Excluded Medicare crossover claims (where Medicaid is the secondary payer behind Medicare)
- Excluded claims for patients who "spent down" their Medicaid eligibility.[21]

The FFS and PCCM claims were from the 2011 Claims Data File (CDF), created by TMHP annually. The CDF reflects well established procedures for validating, organizing, and presenting the data. The dataset of managed care encounters was created especially for this analysis from the Texas Medicaid encounters data warehouse.

Once the FFS, PCCM, and managed care datasets were created, the data was validated and the "analytical dataset" was created that has been used for this report.

B.2 Data Validation

For purposes of studying readmissions, four aspects of data quality are paramount.

- A one-to-one correspondence between an inpatient stay and a record in the analytical dataset
- Unique client identifier
- Unique hospital identifier
- Adequate diagnosis and procedure coding (which affect adjustment for casemix)

Table B.2.1 shows a reconciliation of record counts, starting from the datasets received and ending with the analytical dataset. Out of an initial total of 707,112 records received, 8,128 were excluded because they did not uniquely represent a hospital inpatient stay. Another 334,005 records were intentionally excluded by the design of the study (e.g., because they were for newborns or undocumented aliens). Of the remaining 364,979 records, another 18,964 records, or 5.2 percent, were excluded due to various data issues. The analytical dataset used for the PPR analysis comprised 346,015 stays.

Table B.2.1

Reconciliation of Record Counts

Adjustment	Adjustment Category	Ref.	FFS/PCCM Claims	Encounter Claims	Total Claims
Records received		B.1	467,789	239,323	707,112
Not inpatient bill type	Not unique inpatient stay	B.2.1.1	2	0	2
Informational claim only	Not unique inpatient stay	B.2.1.1	34	0	34
Duplicate claim	Not unique inpatient stay	B.2.1.2	10	5,931	5,941
Consolidated within claim chains	Not unique inpatient stay	B.2.1.3	47	2,104	2,151
Incomplete stay	Data issue	B.2.1.4	562	0	562
Undocumented aliens	Study design	B.2.2.2	78,923	0	78,923
Anomaly re NPI-TPI crosswalk	Data issue	B.2.3.2	0	204	204
Unreliable discharge status—particular MCOs	Data issue	B.2.5.1	0	15,319	15,319
Unreliable discharge status—other	Data issue	B.2.5.1	32	1,908	1,940
APR-DRG grouping errors	Data issue	B.3.3	146	401	547
Newborns	Study design	B.5.1	131,835	66,530	198,365
August 2011, not a readmission	Study design	B.5.2	18,542	11,945	30,487
PPR grouping errors	Data issue	B.5.3	49	343	392
PPR exclusions and non-events	Study design	B.5.4	22,761	3,469	26,230
Analytical dataset			214,846	131,169	346,015
Subtotal—not unique inpatient stay			*93*	*8,035*	*8,128*
Subtotal—study design			*252,061*	*81,944*	*334,005*
Subtotal—data issue			*789*	*18,175*	*18,964*

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 o
2. 707,112 records received minus 8,128 records that did not represent a unique inpatient stay equals 698,984 stays as shown in Table 1.1.1.
3. The count of records excluded from August 2011 reflects a 15-day PPR window. See Section A5.2.

Table B.2.2 shows counts of the dataset records affected by various adjustments as described in the following sections.

Table B.2.2 Adjustments to Analytical Dataset Claim Values				
Adjustment	Ref.	Fee for Service Claims	Encounter Claims	Total Claims
Anchor claim in a claim chain	A.2.1.3	41	641	682
Frequency in bill type set to 1	A.2.5.2	888	-	888
At least one diagnosis code reformatted and/or corrected	A.2.4.2	10	7	17
At least one procedure code reformatted and/or corrected	A.2.4.2	126,708	73,389	200,097

Notes:

1. Only claims within the analytical dataset of 346,015 claims are shown in this table.
2. Some claims may be counted on more than one line in this table.

B.2.1 Defining Complete Hospital Stays

The goal was to ensure a one-to-one match between an inpatient hospital stay and a record in the analytical dataset.

B.2.1.1 Validating Type of Bill

The type of bill (TOB) is a three-digit field that is submitted by the hospital to the payer.[22] A value of 111, for example, is a single admit-through-discharge claim at a hospital for inpatient care. All received values of TOB were examined. A total of 36 claims were excluded, all because the hospital submitted the claim as "information only" and did not request Medicaid payment.

B.2.1.2 Apparent Duplicate Claims

Ten FFS and PCCM claims and 5,931 managed care encounters were excluded because they appeared to be duplicates of other records in the dataset. Exact duplicates were defined as showing identical values for patient, hospital, admission date, discharge date, discharge status, TOB, and billed charges. Potential duplicates were defined as showing identical values for all of the above criteria except billed charges. The existence of duplicate records does not necessarily imply duplicate payments to hospitals, but it does mean that the duplicated records need to be excluded from the analytical dataset in order to prevent double-counting.

