HOSPITAL PERFORMANCE REPORT
49 COMMON MEDICAL PROCEDURES AND TREATMENTS

Report Period: Federal Fiscal Year 2003
(October 1, 2002 through September 30, 2003)

Technical Notes

for

Western Pennsylvania

Central and Northeastern Pennsylvania

Southeastern Pennsylvania

Includes Methodology for Procedure and Treatment Groups in the Printed Report and on the Council's Web Site

The Pennsylvania Health Care Cost Containment Council
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Technical Notes
FFY 2003 Hospital Performance Report

OVERVIEW

This document serves as a technical supplement to the *FFY 2003 Hospital Performance Report* (HPR). The Technical Notes describe the methodology of the analyses and outline the development of the report format and presentation. This document also includes data tables containing information about the statewide results and cases excluded from analysis.

The current report presents the following quality measures for adult (≥ 18 years of age) cases in 49 procedure and treatment groups (see Data Tables C1 and C2 for statewide results):

- ***Risk-adjusted Mortality Rating***—In-hospital Mortality was identified in the patient discharge record as a discharge status of "20."
- ***Risk-adjusted Length of Stay***—Length of Stay was calculated by subtracting the admit date from the discharge date.
- ***Risk-adjusted Length of Stay Outlier Rates and Ratings***—Length of stay outliers (short/long) were those hospitalizations below the 5th or above the 95th percentile of all statewide hospitalizations.
- ***Risk-adjusted Readmissions for Any Reason Rating***—*A* hospital readmission was defined as an acute care rehospitalization, for any reason, which occurred within 30 days of the discharge date of the original hospitalization.
- ***Risk-adjusted Readmissions for Complication or Infection Rating***—A readmission for complication or infection was defined as a rehospitalization with a principal diagnosis of a complication or infection, which occurred within 30 days of the discharge date of the original hospitalization. See Tables D1 and D2 in the "Data Tables" section for detail on cases readmitted for complication or infection, by reason for readmission.
- ***Average Hospital Charge (adjusted by case-mix at the regional level)***—Hospital charge was the patient total charge excluding professional fees.
- ***Transfer to Acute Care***—Percent of cases that were transferred to another acute care facility. Transfer cases were identified as a discharge status of "02" (short term general hospital) or "63" (long term care hospital) in the discharge records of patients admitted for Heart Attack – Medical Management.

It should be noted that not all of these outcome measures are appropriate for all procedure or treatment groups. Those measures not suitable for a particular procedure or treatment group were not analyzed and therefore are not reported.

The printed report includes 29 code-based conditions. Each condition was defined by a particular set of ICD-9-CM codes and limited to certain DRGs. The Council's Web site reports utilization and outcome information for adult cases in the 29 code-based conditions and in 20 DRGs.

The printed report is comprised of three separate "area" reports, which include summaries by procedure and treatment groups for the state, area, and individual hospitals in the area. The three areas allow a broader range of comparison among acute care facilities. These areas are divided into 9 regions as described below:

Western Pennsylvania

1 *Southwestern PA*—Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Washington, and Westmoreland Counties
2 *Northwest PA*—Cameron, Clarion, Clearfield, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Potter, Venango, and Warren Counties
3 *Southern Allegheny*—Bedford, Blair, Cambria, Indiana, and Somerset Counties

Central and Northeastern Pennsylvania

4 *Northcentral PA*—Centre, Clinton, Columbia, Lycoming, Mifflin, Montour, Northumberland, Snyder, Tioga, and Union Counties
5 *Southcentral PA*—Adams, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Perry, and York Counties
6 *Northeastern PA*—Bradford, Lackawanna, Luzerne, Monroe, Pike, Sullivan, Susquehanna, Wayne, and Wyoming Counties

Southeastern Pennsylvania

7 *Lehigh Valley/Reading*—Berks, Carbon, Lehigh, Northampton, and Schuylkill Counties
8 *Suburban Philadelphia*—Bucks, Chester, Delaware, and Montgomery Counties
9 *City of Philadelphia*—Philadelphia County

DATA COLLECTION AND VERIFICATION

The Pennsylvania Health Care Cost Containment Council is mandated by state law to collect (using guidelines set forth by the Center for Medicare and Medicaid Services) and disseminate health care data. The data for the FFY 2003 report, obtained from the UB-92 (Uniform Billing Form), were submitted electronically on a quarterly basis to the Council by Pennsylvania general acute care (GAC) and specialty GAC hospitals as directed by the data submission requirements of Act 89 (currently Act 14). Federal hospitals were not required to submit data. The data included demographic information, hospital charges, and diagnosis and procedure codes using the ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification).

In a contractual agreement with MediQual Systems, Inc.® in Marlborough, Massachusetts (a business of Cardinal Health) hospitals are required to use MediQual's *Atlas Outcomes*™ Severity of Illness System to abstract patient severity information. The Admission Severity scores, the Predicted Probability of Death (MQPredDeath), and the Predicted Length of Stay (MQPredLOS) values generated by this system are submitted to the Council for a select group of acute care inpatient records. For the period of this report (Q4-2002 through Q3-2003) these submissions covered approximately 50 percent of acute care hospital discharges.

Facilities are required to submit data to the Council on a quarterly basis by 90 days from the last day of each quarter. Upon receipt of the data, media verification was performed to assure data were submitted in a readable format. The data verification process continued with extensive quality assurance checks and matching of *Atlas Outcomes*™-derived records to inpatient records. Error reports were then generated and returned to each facility with an opportunity to correct any problems.

Hospitals Not Reported

Utilization and outcome data is not reported for non-compliant, closed, and pediatric hospitals. See Table F in the "Data Tables" section of this document for details of hospitals not included in this year's report. **Although data and analyses specific to these facilities are not displayed in the printed or Web site release editions of the *Hospital Performance Report*, their valid, adult (≥ 18 years of age) records were retained in the reference database for statistical analyses of Mortality, Length of Stay, Length of Stay Outliers, Readmissions for Any Reason, Readmissions for Complication or Infection, and Average Charge.**

PROCEDURE AND TREATMENT GROUPS

Rationale for Including "Code-Based" Conditions

The 49 procedure and treatment groups included in the current *Hospital Performance Report* are comprised of both DRGs and ICD-9-CM code-based conditions. While DRGs typically represent a subset of all patients with a specific diagnosis or surgical treatment that are homogeneous with regard to resource use, the code-based conditions were designed to represent a more clinically cohesive group of patients.

Development of more clinically cohesive groups was accomplished by defining code-based conditions by specific ICD-9-CM codes—as the principal diagnosis or principal procedure—and restricting them to select DRGs. For example, Chronic Obstructive Pulmonary Disease (COPD) was defined as cases with a principal diagnosis of 491.20, 491.21, 492.0, 492.8, 496 and 506.4 and restricted to DRG 088. In addition, cases that were deemed to be clinically complex were excluded. For example, HIV infection in any diagnosis position was excluded from all code-based conditions.

Selection of Code-Based Conditions and DRGs

The procedure and treatment groups included in the *Hospital Performance Report* were selected primarily because 1) they showed high volume or mortality, 2) they showed high variability in mortality among hospitals, 3) they were described in the literature as high cost, high mortality conditions, or 4) the transfer rate (i.e., transfer to another acute care facility) was typically less than 5 percent (so that a complete picture of the care delivered could be obtained by examining a single discharge record). In addition, since the report includes data from acute care facilities regardless of bed size, procedure and treatment groups were selected that are prevalent at smaller facilities as well as at larger facilities. The selected conditions and DRGs represent a broad range of both medical and surgical hospitalizations.

STUDY POPULATION

Inclusion Criteria

The study population for the *Hospital Performance Report* (printed and Web site) included useable records from all Pennsylvania general acute care (GAC) and specialty GAC hospital discharges in FFY 2003. All records that met the definition criteria outlined in the "Procedure and Treatment Groups" section were included. During the study period there were 187 facilities in Pennsylvania.

