

Technical Document

Hip and Knee Care in Utah Hospitals: Quality and Charges, 2006-2008

**Office of Health Care Statistics
Health Data Committee
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Introduction

Mandates for Publishing Utah Health Care Consumer Reports:

Utah Senate Bill 132, titled “Health Care Consumer Report,” passed by the 2005 Utah Legislature, requires the Health Data Committee (HDC) to report hospital performance annually for consumers. The public consumer reports shall use nationally recognized quality and patient safety standards and facility charges for conditions or procedures. In December 2005, the HDC began to publish a series of hospital comparison reports on hospital charges, quality and patient safety.

Purpose of the Technical Documentation:

This technical document is one of a series of publications that provide technical information and methodological explanations on the Utah health care consumer’s reports. Audiences for this publication include hospital personnel, health professionals, health data analysts and other interested professionals.

The Health Data Committee

Chapter 33a, Title 26, Utah Code Annotated established the 13-member Utah Health Data Committee. In accordance with the act, the committee’s purpose is:

“to direct a statewide effort to collect, analyze, and distribute health care data to facilitate the promotion and accessibility of quality and cost-effective health care and also to facilitate interaction among those with concern for health care issues.”

The SB132 Health Care Consumer’s Report Task Force

The Health Data Committee established the SB 132 Health Care Consumer's Report Task Force (SB 132 Task Force) in 2005. The SB132 Task Force is a technical advisory group that provides consultation to the Utah Health Data Committee and its staff members in the Office of Health Care Statistics on measures, methods and priorities for developing health care consumer's reports and the related Web reporting system.

Data Source

The Hospital Discharge Database

Data for the Utah health care consumer reports come from the statewide hospital discharge database. Administrative Rule R428-10, titled “Health Data Authority, Hospital Inpatient Reporting Rule,” mandates that all Utah licensed hospitals, both general acute care and specialty, report information on inpatient discharges. Since 1992, all hospitals have reported “discharge data” for each inpatient served. “Discharge data” means the consolidation of complete billing, medical and demographic information describing a patient, the services received and charges

billed for each inpatient hospital stay. Discharge data records are submitted to the office quarterly. The data elements are based on discharges occurring in a calendar quarter.

Measures Used

Please note that the number of patients for each Agency for Healthcare Research and Quality (AHRQ) Inpatient Quality Indicator (IQI) may not be the same as the number of patients for similar APR-DRGs. First, the APR-DRGs are hierarchical, mutually exclusive groups of conditions and procedures. A patient's APR-DRG reflects that patient's most resource-intensive condition and/or procedure. Second, the IQIs use different inclusion and exclusion criteria than some similarly named APR-DRGs. Third, some IQIs are based on three years of data, because the annual number of deaths per indicator is often small. For example, if a patient had hip joint replacement surgery without other major procedures, that patient received the APR-DRG 301 (Hip Joint Replacement). Other hip joint replacement patients may have received the APR-DRG 912 (Musculoskeletal and Other Procedures for Multiple Significant Trauma) or another APR-DRG depending on the treatment they received in addition to hip joint replacement surgery.

Sources of Quality Indicators

In compliance with SB 132, the Senate Bill for the Health Care Consumer Report, the Utah Health Data Committee adopts "nationally recognized standards" for its public reporting on quality and safety. The federal government's agency charged with overseeing health care quality, the Agency for Healthcare Research and Quality (AHRQ) has developed a set of Quality Indicators derived from hospital discharge data. Carolyn M. Clancy, M.D., Director of AHRQ, has saluted Utah's efforts. She said, "AHRQ views public reporting as one important strategy to advance the quality improvement agenda in health care." Dr. Clancy added, "Evidence shows that publicly reporting performance by specific hospitals is a key element that promotes enhanced patient care." A document titled "Guidance for Using the AHRQ Quality Indicators for Hospital-level Public Reporting or Payment" is available at: <http://www.qualityindicators.ahrq.gov/documentation.htm>.

Inpatient Quality Indicators (IQI)

These indicators were developed by the Agency for Healthcare Research and Quality (AHRQ) based on inpatient hospital discharge data. Although hospital discharge data does have some limitations, research has shown that IQIs may serve as proxies for utilization, quality or patient outcomes. AHRQ IQI definitions and analytical methods were used to calculate the quality indicators in this report. For more detailed information, go to www.qualityindicators.ahrq.gov/

Starting with 2006-2008 data, patients with a palliative care code (ICD9 V66.7) are excluded from the IQIs.