B.2.1.3 Claim Chaining

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

- ***Adjustments***—An earlier claim may be corrected ("adjusted") by a later claim. In this case, the claims processing system includes the original claim, a reversal of the original claim, and the new adjusted claim. The criteria used to select the dataset specified that only the final adjusted claim should be included (Section B.1).
- ***Interim claims***—A hospital may submit an interim claim (indicated by bill frequency 2 or 3 and discharge status 30) while a patient remains in the hospital. When the patient is discharged, the hospital submits a final claim with bill frequency 4 and the appropriate discharge status. (Bill frequency is the third digit in the bill type field.)
- ***Late charges***—A hospital may submit a supplementary claim for late charges without adjusting the original claim. A claim for late charges shows bill frequency 5. This can be confusing because the claims processing system then contains two valid claims for the same patient with the same dates of service.

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, TOB, 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 CDF used for this report had already been processed through claim chaining while the managed care encounter file had not. Both files were checked for potential claim-chaining situations and then the claim-chaining algorithm was applied. Situations that were not handled by the algorithm were reviewed on an individual basis. In most cases, an examination of the admit dates, bill types, discharge statuses, dates of service, diagnoses, and other data allowed determination of the claim status with a high degree of confidence. A total of 2,833 claims were chained into 682 stays. To prevent double-counting, the other 2,151 claims were excluded from the analytical dataset (Table B.2.1). Table B.2.2 shows that the data values for the 682 “anchor” claims were adjusted to reflect the entire stay. In the Claims Data File, 47 claims were chained, and 42 stays were situations involving late charges.

B.2.1.4 Incomplete Stay

A total of 562 claims were excluded because the claims did not clearly show the discharge date (Table B.2.1). These incomplete stays can occur because the client lost Medicaid eligibility during the stay, because the client was still a patient when the CDF was created, or because of billing errors by the hospital.

B.2.1.5 Same-Day Stays

After claim chaining, there were 337 stays 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. For 16 stays, a decision was made to err on the side of caution and reclassify the discharge status to acute care transfer. (See also Section B.2.5.1.) 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. Otherwise these situations could have been classified as PPRs.

B.2.1.6 Claims with Low Charges

Hospital care is very expensive. On average, Texas hospitals charge $7,500 for a day of inpatient care.[23]

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.

This validation step was performed after the above steps. No situations were found where the claim should have been excluded because of an obvious anomaly. Most of the claims with low charges were for psychiatric care, and average charges per day were usually close to the $500 threshold.

B.2.2 Unique Identification of Patients

B.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/PCCM claims and managed care encounters. In general, the quality of this data field was excellent. There were some claims where a newborn baby had the same client number as the mother, but these situations did not affect the record counts because all newborns were excluded from the analytical dataset. The identification of PPRs was performed using the patient identifier, hospital identifier, and dates of service as key fields. If a patient changed managed care plans, or moved between the FFS, PCCM, or managed care sectors, then the PPR count reflected the patient's Medicaid eligibility during the initial stay.

B.2.2.2 Undocumented Aliens

Medicaid pays for inpatient care received by undocumented aliens in certain emergency circumstances. These claims were excluded from the analysis because the patients were not eligible for Medicaid on a continuing basis. Therefore, any readmissions likely would not have been processed in the MMIS. There were 78,923 FFS/PCCM claims excluded for this reason (Table B.2.1). The vast majority of these claims were for childbirth.

B.2.2.3 Corrected Client Gender

Nine managed care claims had the patient's gender listed as "U=unknown," which is not a valid value for purposes of APR-DRG and PPR grouping. These values were corrected to M or F based on other information on the claim. Seven of the claims ended up being excluded from the analytical dataset for other reasons.

B.2.3 Unique Identification of Hospitals

B.2.3.1 Fee for Service

In the CDF of FFS and PCCM stays, hospitals are uniquely identified by the Texas Provider Identifier (TPI) in the MMIS. Each TPI comprises of a seven-digit base ID and a two-digit suffix. For example, 123467-01 might be a hospital's TPI for the hospital itself while 1234567-02 might be the ambulatory surgical center at the same hospital. It is not uncommon for a single hospital to have multiple TPIs. The CDF consistently shows the appropriate TPI for inpatient hospital care, in large part because the TPI is considered in calculating payment on FFS and PCCM claims. Each TPI is associated with a provider name and a provider specialty, e.g., "hospital, non-profit, acute, 1-50 beds."

B.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 204 claims, a TPI could not be assigned to an NPI with a high degree of confidence. These encounters were omitted from subsequent analysis.

B.2.4 Diagnosis and Procedure Coding

B.2.4.1 Importance of Coding

Rates of readmission depend not only on the reason for the initial admission but also on the severity of the patient's condition during the initial admission. 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), as discussed in Section B.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.