Exclusion Criteria

The number of cases included in any single type of analysis varies because each area of analysis has its own unique set of exclusion criteria (see "Records Excluded from Analyses" section). However, the following exclusions were common to all procedure and treatment groups:

- Duplicate records
- Missing or invalid discharge (DC) status (see Appendix Table 1 for valid codes)
- Non-adult (< 18 years) or invalid age (e.g., data not available for calculation of age, or > 120 years)
- Patients who left against medical advice (LAMA, DC Status Code—07)
- Patients transferred to acute care facilities (short-term or long-term care hospital; DC Status codes—02, 63)
  Exception: discharge status codes 02 and 63 are not excluded from the Heart Attack – Medical Management population for analysis of the Transfer to Acute Care percent.

Clinically complex exclusions were applied to the code-based study populations. Records with an HIV infection code (ICD-9-CM code 042, in any position) were excluded from all of the code-based diagnoses and procedure conditions. Also, cases with abdominal trauma codes[1], in any position, were excluded from the Colorectal Procedures study population.

UTILIZATION AND OUTCOME MEASURE ANALYSES

Exclusions from Analyses

Procedure and Treatment Groups Excluded from Analyses

Outcomes are reported for code-based conditions and DRGs based on the appropriateness of the measure to the code-based condition or DRG. The following guidelines were used to determine which procedure and treatment groups would be excluded from a particular analysis:

- Length of Stay Outlier Rates and Ratings (Short and Long) were not analyzed for a particular code-based condition or DRG when less than 95% of the cases in that condition fell into a single MediQual Disease Group.[2]

[1] ICD-9-CM diagnosis codes 863.0 to 864.19, 868.0 to 869.1, 879.2 to 879.9, 902.0 to 902.9, 908.1, 908.2, 908.4, 908.6, 908.9, 922.2, 935.2, 936, 937, 938, 947.3.

[2] Because Length of Stay Outlier Rate and Ratings were based on *Atlas Outcomes*™ Predicted Length of Stay (MQPredLOS) values, these measures were not calculated for those procedure and treatment groups for which the *Atlas Outcomes*™ algorithms (used to calculate the MQPredLOS) could not be suitably applied.

- Readmissions (for Any Reason and for Complication or Infection) were not analyzed for a particular code-based condition or DRG when 10% or more of the cases were cancer related. In addition, Readmissions were not analyzed for Heart Attack – Medical Management because rehospitalizations are expected as part of the treatment process. To maintain consistency within the Heart Attack conditions, Heart Attack – Angioplasty/Stent was also excluded from the Readmissions analyses.

- Transfer to Acute Care percents were calculated for Heart Attack – Medical Management only.

Note that Mortality Rating, Length of Stay and Average Charge were analyzed and reported for all code-based conditions and DRGs.

Records Excluded from Analyses

In addition to the cases excluded from the general study population (see "Exclusion Criteria" section), individual hospitalizations were excluded from outcome analyses when the data in the record was insufficient or inappropriate to the measure of interest. For example, records missing the *Atlas Outcomes*™ MQPredDeath (a risk factor for mortality) were excluded from Mortality analyses because these cases could not be properly risk adjusted. For complete detail of all record exclusions (type and number), see Table E in the Data Table section of this report.

Trimming

Trimming methodology was used to remove outlier cases from the Length Stay and Average Charge analyses. Exclusion of outliers was imperative for the elimination of extreme values that otherwise would have had a significant and unrepresentative impact on the mean (average). For the current *Hospital Performance Report* the mean was the primary descriptive measure for Length of Stay and Average Charge. The trimming (that is, deleting) of individual records from the database was performed after all other exclusions were satisfied.

For Length of Stay the 99th percentile was used as the trim point. If the length of stay of a particular record was in excess of the trim point, that record was removed from the database, and thus from Length of Stay analyses. (Length of stay outliers were also excluded from the Readmissions analyses.)

Trim points for Average Charge for each procedure or treatment group were calculated using the "+/- 3.0 interquartile range" method (IQR). Since charges vary dramatically among regions for the same code-based condition or DRG, trim points were calculated at the regional level. There are nine regions; therefore, nine different sets of upper and lower trim points were used for each procedure or treatment group. Hospitals were consolidated into the three Pennsylvania areas after the trimming of outlier charges was performed.

Trim points for Average Charge were determined as follows:

Q1 = the first quartile (25th percentile length of stay value) of all patient records from the comparative database in a particular category

Q3 = the third quartile (75th percentile length of stay value) of all patient records from the comparative database in a particular category

IQR = Q3 – Q1

Lower Trim Point = Q1 – (3.0 x IQR)
Upper Trim Point = Q3 + (3.0 x IQR)

Determination of Utilization and Outcome Values

Separate analyses were performed to determine ***actual*** Mortality percents, Length of Stay in days, Short Length of Stay Outlier percents, Long Length Of Stay Outlier percents, Readmissions for Any Reason percents, Readmissions for Complication or Infection percents, and Average Charge. Except for the calculation of Average Charge[1], actual results for each hospital were then adjusted for clinical, demographic, and/or socioeconomic risk inherent in a particular hospital's population. The hospital's risk profile was used to calculate ***expected*** values, which were then the basis of the ***risk-adjusted*** values that are displayed in the printed and Web site reports for Length of Stay, Length of Stay Outliers (Short/Long), and Readmissions (for Any Reason and for Complication or Infection). For Mortality, Length of Stay Outliers (Short/Long) and Readmissions (Any Reason and for Complication or Infection) significance tests were conducted to determine if the difference between a hospital's actual and expected values was too large to be attributed solely to chance. These results are displayed as ***ratings.***

Determining Actual (Observed) Values

Mortality	This percent was determined by dividing the total number of hospitalizations ending in death by the number of hospitalizations in the mortality analysis for that particular procedure or treatment group.
Average Length of Stay	The length of stay for a hospitalization was determined by subtracting the admit date from the discharge date. The Average Length of Stay was determined as the arithmetic mean length of stay for the hospitalizations included in the Length of Stay analysis for a particular procedure or treatment group.
Length of Stay Outliers (Short and Long)	This percent was determined by dividing the total number of short/long length of stay outlier hospitalizations by the number of hospitalizations in the Length of Stay Outlier analysis for that particular procedure or treatment group.
Readmissions for Any Reason	This percent was determined by dividing the number of discharges readmitted at least once for an acute care condition[2] to **any** GAC or specialty GAC hospital within 30 days of discharge by the total number of discharges included in the Readmissions analysis for that particular procedure or treatment group. If, over the study period, a patient had multiple discharges in the same procedure or treatment group, each discharge was independently investigated to determine whether it had a readmission within 30 days of that discharge. Thus, a single patient could contribute more than one readmission to the numerator count (i.e., one for each of the multiple discharges that are in the same procedure or treatment group). Same day readmissions were included only if the original hospitalization resulted in a discharge to "home."[3]

[1] Average Charge for the code-based conditions was adjusted to account for variations in case-mix that occurred because these conditions included more than one DRG in their definition. See "Special Considerations for Average Charge" section.

[2] Readmissions for conditions related to behavioral health, physical rehabilitation, mental health, or skilled nursing were not included.

[3] "Home" discharges included those patients who were discharged to: 1) home or self care (routine discharge), 2) home under the care of an organized Home Health Service Organization, or 3) home under the care of a Home IV (intravenous) provider.

Readmissions for Complication or Infection	Similar to Readmissions for Any Reason, except the number of discharges readmitted to any GAC or specialty GAC hospital within 30 days is limited to only those readmissions with a principal diagnosis or principal procedure that indicates a complication or infection. (See Table B for the ICD-9-CM codes that defined readmissions for complication or infection.)
Average Charge	This value was determined as the arithmetic mean average charge for the hospitalizations included in the charge analysis for a particular procedure or treatment group.