This report includes two of the AHRQ IQIs for hip patients.

Definitions and Codes for Each Quality Indicator

The following pages for the quality indicators used in this report are from AHRQ Quality Indicator, Guide to Inpatient Quality Indicators, Quality of Care in Hospital, Volume, Mortality, and Utilization. Rockville, MD, Agency for Healthcare Research and Quality, 2002, Version 3.1 (March 2007)

http://www.qualityindicators.ahrq.gov/downloads/iqi/iqi_guide_v31.pdf

AHRQ Quality Indicators, Inpatient Quality Indicators Technical Specifications, 2002, Version 3.2a (March 2008)

http://www.qualityindicators.ahrq.gov/downloads/iqi/iqi_technical_specs_v32a.pdf

Hip Replacement Mortality Rate (IQI 14)

Total hip arthroplasty (without hip fracture) is an elective procedure performed to improve function and relieve pain among patients with chronic osteoarthritis, rheumatoid arthritis, or other degenerative processes involving the hip joint.

Relationship to Quality	Better processes of care may reduce mortality for hip replacement, which represents better quality care.
Benchmark	State, regional, or peer group average.
Definition	Number of deaths per 100 patients with discharge procedure code of partial or full hip replacement.
Numerator	Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.
Denominator	All discharges, age 18 years and older, with procedure code of partial or full hip replacement in any field. Include only discharges with uncomplicated cases: diagnosis codes for osteoarthritis of hip in any field. Exclude cases: • missing discharge disposition (DISP=missing) • transferring to another short-term hospital (DISP=2) • MDC 14 (pregnancy, childbirth, and puerperium) • MDC 15 (newborns and other neonates)
Type of Indicator	Provider Level, Mortality Indicator for Inpatient Procedures

Hip Replacement Mortality Rate (IQI 14)

Numerator:

Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

Denominator:

All discharges, age 18 years and older, with a procedure code of partial or full hip replacement in any field.

ICD-9-CM hip replacement procedure codes:

8151 TOTAL HIP REPLACEMENT
8152 PARTIAL HIP REPLACEMENT
8153 REVISE HIP REPLACEMENT
0070 REV HIP REPL-ACETAB/FEM OCT05-
0071 REV HIP REPL-ACETAB COMP OCT05-
0072 REV HIP REPL-FEM COMP OCT05-
0073 REV HIP REPL-LINER/HEAD OCT05-

Include only discharges with uncomplicated cases: diagnosis codes for osteoarthritis of hip in any field.

ICD-9-CM osteoarthritis diagnosis codes:

71500 GENL OSTEOARTHRISIS NOS
71509 GENL OSTEOARTHRISIS MULT
71518 LOC PRIM OSTEOARTHR NEC
71520 LOC 2ND OSTEOARTH-UNSPEC
71525 LOC 2ND OSTEOARTH-PELVIS
71528 LOC 2ND OSTEOARTHROS NEC
71530 LOC OSTEOARTH NOS-UNSPEC
71535 LOC OSTEOARTH NOS-PELVIS
71538 LOC OSTEOAR NOS-SITE NEC
71580 OSTEOARTHRISIS-MULT SITE
71589 OSTEOARTHRISIS-MULT SITE
71590 OSTEOARTHROS NOS-UNSPEC
71595 OSTEOARTHROS NOS-PELVIS
71598 OSTEOARTHRO NOS-OTH SITE
71510LOC PRIM OSTEOART-UNSPEC
71515 LOC PRIM OSTEOART-PELVIS
71650 POLYARTHRITIS NOS-UNSPEC
71655 POLYARTHRITIS NOS-PELVIS
71658 POLYARTHRITIS NOS-OTH SITE
71659 POLYARTHRITIS NOS-MULT
71660 MONOARTHRITIS NOS-UNSPEC
71665 MONOARTHRITIS NOS-PELVIS
71668 MONOARTHRITIS NOS-OTH SITE
71690 ARTHROPATHY NOS-UNSPEC
71695 ARTHROPATHY NOS-PELVIS
71698 ARTHROPATHY NOS-OTH SITE
71699 ARTHROPATHY NOS-MULT

Exclude cases:

- missing discharge disposition (DISP=missing)

- transferring to another short-term hospital (DISP=2)
- MDC 14 (pregnancy, childbirth, and puerperium)
- MDC 15 (newborns and other neonates)

END IQI 14

Hip Fracture Mortality Rate (IQI 19)

Hip fractures, which are a common cause of morbidity and functional decline among elderly persons, are associated with a significant increase in the subsequent risk of mortality.