B.2.4.2 Valid Values

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

Other anomalies can arise when a hospital submits a diagnosis code or procedure code that is not valid for the date of discharge. These anomalies typically arise near October 1 of each year, which is the

Nationwide revision date for the ICD-9-CM codeset. In cases where it was obvious what the appropriate code should have been, the code value was adjusted, usually by adding or deleting a fifth digit to a diagnosis code.

Only 10 claims required the adjustment of at least one diagnosis code. A total of 200,097 claims required an adjustment of at least one procedure code, but in almost all cases the adjustment was simply to delete a leading zero.

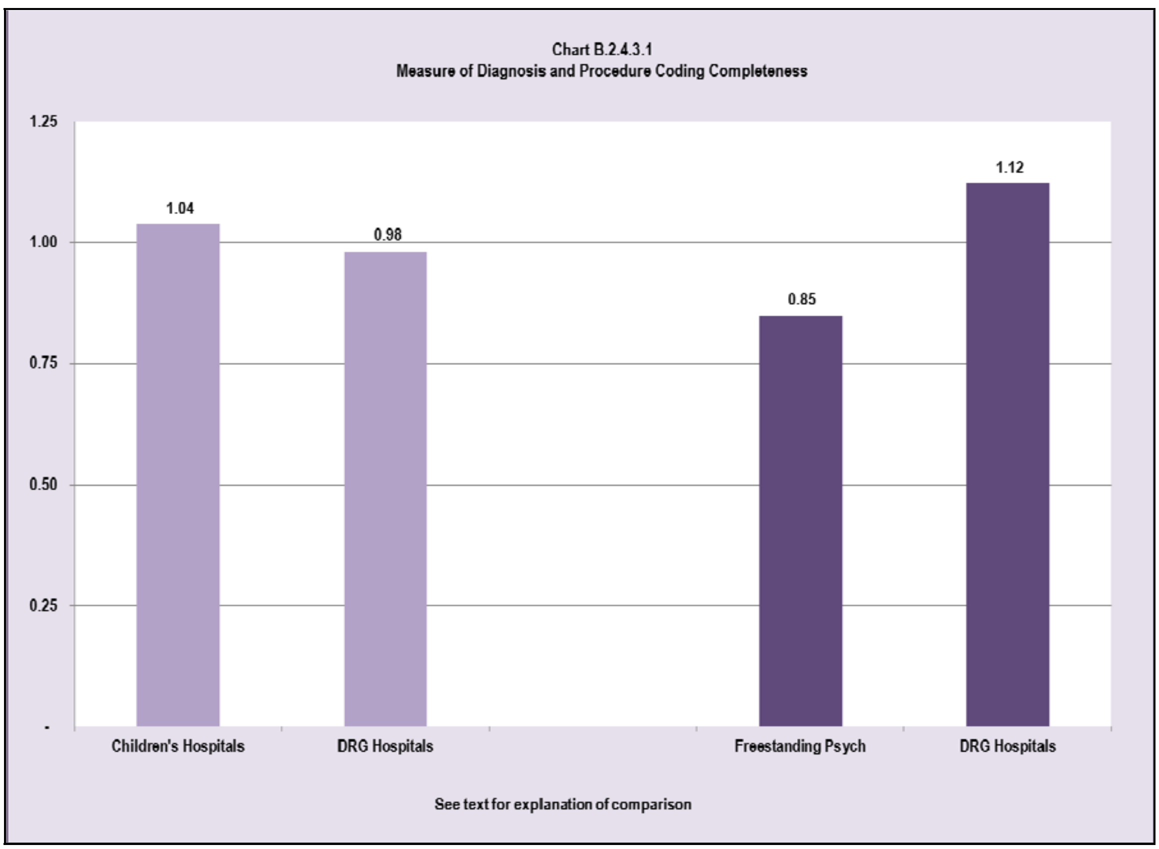
B.2.4.3 Coding Completeness

Within the FFS and PCCM sectors, Texas Medicaid reimburses acute care hospitals based on MS-DRGs. These hospitals have strong financial incentives to be thorough in including diagnosis and procedure codes on claims, since these codes drive the DRG assignment for the claim. Medicaid reimburses other hospitals on cost reimbursement principles using the "TEFRA" reimbursement methodology, which is a reference to the federal Tax Equity and Fiscal Responsibility Act of 1982. Primarily children's hospitals, rural, and state-owned teaching hospitals are reimbursed under the TEFRA methodology. 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.

One measure of coding completeness is simply the average number of diagnosis and procedure codes per claim. This measure is useful if the casemix is very similar between DRG hospitals and TEFRA hospitals. A more careful approach would be to adjust for the differences in the types of clients. Therefore, TMHP did a casemix-adjusted comparison, making use of the fact that every claim shows a principal diagnosis. The principal diagnosis typically drives the assignment of the base APR-DRG.[24] (In some cases, the principal operating room procedure drives the assignment of the base APR-DRG.) The average count of diagnoses and procedures for each base APR-DRG was calculated and used as a norm to compare DRG and TEFRA hospitals.[25] The children's hospitals were compared with pediatric stays at the general hospitals while the specialty psychiatric hospitals were compared with psychiatric stays at the general hospitals.