Determining Expected (Predicted) Values

Risk Adjustment Procedures

Regression techniques were used to construct "risk-adjustment models" for Mortality, Length of Stay, and Readmissions (for Any Reason and for Complication or Infection). The models used three risk factors to calculate expected, or predicted, results. Hospitals whose discharges were characterized by a greater number of risk factors (e.g., severity of illness, comorbidity, demographic and/or socioeconomic factors) were given "credit" in the system; hospitalizations with more risk factors were expected to have longer lengths of stay, and a greater probability of death, and/or readmission.

The first step in building the risk adjustment models for Mortality, Length of Stay, and Readmissions was to identify possible risk-adjustment factors—those factors that potentially contribute to a particular event for the conditions and DRGs in the current report. In doing so, clinical, demographic, and socioeconomic factors identified in the literature were considered. The *Atlas Outcomes*™ Predicted Probability of Death and Predicted Length of Stay scores were also considered. The processes for 1) gathering and reporting the Atlas information and 2) building the PHC4 risk-adjustment models are explained in the following sections.

Atlas Outcomes™ Approach for Risk Adjustment

In a contractual agreement with MediQual Systems, Inc.®, a business of Cardinal Health in Marlborough, Massachusetts, acute care hospitals are required to use MediQual's *Outcomes*™ Severity of Illness System to assess each patient's condition from date of admission through the first two days of the hospital stay (or a maximum of 30 hours, based on when the patient was admitted to the hospital). This system represents a summarization of patient risk/severity that includes the patient's predicted probability of death (MQPredDeath) and predicted length of stay (MQPredLOS). The MQPredDeath is derived from a logistic regression model and has a value from 0.000 to 1.000. The MQPredLOS is derived from a linear regression model and has no bounds.

The *Atlas Outcomes*™ system is based on the examination of numerous Key Clinical Findings (KCFs) such as lab tests, EKG readings, vital signs, the patient's medical history, imaging results, pathology, age, sex, and operative/endoscopy findings. Hospital personnel abstract these KCFs during specified timeframes in the hospitalization. Some pre-admission data are also captured (e.g., cardiac catheterization findings) as are some history findings. The KCF results are entered into algorithms that calculate the overall predicted probability of death or the predicted length of stay.

PHC4 Model Selection

Model selection identified three risk factors that were statistically significant predictors of the relevant event (i.e., mortality, length of stay, or readmission) in the most code-based conditions and DRGs. Each code-based condition and DRG was modeled separately, and

only the code-based conditions and DRGs that received that analysis were included (e.g., only conditions included in the Readmissions analysis were used to select the best risk variables for the Readmissions models).

Linear regression models were used for Length of Stay, while binary logistic regression models were used for Mortality and Readmissions outcomes. Risk factors were considered significant in a code-based condition or DRG if they met the $p < 0.10$ significance criteria.

To determine the first risk factor, individual models were run for each code-based condition and DRG that received that analysis. The candidate variable that was significant ($p < 0.10$) in the most models was chosen to be the first risk factor.

The second risk factor was determined by running a similar set of models for each code-based condition and DRG with the first risk factor already entered into the models. The candidate variable that was significant in the most models (after taking into account the effect of the first risk factor) was selected to be the second risk factor.

Similarly, the third risk factor was determined by running the models for each code-based condition and DRG with the first and second risk factors already entered into the models. The candidate variable that was significant in the most models (after taking into account the effect of the first and second risk factors) was selected to be the third risk factor.

The linear and logistic regression models used to calculate risk-adjusted results were limited to three risk factors in order to avoid over specification. The following table summarizes the risk factors found to be significant for each of the three models:

			Readmissions:	
Rank	**Mortality**	**Length of Stay**	**Any Reason**	**Complication or Infection**
1st	MQPredDeath	MqPredLOS	MqPredLOS	MQPredDeath
2nd	Age/Age^2	Age/Age^2	Diabetes	Age/Age^2
3rd	Cancer	Poverty Rate	Age/Age^2	Female

Calculation of Expected Values

Once the three risk factors were identified for each measure, separate models were run for each code-based condition and DRG using the three risk factors. These models estimated the relative effects (β_n) that the risk factors had on the relevant outcome value for each hospitalization, and generated model equations of the form:

$$\beta X = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \ldots$$

where
β_n = the relevant model coefficient (β_0 is the intercept)
x_n = the value of the risk factor for a hospitalization

(risk factors that are binary, e.g., yes/no, were coded as yes = 1 and no = 0)

These models were then used to provide the predicted values (e.g., predicted probability of death, predicted length of stay) for each individual hospitalization (after exclusions). The risk factor values (X) were multiplied by the model coefficients (β) and summed to determine the value βX for each hospitalization.

For linear models, this value βX is the final predicted value. For logistic models, the predicted value was calculated as:

$$p = \frac{e^{\beta X}}{1 + e^{\beta X}}$$

where $e \approx 2.7182818285$

The expected value for an individual hospital is the average of these predicted values for all hospitalizations (at that hospital) within that code-based condition or DRG. See Appendix Tables 2 and 3 for examples of risk-adjustment calculations.

Determining Risk-Adjusted Values

Risk adjusted values for Mortality, Length of Stay, and Readmissions (for Any Reason and for Complication or Infection) **were calculated for each hospital by dividing the hospital's actual value by its expected value and then multiplying that result by the statewide average.**

Special Considerations for Length of Stay Outlier Measures

The variable of analysis for the calculation of the Length of Stay Outlier Rates was the residual length of stay (ResLOS). This value was calculated for each record as the difference between the actual length of stay and MQPredLOS. Length of stay outliers were identified as those hospitalizations (for a given procedure or treatment group) in which the ResLOS was below the 5th percentile (short length of stay outliers) or above the 95th percentile (long length of stay outliers) of the statewide distribution of ResLOS.

The "expected" percent of short/long length of stay outliers for each hospital within each code-based condition or DRG was equal to the statewide percent—near 5%—of short (or long) length of stay outliers. (Note that since outliers were defined as being strictly less than the 5th percentile or greater than the 95th percentile, the statewide rates of outliers will be near, but less than, 5%.)

Since Length of Stay Outlier Rates were based on the MQPredLOS, the actual percent of outliers for each facility was already "risk-adjusted" and additional adjustments were not necessary.

Special Considerations for Average Charge

Average charge is reported without adjustment for each procedure or treatment group that contains cases from a single DRG. For the code-based conditions that include more than one DRG in their definition, **case-mix adjustment was used to calculate a composite average charge for the combined DRGs representing the condition**. This adjustment was made at the level of the nine Pennsylvania regions and was used to account for hospital variation in the mix of cases across DRGs. See Appendix Table 4 for an example of a case-mix adjustment calculation.

For example, Heart Attack – Medical Management is comprised of a subset of cases in DRGs 121, 122, and 123. The charges associated with DRGs 121, 122, and 123 were adjusted according to the number of patients and the average charge associated with treating patients in each of these three DRGs within a particular Pennsylvania region.

Determining Statistical Ratings

Significance tests (using the binomial distribution) were performed for Mortality, Length of Stay Outliers (Short/Long), and Readmissions (for Any Reason or for Complication or Infection). Even though the observed value for any single hospital may be comparable to its expected value, random variation plays a role in such a comparison. Therefore, statistical evaluation was used to determine whether the difference between the observed and the expected value was *too large* to be attributed solely to chance.

Binomial Distribution

The use of the binomial distribution required the following assumptions:

- each observation included in the study had one of two observable events (e.g., mortality vs. no mortality). In other words, the response was dichotomous.
- the probability of the event (e.g., mortality) for each observation studied within a condition/DRG was equal to the probability provided by the risk models.
- the result for any one observation in the analyses had no impact on the result of another observation. In other words, the observations were independent.

The probability distributions for a specific hospital's outcome in one area of analysis was based on the hospital's predicted or expected values. Using the probability distribution, a p-value was calculated for each observed value. This p-value is the probability, or likelihood, that the value could have occurred by chance. If it was very unlikely ($p < 0.05$; see "Inferential Error" section below) that the observed or actual value could have occurred only by chance, then it was concluded that the observed value was "significantly different" from the expected value.