Relationship to Quality	Better processes of care may reduce mortality for hip fracture, which represents better quality.
Benchmark	State, regional, or peer group average.
Definition	Number of deaths per 100 discharges with principal diagnosis code of hip fracture.
Numerator	Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.
Denominator	All discharges, age 18 years and older, with a principal diagnosis code for hip fracture. Exclude cases: • missing discharge disposition (DISP=missing) • transferring to another short-term hospital (DISP=2) • MDC 14 (pregnancy, childbirth, and puerperium) • MDC 15 (newborns and other neonates)
Type of Indicator	Provider Level, Mortality Indicator for Inpatient Conditions

Hip Fracture Mortality Rate (IQI 19)

Numerator:

Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

Denominator:

All discharges, age 65 years and older, with principal diagnosis code for hip fracture. ICD-9-CM hip fracture diagnosis codes:

82000 FX FEMUR INTRCAPS NOS-CL
82001 FX UP FEMUR EIPHY-CLOS
82002 FX FEMUR, MIDCERVIC-CLOS
82003 FX BASE FEMORAL NCK-CLOS
82009 FX FEMUR INTRCAPS NEC-CL
82010 FX FEMUR INTRCAP NOS-OPN
82011 FX UP FEMUR EIPHY-OPEN
82012 FX FEMUR, MIDCERVIC-OPEN
82013 FX BASE FEMORAL NCK-OPEN
82019 FX FEMUR INTRCAP NEC-OPN
82020 TROCHANTERIC FX NOS-CLOS
82021 INTERTROCHANTERIC FX-CL
82022 SUBTROCHANTERIC FX-CLOSE
82030 TROCHANTERIC FX NOS-OPEN
82031 INTERTROCHANTERIC FX-OPN
82032 SUBTROCHANTERIC FX-OPEN
8208 FX NECK OF FEMUR NOS-CL
8209 FX NECK OF FEMUR NOS-OPN

Exclude cases:

- missing discharge disposition (DISP=missing)
- transferring to another short-term hospital (DISP=2)
- MDC 14 (pregnancy, childbirth, and puerperium)
- MDC 15 (newborns and other neonates)

END IQI 19

AHRQ Rates for Quality Indicators

The Agency for Healthcare Research and Quality (AHRQ) Quality Indicators Software outputs several rates. The AHRQ Quality Indicators e-Newsletter, June 2005, provided guidance to users for appropriate rates to use for specific purposes.

QI Tips: Using Different Types of QI Rates

Which rate should you use: the observed (actual), expected, risk adjusted, and/or smoothed rates? Here are some guidelines.

If the user's primary interest is to identify cases for the health care provider's internal follow-up and quality improvement, then the **observed rate** would help to identify them. *The observed rate is the raw rate generated by the QI software from the data the user provided.* Areas for improvement can be identified by the magnitude of the observed rate compared to available benchmarks and/or by the number of patients impacted.

Additional breakdowns by the default patient characteristics used in stratified rates (e.g., age, gender, or payer) can further identify the target population. Target populations can also be identified by user-defined patient characteristics supplemented to the case/discharge level flags. Trend data can be used to measure change in the rate over time.

Another approach to identifying areas of focus is to compare the observed and **expected rates**. *The expected rate is the rate the provider would have if it performed the same as the reference population given the provider's actual case mix (e.g., age, gender, DRG, and comorbidity categories).* This case mix is not the same as the Case Mix Index calculated and reported in the Office of Health Care Statistics Standard Reports. An example of how the expected rate is calculated appears later in this document.

If the observed rate is higher than the expected rate (i.e., the ratio of observed/expected is greater than 1.0, or observed minus expected is positive), the implication is that the provider had more of these cases than the reference population for that particular indicator. For death rates, users may want to focus on these indicators for quality improvement.