The results, as shown in Chart B.2.4.3.1 and Table B.2.4.3.1, suggested that children's hospitals tend to code more completely than the acute care general hospitals. The children's hospitals reported an average of 4.93 diagnosis and procedure codes per claim (Table B.2.4.3.1). Based on the mix of base APR-DRGs at these hospitals, an average of 4.76 codes would have been expected. The ratio of actual to expected code counts per claim was therefore 1.04. For acute care general hospitals treating pediatric patients, the actual number of codes was 3.77 but the expected number was 3.84 so the actual/expected ratio was 0.98. Although it remains possible that even more diagnosis and procedure codes should have been reported at the children's hospitals, the chart implies that there was no obvious coding deficit in coding in the children's hospitals relative to the general hospitals.

Freestanding psychiatric hospitals reported many fewer diagnosis and procedure codes than would be expected given their mix of base DRGs. On average, freestanding psychiatric hospitals reported 3.19 codes per claim, whereas 3.75 would be expected. Acute care general hospitals reported 5.19 codes per claim, or more than the 4.63 expected. The actual/expected ratio was therefore 1.12. It was also noteworthy that 5.19 codes per claim at the general hospitals were 63 percent more than the 3.18 average at the freestanding hospitals. The differences in both absolute terms and relative to expectations suggest that coding was relatively incomplete in the freestanding psychiatric hospitals.



When coding is incomplete, the average casemix of patients can be understated. That, in turn, would understate the expected PPR rates, resulting in reported PPR performance ratios that are worse than they may be in reality. If there is a bias (where "bias" in used in the statistical sense), then its magnitude cannot be determined without better data from these hospitals. The magnitude may be modest, however, because Table 2.5.1 did not show large differences in PPR rates between severity levels for the most common MH/SA conditions.

Table B.2.4.3.1
Actual and Expected Diagnosis and Procedure Coding by DRG Hospitals, Children's Hospitals and Freestanding Psych Hospitals

Hospital Group	DRG Group	Total Stays	Total Diagnosis and Procedure Codes	Average Diagnosis/Procedure Codes per Stay		
				Actual	Expected	Actual/Expected
DRG hospitals	Psychiatric	16,167	83,900	5.19	4.63	1.12
Freestanding psych	Psychiatric	16,056	51,150	3.19	3.75	0.85
All hospitals	Psychiatric	32,223	135,050	4.19	4.19	1.00
DRG hospitals	Pediatric	64,693	244,207	3.77	3.84	0.98
Children's hospitals	Pediatric	24,635	121,549	4.93	4.76	1.04
All hospitals	Pediatric	89,328	365,756	4.09	4.09	1.00

Notes:

1."Mental health" refers to APR-DRGs 750 to 777.

2. "Pediatric" refers to patients under 18 years old.

3. The calculation of the actual to expected ratios was performed as follows:

a—For each base APR-DRG, the statewide average count of diagnoses and procedures was calculated.

b—The statewide average diagnosis/procedure counts were multiplied by the counts for each base APR-DRG within each hospital group (e.g., DRG hospitals or children's hospitals) to arrive at the expected diagnosis/procedure counts for that hospital group.

c—Actual/expected ratios were then calculated. By definition, the A/E ratio = 1.00 across all hospitals.

d—This analytical technique is known as indirect rate standardization.

B.2.5 Other Data Validation Steps

B.2.5.1 Discharge Status

In the discharge status field, the hospital indicates whether the patient went home, died, left against medical advice, was transferred to another hospital, was transferred to another setting (such as a nursing home), or remains in the same hospital. For PPR analysis, this field is essential. Deaths, discharges against medical advice, and acute care transfers are excluded from the PPR analysis.

In general, the data in this field were in line with expectations. Two managed care plans, however, showed over 99 percent of their patients discharged home, with literally zero transfers, deaths, or discharges against medical advice. Such a pattern is highly unlikely. Because this important field was suspect, all 15,449 claims from these plans were excluded from the dataset.

Another 32 fee-for-service claims and 1,908 managed care encounters were excluded due to various other issues with regard to discharge status. Most commonly, the discharge status was 30 (still a patient) but there was no subsequent claim.

B.2.5.2 Type of Bill

As described in Section B.2.1.1, one purpose of the TOB 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. In the analytical dataset these values were changed to 111 to show that the record now represents a complete admit-through-discharge claim.

B.3 Grouping by APR-DRG

B.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.[26]

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

B.3.2 Base DRG and the Severity of Illness

An advantage of APR-DRGs for analyses such as the present study 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 PPR software includes logic to assign a stay to an APR-DRG. This assignment is identical to what stand-alone APR-DRG software would do, with two exceptions. First, some tracheostomy stays are re-assigned from the tracheostomy APR-DRG to an APR-DRG that reflects the underlying condition (e.g., stroke or pneumonia). Second, eight APR-DRGs have been split into two. The split allows the PPR logic to differentiate more finely between readmissions that were likely planned (e.g., cardiac catheterization following an initial admission for cardiac ischemia) and those that were likely unplanned (e.g., cardiac catheterization with a diagnosis of acute ischemia).