Calculation of p-values

The binomial distribution defines a probability of each potential outcome (e.g., the probability of observing exactly 3 deaths out of 40) according to the binomial formula:

$$P(a) = \left[\frac{N!}{a!(N-a)!}\right] p^a (1-p)^{N-a}$$

where:

a is the number of events (e.g., mortalities) that would be observed (i.e., a = 1 mortality, a = 2 mortalities, etc.) in N hospitalizations. The value of "a" can range from 0 through N (in other words, $0 \leq a \leq N$)

P(a) is the probability that exactly "a" events would be observed

N is the number of hospitalizations in a particular hospital's condition/DRG.

p is the overall expected rate (e.g., expected percent mortality) for a particular hospital's condition/DRG.

The rating process evaluated both fewer than expected as well as greater than expected mortalities. Thus a two-tailed test was used. In the example 3 deaths out of 40, the probability associated with the left-hand tail would be the sum of the probability for 0, 1, 2, or 3 deaths out of 40. The probability of the right-hand tail would be the sum of the probabilities at the upper end of the range (40, 39, 38…) until that sum is as close as possible to (but still less than) the probability associated with the left-hand tail. The two-tailed p-value is the sum of the probability of the left-hand and right-hand tails.

The two-tailed p-value was calculated for each hospital and code-based condition or DRG analyzed.

Inferential Error

A type of inferential error that can be made in statistics is called a Type I error or "false positive." The probability of committing a Type I error is equal to the level of significance established by the

researcher. For the current analysis, the level of significance was set to 0.05. In the context of the *Hospital Performance Report*, a Type I error occurred when the difference between the observed Mortality percent and the expected Mortality percent was declared statistically significant, when in fact, the difference was due to chance. That is, for a particular code-based condition or DRG, the hospital was declared to be statistically higher or lower than expected, when in reality the hospital's level of performance was comparable to its expected performance as determined by its risk profile. Since the level of significance was set to 0.05, there was a 5% (or 1 in 20) chance of committing this type of error.

Assignment of Statistical Rating

A statistical rating was assigned to each hospital if the difference between what was observed and what was expected in a particular clinical condition was statistically significant. The p-value, calculated in terms of a "two-tailed" test was compared to the level of significance. For example, in determining the Mortality rating for each hospital:

- if the calculated p-value was greater than or equal to 0.05, then the conclusion was made that the difference between what was expected and what was observed was *not* statistically significant. It *cannot be concluded* that the actual Mortality percent for that particular clinical condition in that particular hospital was different from the expected Mortality percent derived from that particular hospital's risk profile.

- if the calculated p-value was less than 0.05, then the conclusion was made that the difference between what was expected and what was observed was statistically significant.

    - If the observed Mortality percent was less than expected the hospital was assigned the symbol "○" (as shown in the *Hospital Performance Report*) to indicate that the Mortality percent was significantly less than expected for a particular clinical condition.

    - If the observed Mortality percent was higher than expected the hospital was assigned the symbol "●" (as shown in the *Hospital Performance Report*) to indicate that the Mortality percent was significantly greater than expected for a particular clinical condition.

CASE REQUIREMENTS FOR REPORTING

In the printed report "NR" (not reported) is displayed in place of a particular result whenever the number of cases analyzed for that particular measure (after exclusions) is less than five. However, if there are less than five cases in the mortality analysis (identified in the report in the column named "cases"), NR appears in place of all results. Note that for Abdominal Aortic Aneurysm Repair and Heart Attack – Angioplasty/Stent there was a high percentage of hospitals with zero cases; for practical reasons these hospitals do not appear in the display for these particular procedures.

Results presented on the Web site are similar to the printed report, with one exception: When there are less than 5 cases in the mortality analysis, the hospital does not appear in the display for that particular condition or DRG.

DEFINITION TABLES

Table A

The 29 Code-Based Conditions and 20 DRGs in the *FFY 2003 Hospital Performance Report*

The following table outlines the code-based conditions (the ICD-9-CM codes and DRGs used to define each) and the DRGs included in the report. These codes and DRGs are applicable to CMS Grouper Version 20 (inpatient discharges occurring October 1, 2002 through September 30, 2003). Additional exclusions (clinically complex cases) are identified as footnotes.

The 19 code-based diagnoses on the Council's Web site are:

Diagnoses[1]	*Principal Diagnosis Codes (ICD-9-CM)*	*DRGs*
Abnormal Heartbeat	426.0, 426.10, 426.11, 426.12, 426.13, 426.2, 426.3, 426.4, 426.50, 426.51, 426.52, 426.53, 426.54, 426.6, 426.7, 426.81, 426.89, 426.9, 427.0, 427.1, 427.2, 427.31, 427.32, 427.60, 427.61, 427.69, 427.81, 427.89, 427.9, 746.86, 785.0	116, 117, 118, 124, 125, 138, 139, 517, 518
Blood Clot in Extremities	451.0, 451.11, 451.19, 451.2, 451.81, 451.82, 451.83, 451.84, 451.89, 451.9, 453.8, 453.9	128,130,131
Blood Clot in Lung	415.11, 415.19	078
Chronic Obstructive Pulmonary Disease	491.20, 491.21, 492.0, 492.8, 496, 506.4	088
Congestive Heart Failure (CHF)	398.91, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32 428.33, 428.40, 428.41, 428.42, 428.43, 428.9	124, 125, 127
Diabetes with Amputation	250.xy (x = 0-9, y = 0-3)	113, 114, 285
Diabetes – Medical Management	250.xy (x = 0-9, y = 0-3)	018, 019, 130, 131, 294, 295, 331, 332
Heart Attack – Medical Management	410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91	121,122,123
Intestinal Obstruction	560.0, 560.2, 560.30, 560.31, 560.39, 560.81, 560.89, 560.9	180, 181
Kidney Failure	403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5, 584.6, 584.7, 584.8, 584.9, 585, 586	316
Kidney and Urinary Tract Infections	590.00, 590.01, 590.10, 590.11, 590.2, 590.3, 590.80, 590.9, 595.x (x = 0-3), 595.81, 595.89, 595.9, 599.0	320, 321
Pneumonia – Aspiration	507.0	079, 080
Pneumonia – Infectious	480.0, 480.1, 480.2, 480.8, 480.9, 481, 482.0, 482.1, 482.2, 482.30, 482.31, 482.32, 482.39, 482.40, 482.41, 482.49, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 483.0, 483.1, 483.8, 485, 486, 487.0	079, 080, 089, 090
Respiratory Failure with Mechanical Ventilation	506.1, 518.5, 518.81, 518.83, 518.84	475
Respiratory Failure without Mechanical Ventilation	506.1, 518.5, 518.81, 518.83, 518.84	087
Septicemia	038.0, 038.10, 038.11, 038.19, 038.2, 038.3, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9, 995.90, 995.91, 995.92, 995.93, 995.94	416
Stomach and Intestinal Bleeding	456.0, 530.7, 530.82, 531.00, 531.01, 531.20, 531.21, 531.40, 531.41, 531.60, 531.61, 532.00, 532.01, 532.20, 532.21, 532.40, 532.41, 532.60, 532.61, 533.00, 533.01, 533.20, 533.21, 533.40, 533.41, 533.60, 533.61, 534.00, 534.01, 534.20, 534.21, 534.40, 534.41, 534.60, 534.61, 535.01, 535.11, 535.21, 535.31, 535.41, 535.51, 535.61, 537.83, 537.84, 562.02, 562.03, 562.12, 562.13, 569.3, 569.85, 578.9	174, 175
Stroke – Hemorrhagic	430, 431, 432.0, 432.1, 432.9	014
Stroke – Non-Hemorrhagic	433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436	014, 015

[1]Cases involving HIV Infection (ICD-9-CM code 042, in any position) were excluded from all code-based diagnoses and procedures.