If the observed rate is lower than the expected rate (i.e., the ratio of observed/expected is less than 1.0, or observed minus expected is negative), the implication is that the provider had fewer cases than the reference population. For death rates, users may want to focus on these indicators for identifying best practices.

Users can also compare the expected rate to the **population rate** reported in the detailed evidence section of the IQI, PQI, or PSI Guide to determine how their case mix compares to the reference population. If the population rate is higher than the expected rate, the provider's case mix is less severe than the reference population. If the population rate is lower than the expected rate, then the provider's case mix is more severe than the reference population.

AHRQ uses this difference between the population rate and the expected rate to “adjust” the observed rate to account for the difference between the case mix of the reference population and the provider’s case mix. This is the provider’s **risk-adjusted rate**.

If the provider has a less severe case mix, then the adjustment is positive (population rate > expected rate) and the risk-adjusted rate is higher than the observed rate. If the provider has a more severe case mix, then the adjustment is negative (population rate < expected rate) and the risk-adjusted rate is lower than the observed rate. *The risk-adjusted rate is the rate the provider would have if it had the same case mix as the reference population given the provider’s actual performance.*

Finally, users can compare the risk-adjusted rate to the **smoothed** or “reliability-adjusted” rate to determine whether the difference between the risk-adjusted rate and reference population rate is likely to remain in the next measurement period. *Smoothed rates are weighted averages of the population rate and the risk-adjusted rate, where the weight reflects the reliability of the provider’s risk-adjusted rate.*

A ratio of (smoothed rate - population rate) / (risk-adjusted rate - population rate) greater than 0.80 suggests that the difference is likely to persist (whether the difference is positive or negative). A ratio of less than 0.80 suggests that the difference may be due in part to random differences in patient characteristics (patient characteristics that are not observed and controlled for in the risk-adjustment model). In general, users may want to focus on areas where the differences are more likely to persist.

From <http://qualityindicators.ahrq.gov/newsletter/2005-June-AHRQ-QI-Newsletter.htm#Headline3> (Accessed on July 31, 2008).

Expected Death Percentage

Expected death percentage is the number of deaths expected per 100 patients with a certain hip condition or procedure if the hospital performed the same as other hospitals in the nation with similar patients. Expected death percentage adjusts for the hospital’s case mix (patients’ age, gender and how ill the patients are). For example, a hospital’s hip replacement expected death percentage is the number of expected patient deaths per 100 hip replacement patients in that hospital if it performed similarly with patients similar to those in the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases for 2006, which contain the most recent, available national data. For more information on the AHRQ Inpatient Quality Indicators, see: www.qualityindicators.ahrq.gov/downloads/iqi/iqi_guide_v31.pdf.

Statistical Tests and Rating System for Quality Indicators

Star Rating

The star rating system in the report is based on a test of statistical significance. This test shows whether the difference between a hospital’s observed (actual) rate and the

expected rate is real or just due to chance. For each indicator, the upper and lower 95% confidence intervals were calculated for each hospital’s rate. The 95% confidence interval is the interval that one can be 95% certain contains the “true” hospital average. The 95% confidence interval for each hospital was then compared to the expected rate. When the lower limit of 95% confidence interval of a hospital rate is higher than the expected rate, the hospital rate is significantly higher than the expected rate. It is rated as one star, “ * ”. When the higher limit of 95% confidence interval of a hospital rate is lower than the expected rate, the hospital rate is significantly lower than the expected rate. It is rated as three stars, “ *** ”. When a hospital’s 95% confidence interval overlaps with the expected rate, the hospital rate is not significantly different from the expected rate and is rated as two stars, “ ** ”.

Keep in mind, however, that many factors affect a hospital’s rates. For example, a hospital that cares for a higher percentage of high-risk hip and knee surgery patients may have a higher rate for one or more quality indicators than a hospital that cares for a lower percentage of high-risk patients, which does not mean that the hospital delivers poor quality care.

95% Confidence Interval

Most methods for calculation of confidence intervals assume a normal distribution among the values for which the confidence intervals are calculated. However, these formulas do not work well on small numbers. The formula for exact confidence intervals does not assume a normal distribution. Instead, confidence intervals of the actual (observed) rate are calculated using the method of exact confidence intervals for the cumulative binomial distribution (Holubkov, 1998). This method is more appropriate for rates based on small numbers than other methods and is used in this report’s rating system.