Version 29 of the combined APR-DRG and PPR software package was used for this analysis. Although this version was released in November 2011, it can be appropriately used for claims with earlier dates of service.

B.3.3 Validation of APR-DRG Assignments

About 0.08 percent of stays in the analytical dataset grouped to an error DRG, either "ungroupable" or the principal diagnosis code listed was not appropriate as a principal diagnosis (Table B.2.1).This percentage is in line with similar experience elsewhere.

There are 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.

B.4 Medicaid Care Category

Medicaid Care Category (MCC) is a categorization algorithm developed by TMHP for purposes of this analysis. It is intended to result in a manageable list of categories (eleven) that are aligned with both the policy areas of a typical Medicaid program and the internal organization of a typical hospital. Table 1.1.1

shows the number of stays in the analytical dataset in each care category. Pediatric patients were defined as 18 and under; the categories of medical, surgical, etc. were defined by the APR-DRG; and patients in the obstetric category could 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).

B.5 PPR Analysis

B.5.1 Overview

The PPR methodology developed by 3M Health Information Systems is separate and quite distinct from other methods of measuring readmissions. Refer to Section 1.4 for further information on the PPR methodology. The logic for defining PPRs is well documented in R.F. Averill et al., Potentially Preventable Readmissions Classification System Definitions Manual (Wallingford, CT: 3M Health Information Systems, 2010). The 3M methodology has been used in the Florida, Maryland and Utah all-payer populations, the New York Medicaid population, and the Medicare population.[27]

B.5.2 Time Frame

A "PPR chain" is created when more than one readmission follows an initial admission. For example, a two-day stay on January 1 followed by a two-day readmission on January 10 followed by another two-day readmission on January 20 constitutes a single PPR chain. To count in a chain, each readmission must be within the PPR window (e.g., 15 days) of the discharge date of the previous stay. In this example, the third stay counts in the PPR chain because it occurred within 15 days of the second stay, even though more than 15 days had passed since the discharge from the first stay.

Although the analytical dataset comprises 12 months of data, the PPR results are based only on 11 months of data. That is, for admissions in the September-July period TMHP looked for readmissions in the September-August period. The use of a one-month "run-out" period minimizes the likelihood that readmissions were omitted from the analytical dataset. An example of such an omission would be if a patient were admitted on July 31, discharged on August 20, and then readmitted on September 1. Similarly, if a patient were admitted in July, readmitted in August and readmitted again in September, then the PPR results would count the readmission chain accurately but miss the second readmission in the count of total readmissions.

B.5.3 PPR Grouping Errors

About 0.1 percent of stays in the analytical dataset were excluded because the PPR software could not assign it as an initial stay or a readmission.

B.5.4 PPR Exclusions and Non-Events

The 3M PPR methodology used in this analysis differs from all-cause readmission methodologies in several ways. One important difference is the emphasis on whether there is a plausible clinical connection between the initial admission and the readmission. The "PPR exclusion" logic in the software identifies situations where it is very likely that a readmission was either planned (e.g., chemotherapy for major metastatic cancer), unpreventable (e.g., infections for HIV/AIDS patients), or beyond a hospital's influence (e.g., patient left against medical advice).

Other stays were excluded from the study under the category of "non-event." These include admissions into an acute care hospital for non-acute care services such as rehabilitation, aftercare, and convalescence. Non-events also include transfers to another acute care hospital.

B.6 Casemix Adjustment of PPR Rates

B.6.1 Overview

Differences among hospitals and other patient groupings (e.g., by health-care delivery method) 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 B.6.2 describes how expected values were developed.

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

This report has two features to help hospitals guard against over-interpretation of results based on small volumes. First, A/E ratios are reported only for patient groupings that meet a minimum volume test, which is discussed in Section B.6.4. Second, for each A/E ratio that is reported, TMHP 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 Texas Medicaid inpatients in SFY 2011. This test is discussed in Section B.6.5.

B.6.2 Development of Expected Rates

Expected rates were based on the PPR experience of all Texas Medicaid patients in SFY 2011. Four important characteristics that are strongly correlated with the incidence of PPRs 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 B.3.2).
- ***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 B.3.2).
- ***Age:*** Pediatric (18 and under) or adult (18 and over).
- ***MH/SA co-morbidity:*** For medical-surgical stays, whether or not the patient had a major mental health or substance abuse condition as a comorbidity. (A MH/SA comorbidity is not strongly correlated with the PPR rate when the initial admission is MH/SA or obstetrics.)

For each combination of APR-DRG, severity of illness, and age, the actual statewide PPR rate was established as the norm, except for obstetrics, for which no distinction by age was made. The first three columns of Table B.6.2.1 illustrate these norms. The MH/SA comorbidity characteristic was accounted for as an adjustment to the norm for medical/surgical stays only (not MH/SA or obstetrics). Table 2.5.2 documents the MH/SA adjustment factors that were used.