Table A continued

The 10 code-based procedures in the printed report and on the Council's Web site are:

Procedures[1]	*Principal Procedure Codes (ICD-9-CM)*	*DRGs*
Abdominal Aortic Aneurysm Repair	38.44, 38.64, 38.84 With PDx of 441.4	110, 111
Colorectal Procedures[2]	45.71, 45.72, 45.73, 45.74, 45.75, 45.76, 45.79, 45.8, 45.92, 45.94, 46.03, 46.10, 46.11, 46.13, 46.42, 46.43, 46.52, 46.76, 46.94, 48.49, 48.5, 48.62, 48.63, 48.69, 48.75, 48.76, 70.72	146, 147, 148, 149
Gallbladder Removal - Laparoscopic	51.23, 51.24	195, 196, 493, 494
Gallbladder Removal - Open	51.21, 51.22	195, 196, 197, 198
Heart Attack - Angioplasty/Stent	36.01, 36.02, 36.05, 36.06, 36.07 With PDx of 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, or 410.91	516, 526
Hip Fracture - Surgical Repair	78.55, 79.15, 79.25, 79.35, 79.55, 81.51, 81.52 With PDx of 820.0x (x = 0–3,9), 820.1x (x = 0–3,9), 820.2x (x = 0–2), 820.3x (x = 0–2), 820.8, or 820.9	209, 210, 211
Hysterectomy - Abdominal	68.3, 68.4, 68.6, 68.9	353, 354, 355, 357, 358, 359
Hysterectomy - Vaginal	68.51, 68.59, 68.7	353, 354, 355, 357, 358, 359
Prostatectomy - Radical	60.3, 60.4, 60.5, 60.62, 60.69	306, 307, 334, 335, 338, 339, 341
Prostatectomy - Transurethral	60.21, 60.29	306, 307, 334, 335, 336, 337, 338, 339, 341

[1]Cases involving HIV Infection (ICD-9-CM code 042, in any position) were excluded from all code-based diagnoses and procedures.
[2]In addition to the HIV Infection exclusions, cases involving abdominal trauma were excluded. Abdominal trauma was defined by the following ICD-9-CM codes: 863.0—864.19, 868.00—869.1, 879.2—879.9, 902.0—902.9, 908.1, 908.2, 908.4, 908.6, 908.9, 922.2, 935.2, 936, 937, 938, 947.3.

The 20 DRGs reported *only* on the Council's *Web site* are:

DRG	Common Names
001	Brain Surgery, complicated
005	Removal of Blockage of Head and Neck Vessels
075	Major Lung Operations
076	Miscellaneous Lung Procedures, complicated
096	Bronchitis and Asthma, complicated
097	Bronchitis and Asthma, uncomplicated
141	Hypotension and Fainting, complicated
143	Chest Pain
154	Stomach and Small Intestinal Operations, complicated
182	Stomach and Intestinal Infections and Disorders, complicated
183	Stomach and Intestinal Infections and Disorders, uncomplicated
188	Stomach and Intestinal Complications and Disorders
202	Cirrhosis and Alcoholic Hepatitis
203	Liver, Gallbladder or Pancreatic Cancer
204	Noncancerous Pancreatic Disorders
205	Liver Disease Except Cancer, Cirrhosis, Alcoholic Hepatitis, complicated
243	Medical Back Problems
415	Surgery for Infectious or Parasitic Disease
418	Infection after Surgery or Trauma
478	Vascular Operations Except Heart, complicated

TABLE B

ICD-9-CM Codes Used to Define Readmissions for Complication or Infection

Readmissions with one of the following ICD-9-CM codes listed as the principal diagnosis or principal procedure were included in this measure. These codes are applicable to CMS Grouper Versions 20 and 21.

ICD-9-CM Codes Diagnosis/Procedure	
Procedure/Medical Care Related Events	
54.61 (procedure)	998.7
909.3	998.83
995.4	998.89
995.86	998.9
995.89	999.2
998.0	999.4
998.2	999.5
998.31	999.6
998.32	999.7
998.4	999.8
998.6	999.9
Digestive System Complications	
564.2	997.4
Pulmonary Compromise	
31.1 (procedure)	518.5
31.21 (procedure)	518.81
31.29 (procedure)	518.82
512.1	518.84
514	997.3
518.4	998.81
Hemorrhage	
39.41 (procedure)	998.11
39.98 (procedure)	998.12
57.93 (procedure)	998.13
Infection	
038.0	569.61
038.10	995.90
038.11	995.91
038.19	995.92
038.2	995.93
038.3	995.94
038.40	996.60
038.41	996.61
038.42	996.62
038.43	996.64
038.44	996.65
038.49	996.69
038.8	998.51
038.9	998.59
536.41	999.3
Pneumonia (coded by causative organism)	
481	482.81
482.0	482.82
482.1	482.83
482.2	482.84
482.30	482.89
482.31	482.9
482.32	483.0
482.39	483.1
482.40	483.8
482.41	485
482.49	486

ICD-9-CM Codes Diagnosis/Procedure	
Cardiac Complications	
410.01	410.61
410.11	410.71
410.21	410.81
410.31	410.91
410.41	997.1
410.51	
Venous Thrombosis/Pulmonary Embolism	
415.11	451.81
415.19	453.8
451.11	997.2
451.19	999.1
Hypo/Hypertension	
458.21**	997.91
458.29**	
Stroke/Anoxic Brain Damage	
348.1	433.81
430	433.91
431	434.01
432.0	434.11
432.1	434.91
432.9	436
433.01	997.00
433.11	997.01
433.21	997.02
433.31	997.09
Device, Implant or Graft Complications	
536.40	996.31
536.42	996.39
536.49	996.52
569.60	996.59
569.62	996.70
569.69	996.72
996.04	996.74
996.1	996.76
996.30	996.79
Gastric/Intestinal Hemorrhage or Ulceration	
49.95 (procedure)	533.01
531.00	533.10
531.01	533.11
531.10	533.20
531.11	533.21
531.20	533.40
531.21	533.41
531.40	533.60
531.41	533.61
531.60	534.00
531.61	534.01
532.00	534.10
532.01	534.11
532.10	534.20
532.11	534.21
532.20	534.40
532.21	534.41
532.40	534.60
532.41	534.61
532.60	537.84
532.61	578.9
533.00	

**New codes effective 4th quarter of 2003

DATA TABLES

TABLE C1

Statewide Utilization and Outcome Data for Code-Based Conditions

Diagnoses in Printed Report and on the Web Site

Description	# of Cases[1]	% Mortality[2]	Length of Stay[2]	Readmissions: % Any Reason[2]	Readmissions: % Comp/ Infec[2]	Average Charge[2]
Abnormal Heartbeat	40,201	1.0	3.6	15.1	2.2	$23,677
Blood Clot in Extremities	7,904	0.6	4.4	NR	NR	$12,779
Blood Clot in Lung	5,229	3.0	5.9	NR	NR	$21,789
Chronic Obstructive Pulmonary Disease	27,793	1.5	4.7	22.3	5.2	$16,851
Congestive Heart Failure	56,108	3.6	5.0	26.0	4.2	$19,914
Diabetes with Amputation	2,084	2.5	9.9	22.7	4.8	$48,374
Diabetes - Medical Management	16,040	1.2	3.8	19.2	2.7	$15,786
Heart Attack - Medical Management	15,925	13.5	5.7	NR	NR	$25,156
Intestinal Obstruction	8,116	2.8	4.5	NR	NR	$15,568
Kidney Failure	12,380	8.2	6.3	26.0	5.5	$24,798
Kidney and Urinary Tract Infections	19,840	1.5	4.3	17.4	4.1	$15,509
Pneumonia - Aspiration	9,361	14.9	7.2	24.6	6.6	$26,087
Pneumonia - Infectious	44,145	4.2	5.3	17.8	5.7	$18,006
Respiratory Failure with Mechanical Ventilation	3,671	31.2	10.2	25.8	11.1	$59,804
Respiratory Failure without Mechanical Ventilation	4,004	16.9	6.5	24.8	11.1	$22,768
Septicemia	14,714	19.0	7.2	NR	NR	$24,529
Stomach and Intestinal Bleeding	21,373	2.5	4.3	15.9	4.8	$17,333
Stroke - Hemorrhagic	3,619	33.5	6.6	16.0	7.5	$29,709
Stroke - Non-Hemorrhagic	20,696	6.0	5.4	14.8	5.4	$23,247