Each initial admission was assigned an expected PPR rate, which is (i) the norm for the applicable APR-DRG, SOI, and age combination, times (ii) the applicable MH/SA adjustment factor. The expected rate for an individual initial admission represents the estimated probability that it would be followed by a PPR. For a group of initial admissions, the sum of these estimated probabilities is the expected number of readmission chains, and the average is the expected PPR rate. Table B.6.2.1 illustrates this process for a medical/surgical DRG, a mental health/substance abuse DRG, and an obstetric DRG.

Table B.6.2.1					
Illustration of Norm Development and Calculation of Expected Values					
Patient Characteristics			Norms		Estimated Probability of a PPR
APR-DRG	Age (Category)	MH/SA Co-morbidity?	Average Statewide PPR Rate	MH/SA Adjust. Factor	
420-2 Diabetes	Pediatric	No	10.0%	0.989	9.89%
420-2 Diabetes	Adult	No	14.3%	0.976	13.94%
420-2 Diabetes	Pediatric	Yes	10.0%	1.481	14.81%
420-2 Diabetes	Adult	Yes	20.0%	1.141	22.82%
751-1 Major Depression	Pediatric	N/A	10.0%	1.000	10.00%
751-1 Major Depression	Adult	N/A	13.3%	1.000	13.33%
540-1 Cesarean Section	N/A	N/A	1.5%	1.000	1.50%

Notes:

1. For medical/surgical APR-DRGs, the estimated probability of a PPR depends on the base APR-DRG, the severity of illness, patient age (pediatric vs. adult) and the presence of absence of major mental health/substance abuse comorbidity as defined in the PPR algorithm.
2. For MH/SA stays, the estimated probability of a PPR depends on the base APR-DRG, the level of severity and the patient age.
3. For obstetric stays, the estimated probability of a PPR depends on the base APR-DRG and the severity of illness.

B.6.3 Comparing PPR Rates across Years

In general, it is inadvisable to compare PPR rates without adjusting for differences in casemix. This caution also applies to comparing PPR rates across time periods. Section 2.8 noted that the Texas Medicaid PPR rate was 3.576 percent in SFY 2009, 3.704 percent in SFY 2010, and 3.678 in SFY 2011. (Extra decimal places are shown for clarity.) In principle, this could have occurred because "real" PPR performance while casemix was unchanged, because casemix increased while "real" PPR performance was unchanged, or a combination changed of the two factors.

Table B.6.3.1 shows a simplified and hypothetical example of a factor decomposition between Year 1 and Year 2. In essence, each year's PPR rate is a weighted average of the individual PPR rates for every unique combination of four-digit APR-DRG, age group, and major MH/SA comorbidity. To control for changes in casemix, the number of stays in Year 2 for each unique combination of APR-DRG, age group, and MH/SA comorbidity is used as the weights for calculating PPR rates in both Year 1 and Year 2. Any change must therefore reflect only changes in "real" PPR performance and not changes in casemix.

This analytical technique was borrowed from the calculation of price indexes in economics.[28] Use of Year 2 weights is a Paasche index. Use of earlier year weights would be a Laspeyres index and would generate a different result. In Section 2.8, a Paasche index was used to split the increase of 0.128 percentage points between SFY 2009 and SFY 2010 into a 0.034 percentage point increase representing "real" change in PPR rates and a 0.094 percentage point increase representing change in casemix. Strictly speaking, the two factors are multiplicative, not additive. This distinction can be safely ignored when the overall change is small. If a Laspeyres index had been used, the split would have been a 0.019 percentage point increase representing "real" change in PPR rates and a 0.110 percentage point increase representing casemix change. Under either approach, most of the year-to-year change in the PPR rate was due to casemix change. The change in the PPR rate between 3.704 in SFY 2010 and 3.678 in SFY 2011 was sufficiently small—0.026 percentage point in total—that a factor decomposition was not performed.

Table B.6.3.1

Hypothetical Illustration of Using Index Values to Compare PPR Rates Across Time Periods