Procedures in Printed Report and on the Web Site

Abdominal Aortic Aneurysm Repair	1,012	3.4	7.7	11.1	3.7	$57,586
Colorectal Procedures	15,497	3.4	9.0	NR	NR	$46,058
Gallbladder Removal - Laparoscopic	14,322	0.2	3.4	7.0	2.0	$23,138
Gallbladder Removal - Open	3,156	1.3	6.7	10.1	3.8	$36,888
Heart Attack - Angioplasty/Stent	11,673	1.5	4.0	NR	NR	$49,867
Hip Fracture - Surgical Repair	13,866	2.5	6.0	14.8	4.9	$29,995
Hysterectomy - Abdominal	17,749	0.1	2.9	NR	NR	$17,614
Hysterectomy - Vaginal	7,491	0.0	1.8	3.2	1.8	$13,511
Prostatectomy - Radical	3,336	0.1	3.2	NR	NR	$25,842
Prostatectomy - Transurethral	5,067	0.3	2.7	NR	NR	$12,550

[1]Number of cases after mortality exclusions.
[2]All measures, Mortality, Length of Stay, Readmissions, and Average Charge were calculated after specific exclusion criteria were met for each measure.
NR: Not Reported

TABLE C2

Statewide Utilization and Outcome Data for Diagnosis Related Groups

DRGs on the Web Site

DRG	Description	# of Cases[1]	% Mortality[2]	Length of Stay[2]	Readmissions		Average Charge[2]
					% Any Reason[2]	% Comp/ Infec[2]	
001	Brain Surgery, complicated	4,157	12.8	9.6	NR	NR	$93,973
005	Removal of Blockage of Head and Neck Vessels	7,757	0.5	2.6	9.9	2.8	$22,652
075	Major Lung Operations	5,645	3.8	8.2	NR	NR	$55,536
076	Miscellaneous Lung Procedures, complicated	4,693	8.1	9.1	NR	NR	$49,415
096	Bronchitis and Asthma, complicated	6,270	0.2	3.9	14.7	2.6	$15,749
097	Bronchitis and Asthma, uncomplicated	7,006	0.1	2.8	8.2	1.0	$11,345
141	Hypotension and Fainting, complicated	11,317	0.3	3.3	13.5	2.3	$15,700
143	Chest Pain	38,155	0.1	1.7	9.6	1.3	$12,440
154	Stomach and Small Intestinal Operations, complicated	3,097	8.1	11.6	NR	NR	$80,173
182	Stomach and Intestinal Infections and Disorders, complicated	30,311	0.9	3.9	NR	NR	$14,539
183	Stomach and Intestinal Infections and Disorders, uncomplicated	18,128	0.0	2.6	NR	NR	$11,571
188	Stomach and Intestinal Complications and Disorders	8,796	4.4	4.9	NR	NR	$19,439
202	Cirrhosis and Alcoholic Hepatitis	3,908	8.6	5.7	32.9	3.3	$28,997
203	Liver, Gallbladder or Pancreatic Cancer	3,606	14.5	5.9	NR	NR	$27,564
204	Noncancerous Pancreatic Disorders	9,776	1.2	4.8	20.0	2.1	$17,663
205	Liver Disease Except Cancer, Cirrhosis, Alcoholic Hepatitis, complicated	3,883	7.9	5.3	35.4	3.9	$25,160
243	Medical Back Problems	11,763	0.6	3.9	16.7	2.3	$13,630
415	Surgery for Infectious or Parasitic Disease	4,937	7.5	10.6	21.5	9.4	$53,521
418	Infection after Surgery or Trauma	4,042	0.5	4.7	16.0	7.9	$17,086
478	Vascular Operations Except Heart, complicated	8,883	2.8	6.8	NR	NR	$49,958

[1]Number of cases after mortality exclusions.
[2]All measures, Mortality, Length of Stay, Readmissions, and Average Charge were calculated after specific exclusion criteria were met for each measure.
NR: Not Reported

TABLE D1

Statewide Cases Readmitted for Complication or Infection, by Reason for Readmission Code-Based Conditions

Code-Based Condition	# of Cases Meeting Readmissions Criteria	Total # of Cases Readmitted for Complication or Infection	% of Cases Readmitted for Complication or Infection	*Reason for Readmission*											
				Procedure/Medical Care Related Events	Digestive System Complications	Pulmonary Compromise	Hemorrhage	Infection	Pneumonia	Cardiac Complications	Venous Thrombosis/ Pulmonary Embolism	Hypo/Hypertension	Stroke/Anoxic Brain Damage	Device, Implant or Graft Complications	Gastric/Intestinal Hemorrhage or Ulceration
Diagnoses															
Abnormal Heart Beat	37,196	826	2.2	14	2	65	24	120	196	123	59	5	108	48	64
Chronic Obstructive Pulmonary Disease	26,509	1368	5.2	5	1	366	3	96	596	118	74	3	41	17	55
Congestive Heart Failure	51,831	2194	4.2	14	2	302	14	321	628	423	87	17	181	48	162
Diabetes with Amputation	1,952	94	4.8	12	0	3	3	37	16	8	2	0	4	6	3
Diabetes - Medical Management	15,197	414	2.7	8	4	33	4	116	76	54	27	1	54	16	25
Kidney Failure	10,710	591	5.5	6	5	48	10	191	110	64	55	3	40	27	35
Kidney and Urinary Tract Infections	18,765	762	4.1	8	3	61	7	272	159	35	55	2	74	30	59
Pneumonia - Aspiration	7,598	505	6.6	2	1	96	1	109	193	23	18	0	11	28	31
Pneumonia - Infectious	40,520	2293	5.7	4	1	232	6	247	1342	137	132	4	82	24	94
Respiratory Failure with Mechanical Ventilation	2,343	260	11.1	1	0	140	0	36	57	11	5	0	3	0	7
Respiratory Failure without Mechanical Ventilation	3,151	349	11.1	0	1	234	0	16	71	7	8	0	2	3	7
Stomach and Intestinal Bleeding	19,981	953	4.8	2	4	34	20	105	136	87	56	1	81	30	398
Stroke - Hemorrhagic	2,073	155	7.5	0	0	4	0	19	10	6	15	0	99	1	2
Stroke - Non-Hemorrhagic	18,290	979	5.4	2	0	49	4	119	101	70	61	4	496	23	55
Procedures															
Abdominal Aortic Aneurysm Repair	886	33	3.7	4	3	1	3	8	5	2	3	0	1	1	2
Gallbladder Removal - Laparoscopic	13,521	267	2.0	16	80	21	15	39	22	16	23	0	14	8	13
Gallbladder Removal - Open	2,924	112	3.8	5	29	3	6	37	8	4	9	0	5	4	2
Hip Fracture - Surgical Repair	12,965	632	4.9	7	9	36	36	160	136	63	84	2	37	1	62
Hysterectomy - Vaginal	7,129	130	1.8	14	12	3	30	60	1	0	5	1	2	1	2

Note: For some conditions, the sum of the readmits for complication or infection may be higher than the total because some records had both a principal diagnosis and a principal procedure that met the criteria for being captured in this analysis. When this occurs, the record is shown in each readmission category; however, the record was counted only once in determining the percent of readmissions for complication or infection.