			A	B	C	D	E	F	G	H	I
APR-DRG	Age Group	MH/SA Comorbid	Year 1 Initial Admits	Year 1 Volume Weight	Year 1 PPR Rate	Year 1 Wt'd Average (B x C)	Year 2 Initial Admits	Year 2 Volume Weight	Year 2 PPR Rate	Year 2 Wt'd Average (F x G)	Year 1 PPR Rate x Year 2 Vol Wt (C x F)
420-2 Diabetes	Ped	No	5	0.0143	1.9%	0.000278	40	0.1212	0.5%	0.000609	0.002361
420-2 Diabetes	Adult	No	10	0.0286	5.0%	0.001433	35	0.1061	2.6%	0.002791	0.005319
420-2 Diabetes	Ped	Yes	15	0.0429	9.1%	0.003896	20	0.0606	0.0%	-	0.005510
420-2 Diabetes	Adult	Yes	20	0.0571	11.0%	0.006272	10	0.0303	5.7%	0.001732	0.003326
751-1 Maj Dep	Ped	Yes	100	0.2857	8.6%	0.024455	10	0.0303	7.8%	0.002363	0.002594
751-1 Maj Dep	Adult	Yes	150	0.4286	8.7%	0.037474	15	0.0455	11.4%	0.005178	0.003974
540-1 C-Section		No	50	0.1429	1.1%	0.001544	200	0.6061	1.2%	0.007433	0.006550
Total			350	1.0000		0.075352	330	1.0000		0.020106	0.029633
					Year 1 PPR Rate:	7.54%		Year 2 PPR rate:		2.01%	
					Year 1 PPR rate if casemix were the same in Year 1 as it was in Year 2:						2.96%

Explanation:

1. In this example, PPR rates in columns C and G are realistic but volume numbers in columns A and E have been simplified and exaggerated to highlight differences.
2. The actual PPR rate drops sharply from 7.54% in Year 1 to 2.01% in Year 2.
3. However, there has been a sharp change in casemix. Year 1 has many fewer Major Depression stays but many more Diabetes and Cesarean Section stays. In general, the PPR rate for Major Depression is much higher than the PPR rate for Cesarean Section. So the question to be addressed is: how much of the change in the overall PPR rate is due to the change in casemix and how much is due to changes in PPR rates at the DRG level?
4. In Columns D and H, the overall PPR rate is the weighted average of the individual PPR rates, using the volumes of initial admissions to generate the weights.
5. Column I controls for changes in casemix by multiplying the Year 1 individual PPR rates by the Year 2 volume weights. The result is a weighted average of 2.96%.
6. The interpretation is as follows: After controlling for changes in casemix, the PPR rate decreased from 2.96% in Year 1 to 2.01% in Year 2.
7. As noted in the text, the actual effect of controlling for casemix change was much lower than in this hypothetical illustration.

B.6.4 Minimum Volume Test

For very low volumes, the A/E ratio is subject to large swings resulting from random events and should not be reported or tested for significance. Table B.6.4.1 shows several scenarios. The first case is a group of 40 admissions from the patients with a single combination of APR-DRG, severity of illness, and age combination where the statewide PPR rate is 5 percent. A chance difference of one readmission changes the A/E ratio by 50 percent, from 1.0 to 0.5 in the case of reduction or 1.0 to 1.5 in the case of an increase. There are no intermediate possibilities; it is impossible for this group to have an A/E ratio of 0.9 or 1.1.

The second and third examples show how the expected rate also can affect the degree of volatility in the A/E ratio. This is why the number of readmission chains 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 PPR 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 initial admissions increases or as the expected or actual PPR rates increase, it is apparent that one more or one fewer PPR chain 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. To discourage over-interpretation of the results, the report includes the A/E ratio only if (1) the group of stays had at least 40 initial admissions, (2) there were at least 5 actual readmission chains, and (3) there were at least 5 expected readmission chains. These levels follow precedents established by Maryland and Florida.

Table B.6.4.1

Scenarios Illustrating Fluctuation of A/E Ratio When Volume Is Low

Group Size	Expected		Actual		A/E Ratio
	Rate	# PPRs	# PPRs	PPR Rate	
Example 1: 40 initial admissions and an expected PPR rate of 5%					
40	5%	2	1	2.5%	0.5
			2	5.0%	1.0
			3	7.5%	1.5
Example 2: 50 initial admissions and an expected PPR rate of 2%					
50	2%	1	0	0.0%	0.0
			1	2.0%	1.0
			2	4.0%	2.0
Example 3: 50 initial admissions and an expected PPR rate of 5%					
50	8%	4	2	4.0%	0.5
			3	6.0%	0.8
			4	8.0%	1.0
			5	10.0%	1.3
			6	12.0%	1.5
Example 4: 100 initial admissions and an expected PPR rate of 5%					
100	5%	5	2	2.0%	0.4
			3	3.0%	0.6
			4	4.0%	0.8
			5	5.0%	1.0
			6	6.0%	1.2

B.6.5 Statistical Test of Significance

The significance of hospital-specific actual/expected rates was tested using the Cochran-Mantel-Haenszel (CMH) test of conditional independence.[29] The CMH statistic is an estimate of how likely it would be for a hospital's A/E ratio to be 1.00 in reality yet for the observed difference from 1.00 to be as wide as it is. Other things equal, the CMH statistic is higher when the number of stays is large and/or the observed A/E ratio is further away from 1.00. For the CMH statistics in this report, the thresholds are 2.7055 at the 90 percent confidence level and 3.8415 at the 95 percent confidence level. Because the study compares 226 hospitals using a 10 percent confidence level, 22 hospitals would be expected to show statistically significant differences from zero due simply to chance. (This is an example of the multiple comparisons issue in statistics.) A description of the application of the CMH test to indirectly standardized PPR rates can be found in the methodology documentation provided by the Florida Agency for Health Care Administration (reported at www.floridahealthfinder.gov).[30]

Notes

[1] Results in this analysis 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.