TABLE D2

Statewide Cases Readmitted for Complication or Infection, by Reason for Readmission DRGs

DRG		# of Cases Meeting Readmissions Criteria	Total # of Cases Readmitted for Complication or Infection	% of Cases Readmitted for Complication or Infection	*Reason for Readmission*											
					Procedure/Medical Care Related Events	Digestive System Complications	Pulmonary Compromise	Hemorrhage	Infection	Pneumonia	Cardiac Complications	Venous Thrombosis/ Pulmonary Embolism	Hypo/Hypertension	Stroke/Anoxic Brain Damage	Device, Implant or Graft Complications	Gastric/Intestinal Hemorrhage or Ulceration
005	Removal of Blockage in Head and Neck Vessels	7,230	201	2.8	2	1	9	25	24	25	21	13	1	63	6	13
096	Bronchitis and Asthma, complicated	6,053	155	2.6	0	1	20	0	28	51	10	21	0	11	5	9
097	Bronchitis and Asthma, uncomplicated	6,755	69	1.0	1	1	15	0	2	24	6	14	0	2	1	3
141	Hypotension and Fainting, complicated	10,829	251	2.3	4	0	8	1	43	65	24	29	4	52	5	17
143	Chest Pain	36,334	461	1.3	7	4	19	7	51	96	115	43	3	51	41	25
202	Cirrhosis and Alcoholic Hepatitis	3,269	109	3.3	3	1	17	3	39	17	1	3	2	2	0	22
204	Noncancerous Pancreatic Disorders	9,152	189	2.1	2	21	14	2	59	26	16	13	0	10	13	15
205	Liver Disease Except Cancer, Cirrhosis and Alcoholic Hepatitis, complicated	3,230	126	3.9	0	2	20	3	42	20	4	6	0	6	7	16
243	Medical Back Problems	10,995	251	2.3	9	1	23	3	64	51	28	32	1	25	2	13
415	Surgery for Infectious or Parasitic Disease	4,162	392	9.4	25	7	17	15	228	32	12	24	0	10	18	6
418	Infection After Surgery or Trauma	3,671	291	7.9	23	10	4	5	209	4	5	17	0	3	10	2

Note: For some DRGs, the sum of the readmits for complication or infection may be higher than the total because some records had both a principal diagnosis and a principal procedure that met the criteria for being captured in this analysis. When this occurs, the record is shown in each readmission category; however, the record was counted only once in determining the percent of readmissions for complication or infection.

TABLE E

Statewide Exclusions from Analyses, by Measure

The exclusions are listed in the order in which they were removed from the reference database.

Code-Based Conditions

	Mortality		*Length of Stay*		*Length of Stay Outliers: Short and Long*		*Readmissions: Any Reason and Complication or Infection*		*Average Charge*	
	#	%	#	%	#	%	#	%	#	%
Total Cases Before Exclusions	454,677	100.0	454,677	100.0	310,643	100.0	339,564	100.0	454,677	100.0
Exclusions:										
Duplicate records	367	0.1	367	0.1	249	0.1	281	0.1	367	0.1
Missing or invalid discharge (DC) status	32	<0.1	32	<0.1	26	<0.1	31	<0.1	32	<0.1
Non-adult (< 18) or invalid age	3,013	0.7	3,013	0.7	568	0.2	2,482	0.7	3,013	0.7
Patients with HIV Infection[1]	405	0.1	405	0.1	286	0.1	328	0.1	405	0.1
Patients with abdominal trauma[2]	61	<0.1	61	<0.1	NA	NA	NA	NA	61	<0.1
Patients who left against medical advice	2,574	0.6	2,574	0.6	1,868	0.6	2,099	0.6	2,574	0.6
Patients transferred to GAC facilities	16,297	3.6	16,297	3.6	14,232	4.6	8,831	2.6	16,297	3.6
Patients who died	NA	NA	19,477	4.3	15,568	5.0	13,236	3.9	NA	NA
Missing Atlas Outcomes™ data[3]	5,556	1.2	5,163	1.1	3,505	1.1	4,071	1.2	NA	NA
Invalid length of stay	NA	NA	0	0.0	0	0.0	0	0.0	NA	NA
Length of stay outliers	NA	NA	3,645	0.8	NA	NA	2,702	0.8	NA	NA
Non-Pennsylvania residents	NA	NA	NA	NA	NA	NA	8,648	2.5	NA	NA
Patients discharged to hospice	NA	NA	NA	NA	NA	NA	1,453	0.4	NA	NA
Missing or inconsistent patient identifiers[4]	NA	NA	NA	NA	NA	NA	1,389	0.4	NA	NA
Admit, DC, readmit date discrepancies	NA	NA	NA	NA	NA	NA	472	0.1	NA	NA
Invalid charges	NA	NA	NA	NA	NA	NA	NA	NA	66	<0.1
Charge outliers	NA	NA	NA	NA	NA	NA	NA	NA	9,333	2.1
No reference data	NA	NA	NA	NA	NA	NA	NA	NA	1,021	0.2
Total Exclusions	28,305	6.2	51,034	11.2	36,302	11.7	46,023	13.6	33,169	7.3
Total Cases in Analysis	426,372	93.8	403,643	88.8	274,341	88.3	293,541	86.4	421,508	92.7

DRGs

Total Cases Before Exclusions	208,273	100.0	208,273	100.0	77,205	100.0	117,004	100.0	208,273	100.0
Exclusions:										
Duplicate records	139	0.1	139	0.1	42	0.1	84	0.1	139	0.1
Missing or invalid discharge (DC) status	16	<0.1	16	<0.1	7	<0.1	8	<0.1	16	<0.1
Non-adult (< 18) or invalid age	1,489	0.7	1,489	0.7	669	0.9	1,055	0.9	1,489	0.7
Patients with HIV Infection[1]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Patients with abdominal trauma[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Patients who left against medical advice	2,923	1.4	2,923	1.4	1,796	2.3	2,178	1.9	2,923	1.4
Patients transferred to GAC facilities	4,742	2.3	4,742	2.3	2,543	3.3	3,224	2.8	4,742	2.3
Patients who died	NA	NA	4,254	2.0	869	1.1	1,381	1.2	NA	NA
Missing Atlas Outcomes™ data[3]	2,834	1.4	2,743	1.3	1,040	1.3	1,611	1.4	NA	NA
Invalid length of stay	NA	NA	1	0.0	0	0.0	0	0.0	NA	NA
Length of stay outliers	NA	NA	1,709	0.8	NA	NA	943	0.8	NA	NA
Non-Pennsylvania residents	NA	NA	NA	NA	NA	NA	3,671	3.1	NA	NA
Patients discharged to hospice	NA	NA	NA	NA	NA	NA	173	0.1	NA	NA
Missing or inconsistent patient identifiers[4]	NA	NA	NA	NA	NA	NA	833	0.7	NA	NA
Admit, DC, readmit date discrepancies	NA	NA	NA	NA	NA	NA	163	0.1	NA	NA
Invalid charges	NA	NA	NA	NA	NA	NA	NA	NA	41	0.0
Charge outliers	NA	NA	NA	NA	NA	NA	NA	NA	4,304	2.1
No reference data	NA	NA	NA	NA	NA	NA	NA	NA	0	0.0
Total Exclusions	12,143	5.8	18,016	8.7	6,966	9.0	15,324	13.1	13,654	6.6
Total Cases in Analysis	196,130	94.2	190,257	91.3	70,239	91.0	101,680	86.9	194,619	93.4

[1]This exclusion is only applicable to the code-based conditions.
[2]This exclusion is only applicable to the Colorectal Procedures study population.
[3]Either Missing MQPredDeath or MQPredLOS, depending on which one is used as a risk adjustor (MQPredDeath was used for mortality; MQPredLOS was used for Length of Stay, Length of Stay Outliers, and Readmissions).
[4]Social Security Number, Date of Birth, Sex
NA: Not Applicable

TABLE F

Hospitals Not Reported in the *FFY 2003 Hospital Performance Report*
Printed Report and Web Site Release

The study population for the FFY 2003 *Hospital Performance Report* included useable discharge records from all Pennsylvania facilities required to abstract clinical data (Atlas) in the reported time period. All records that met the definition criteria outlined in the Procedures and Treatment Groups section were included. During the study period there were 187 facilities in Pennsylvania.