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

[3] Refer to Texas Health and Human Services Commission, *Hospital Services Handbook* (Austin: HHSC, 2010), p. HS-9.

[4] "Newborns" were defined as all babies 0 to 7 days old on the date of admission as well as a subset of babies age 8 to 14 days old, that is, those with low birthweight who may still have had complications originating in the perinatal period. See Richard F. Averill, Norbert I. Goldfield, Jack Hughes et al., *3M™ APR DRG Classification System: Definitions Manual,* Version 28.0 (Wallingford, CT: 3M HIS, 2010), p. 26.

[5] In a few cases, Medicaid acts as the primary payer when dually eligible clients exhaust or are ineligible for the Medicare inpatient hospital benefit. These stays are included in the analytical dataset used for this report.

[6] Gerard F. Anderson and Earl P. Steinberg, "Hospital Readmissions in the Medicare Population," *New England Journal of Medicine,* 311:21 (Nov. 22, 1984), pp. 1349-1353.

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

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

[9] Section 1.4 is a summary of the PPR methodology developed by 3M Health Information Systems and used for this analysis. No changes were made to the methodology for this analysis. Detailed information about the methodology is available in the Richard F. Averill, Norbert I. Goldfield, Jack S. Hughes et al., *Potentially Preventable Readmissions Classification System Definitions Manual* (Wallingford, CT: 3M, October 2011). It is available to Texas hospitals that contact 3M at gmperfetto@mmm.com.

[10] Much of the methodology presented in this section and Section 1.6 is based on the methodology used in Florida. Refer to the references above.

[11] 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.

[12] Agresti, Introduction to Categorical Data Analysis, pp. 114-15.

[13] The $95.5 million figure is for PPRs that followed initial admissions in the 11-month period from September 2010 through July 2011. Annualized, the figure would be $104.2 million, or 3.1 percent of $3.32 billion from Table 1.1.1.

[14] Stephen F. Jencks, Mark V. Williams and Eric A. Coleman, "Rehospitalizations among Patients in the Medicare Fee-for-Service Program," *New England Journal of Medicine,* 360:14 (April 2, 2009), pp. 1418-1428.

[15] Goldfield et al, "Identifying Potentially Preventable Readmissions."

[16] Agresti, Introduction to Categorical Data Analysis, p. 343.

[17] "Major" is as defined in Appendix K of 3M Health Information Systems, *Potentially Preventable Readmissions Classification System Definitions Manual* (Wallingford, CT: 3M Health Information Systems, 2011).

[18] Because the study includes multiple comparisons among hospitals, the reader should bear in mind that about 10% of the hospitals would show a statistically significant difference from 1.00 simply because of random variation. See Martin Bland, *An Intoduction to Medical Statistics,* 3rd edition (New York: Oxford University Press, 2000), pp. 148-151.

[19] Kevin Quinn and Connie Courts, *Sound Practices in Medicaid Payment for Hospital Care* (Hamilton, NJ: Center for Health Care Strategies, 2010).

[20] Some definitions in this appendix are drawn from 3M Health Information Systems, *Potentially Preventable Readmissions Classification System: Definitions Manual* (Wallingford CT: 3M HIS, October 2011). All copyrights in and to the 3MTM Software are owned by 3M. All rights reserved.

[21] This exclusion was also in effect for the SFY 2009 and SFY 2010 analyses.

[22] Strictly speaking, the bill type field comprises four digits, including a leading zero. TMHP follows convention in referring only to the three meaningful digits. Refer to Ingenix Inc., *Uniform Billing Editor* (Salt Lake City, UT: Ingenix, August 2010), pp. II-12 to II-109.

[23] The figure includes all patients (including Medicare, Medicaid, commercial payers and uninsured) but excludes newborn days. AHA, *Hospital Statistics,* p. 137.

[24] Using the full APR-DRG—base DRG plus the severity of illness—would be circular reasoning. Assignment of the severity of illness depends in part on the number of secondary diagnoses on a claim. The principal diagnosis, by contrast, must be present on every claim. An operating room procedure would also be important to be coded on any claim.

[25] This analytic technique is known as indirect rate standardization. See Goldfield et al., "Identifying Potentially Preventable Readmissions," p. 78.

[26] Quinn, "New Directions"; Quinn and Courts, Sound Practices, pp. 6-7.

[27] For more information on the Florida analysis, refer to Goldfield et al., "Identifying Potentially Preventable Readmissions."

[28] Roger Porkess, *The HarperCollins Dictionary of Statistics* (New York: HarperCollins, 1991), pp.111-114.

[29] Agresti, Categorical Data Analysis.

[30] Refer to www.floridahealthfinder.gov/Researchers/Reference/Methodology/Methodology.aspx#hreadmit.