Hospital Name	Reason for Not Reporting
Facilities currently in operation that submitted incomplete data[1]:	
Western Pennsylvania	
Armstrong County Memorial	*Missing Atlas severity scores = 14.1%*
Jefferson Regional	*Missing Atlas severity scores = 16.6%*
Millcreek Community	*Missing Atlas severity scores = 35.6%*
Tyrone	*Inadequate UB submission (Q1 2003)*
Central and Northeastern Pennsylvania	
Phillipsburg Area Hospital	*Missing Atlas severity scores = 11.2%*
Southeastern Pennsylvania	
Montgomery Hospital	*Missing Atlas severity scores = 22.3%*
Palmerton	*Missing Atlas severity scores = 17.6%*
Facilities that closed:	
Western Pennsylvania	
Metro Health Center	*Closed facility—effective 04/07/03*
St. Francis Hospital/Cranberry	*Closed facility—effective 10/31/02*
St. Francis Hospital of New Castle	*Closed facility—effective 10/31/02*
Central and Northeastern Pennsylvania	
Lancaster General/Susquehanna	*Closed facility—effective 06/30/03*
Southeastern Pennsylvania	
Elkins Park	*Closed facility—effective 10/31/03*
Parkview	*Closed facility—effective 09/08/03*
Other facilities not reported:	
Western Pennsylvania	
Children's Hospital Pittsburgh	*Children's hospital[2]*
UPMC Passavant Cranberry	*New Facility – opened 11/01/02*
UPMC Shadyside	*Facility merged with UPMC Presbyterian Shadyside – effective 05/30/03*
Southeastern Pennsylvania	
Children's Hospital Philadelphia	*Children's hospital[2]*
St. Christopher's Children's	*Children's hospital[2]*
Temple University Children's	*Children's hospital[2]*
Will's Eye	*Facility not required to abstract clinical (Atlas) data – effective Q3, 2003*

[1]Noncompliant hospitals with ≥ 10% missing *Atlas Outcomes*™ severity scores (for all code-based conditions and DRGs for which severity scores are required to be reported) or facilities that submitted incomplete UB data for one or more quarters.
[2]Pediatric cases were excluded from the *FFY 2003 Hospital Performance Report* study populations. Therefore, data for children's hospitals were not reported. Adult discharges from pediatric hospitals were retained in the statewide dataset.

APPENDIX

TABLE 1

Valid Discharge Status Codes

Code	*Description*
01	Discharged to home or self-care (routine discharge)
02	Discharged/transferred to another short-term general hospital for inpatient care
03	Discharged/transferred to a skilled nursing facility (SNF) with Medicare certification
04	Discharged/transferred to an intermediate care facility (ICF)
05	Discharged/transferred to another type of institution or referred for outpatient services to another institution (including distinct parts)
06	Discharged/transferred to home under care of organized Home Health Service Organization
07	Left against medical advice (AMA) or discontinued care
08	Discharged/transferred to home under care of a home IV (intravenous) provider
20	Expired
50	Discharged to Hospice—home
51	Discharged to Hospice—medical facility
61	Discharged/transferred within this institution to a hospital-based Medicare approved swing bed
62	Discharged/transferred to another rehabilitation facility including rehabilitation distinct part units of a hospital
63	Discharged/transferred to a Medicare certified long term care hospital (LTCH)
64	Discharged/transferred to a nursing facility certified under Medicaid but not certified under Medicare
71	Discharged/transferred/referred to another institution for outpatient services as specified by the discharge plan of care
72	Discharged/transferred/referred to this institution for outpatient services as specified by the discharge plan of care

TABLE 2

Linear Regression Example

Calculations Used in Determining Length of Stay for a Hospital
Condition: Heart Attack – Medical Management

Total Cases:	Number of hospitalizations for a hospital after exclusions (equal to n).
Actual Length of Stay:	Mean of the length of stay for each hospitalization.
Expected Length of Stay:	Mean of the predicted length of stay for each hospitalization. Step 1: Calculate each hospitalization's predicted length of stay (PLOS): $PLOS = \beta X$ $= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$ $= -1.3750 + (0.9274)(x_1) + (0.0224)(x_2) + (-0.0590)(x_3) + (1.2680)(x_4)$ where x_1 = MQPredLOS value x_2 = Age x_3 = Age-squared x_4 = Poverty Rate β's are the regression coefficients that correspond to each respective risk factor (x). Step 2: Calculate the mean PLOS for a hospital (expected length of stay): $\text{Mean PLOS} = \frac{\Sigma \text{ PLOS}}{n}$
Risk-Adjusted Length of Stay:	$\frac{\text{Mean Actual LOS}}{\text{Mean PLOS}}$ (Statewide Mean Actual LOS)

TABLE 3

Logistic Regression Example

Calculations Used in Determining Readmissions for Any Reason for a Hospital
Condition: Chronic Obstructive Pulmonary Disease

Total Cases: Number of hospitalizations for a hospital after exclusions (equal to n).

Actual Percent Readmitted for Any Reason: Total number of cases readmitted for any reason / total number of hospitalizations.

Expected Percent Readmitted for Any Reason: Mean of the predicted probability of readmission for any reason for each hospitalization.

Step 1: Calculate the predicted probability of readmission for any reason for each hospitalization (PReAny):

$$\beta X = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4$$
$$= -3.3282 + (0.2215)(x_1) + (0.0808)(x_2) + (0.0263)(x_3) + (-0.1879)(x_4)$$

where
- x_1 = MQPredLOS
- x_2 = Diabetes
- x_3 = Age
- x_4 = Age-squared

β's are the regression coefficients that correspond to each respective risk factor (x).

$$\text{PReAny} = \frac{e^{\beta X}}{1 + e^{\beta X}}$$

where $e \approx 2.7182818285$

Step 2: Calculate the mean PReAny for a hospital (expected percent of readmissions):

$$\text{Mean PReAny} = \frac{\Sigma\ \text{PReAny}}{n}$$

Risk-Adjusted Percent Readmitted for Any Reason:

$$\frac{\text{Mean Actual Percent Readmitted for Any Reason}}{\text{Mean PReAny}} \left(\text{Statewide Mean Actual Percent Readmitted for Any Reason} \right)$$

TABLE 4

Case-Mix Adjustment Example

Calculations Used in Determining Average Charge for a Hospital

Area: Western PA
Condition: Pneumonia - Infectious

Total Cases:	Number of hospitalizations for a hospital after exclusions (equal to n).
Actual Charge:	Mean of the charges for each hospitalization.
Expected Charge:	Mean of the predicted charges for each hospitalization. Step 1: Calculate each hospitalization's predicted charge (PChg): The PChg for each record is equal to the average charge for all hospitalizations (after exclusion) in the hospital's same region, condition, and DRG within the condition. Region 1 - Southwestern PA, Pneumonia - Infectious, DRG079: ..... $15,471 or Region 1 - Southwestern PA, Pneumonia - Infectious, DRG080: ..... $9,268 or Region 1 - Southwestern PA, Pneumonia - Infectious, DRG089: ..... $10,005 or Region 1 - Southwestern PA, Pneumonia - Infectious, DRG090: ..... $5,911 Step 2: Calculate the mean PChg for a hospital (expected charge): $$\text{Mean PChg} = \frac{\Sigma \text{ PChg}}{n}$$
Risk-Adjusted Charge:	$$\frac{\text{Mean Actual Chg}}{\text{Mean PChg}}$$ (Statewide Mean Actual Charge)

GLOSSARY OF ABBREVIATED TERMS

DC	Discharge
DOB	Date of Birth
DRG	Diagnosis Related Group
FFY	Federal Fiscal Year
GAC	General Acute Care Hospital
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
IQR	Interquartile Range
KCF	Key Clinical Findings
MQPredDeath	*Atlas Outcomes*™ Predicted Probability of Death
MQPredLOS	*Atlas Outcomes*™ Predicted Length of Stay
NR	Not Reported
Q	Quarter
SSN	Social Security Number
UB-92	Uniform Billing Form