The statistical formulas to calculate standard errors and 95% confidence intervals are as follows:

$$[[Pi].sub.L]=x/(x+[n-x+1][F.sub..025,2n-2x+2,2x])$$

$$[[Pi].sub.U]=(x+1)/(x+1[n-x][[[F.sub..025,2x+2,2n-2x]].sup.-1])$$

Formula used in an Excel spread sheet to calculate the values for the report:

$$95\% \text{ CI LowerLimit} = (x/(x+(n-x+1)*\text{finv}(0.025, (2*(n-x)), 2*x))*100$$

$$95\% \text{ CI UpperLimit} = ((x+1)/(x+1+(n-x)/\text{finv}(0.025, 2*x+2, 2*(n-x))))*100$$

Where:

- [Pi].sub.L = Value of 95% Confidence Interval Lower Limit
- [Pi].sub.U = Value of 95% Confidence Interval Lower Limit
- x = numerator/number of events
- n = denominator/number of risk population
- F = F distribution
- F.sub..025 = Selected critical value for 95% Confidence Interval

Reference: Holubkov, R. 1998 (August). “Analysis, assessment, and presentation of risk-adjusted statewide obstetrical care data: the StORQS II study in Washington State-Statewide Obstetrics Review and Quality System,” published in Health Service Research.

Other health care consumer reports may use some of the following additional methods:

I. AHRQ Method for Calculating Standard Errors for the Actual [Observed] Rates

- 1) The root mean squared error (RMSE) for each QI for “Hospital J” is:

$$RMSE = \sqrt{RATE_{ij} * (1 - RATE_{ij})}$$

where $RATE_{ij}$ is the observed rate for “QI #i” and “Hospital J”

- 2) The standard error on the observed rate for “Hospital J” is:

$$SE = RMSE / \sqrt{N_{ij}}$$

where N_{ij} is the denominator for “QI #i” and “Hospital J”

- 4) The 95% confidence interval on the observed rate for “Hospital J” for each QI is:

$$\text{Lower confidence interval} = \text{“Hospital J” observed rate} - (1.96 * SE)$$

$$\text{Upper confidence interval} = \text{“Hospital J” observed rate} + (1.96 * SE)$$

- 5) For example, if the rate for “Hospital J” for IQI #12 is Rate=0.10 and the denominator is N=200, then the lower bound 95% CI is:

$$\begin{aligned} 0.10 - 1.96 * \sqrt{(0.10 * (1 - 0.10)) / 200} &= \\ 0.10 - 1.96 * 0.021213 &= \\ 0.10 - 0.041578 & \end{aligned}$$

and the upper bound 95% CI is:

$$\begin{aligned} 0.10 + 1.96 * \sqrt{(0.10 * (1 - 0.10)) / 200} &= \\ 0.10 + 1.96 * 0.021213 &= \\ 0.10 + 0.041578 & \end{aligned}$$

II. Calculating Standard Errors for the IQI Risk-adjusted Rates

Risk adjusted rates

- 1) Open the file IQI_V21_R4_RMSE.xls in the AHRQ Quality Indicator Software Package

2) The column labeled “RMSE” is the root mean squared error (RMSE) for each IQI based on the risk-adjustment model.

3) The standard error on the risk-adjusted rate for “Hospital J” is:

$$SE = \sqrt{MSE/N_{ij}} = RMSE / \sqrt{N_{ij}}$$

where N_{ij} is the denominator for “IQI #i” and “Hospital J”

4) The 95% confidence interval on the risk-adjusted rate for “Hospital J” for each IQI is:

$$\text{Lower confidence interval} = \text{“Hospital J” risk-adjusted rate} - (1.96 * SE)$$

$$\text{Upper confidence interval} = \text{“Hospital J” risk-adjusted rate} + (1.96 * SE)$$

5) For example, if the denominator for “Hospital J” for IQI #12 is $N=200$, then $RMSE= 0.171757$ and the lower bound 95% CI is:

$$\text{rate} - 1.96 * (0.171757 / \sqrt{200}) =$$

$$\text{rate} - 1.96 * 0.012145 =$$

$$\text{rate} - 0.023804$$

and the upper bound 95% CI is:

$$\text{rate} + 1.96 * (0.171757 / \sqrt{200}) =$$

$$\text{rate} + 1.96 * 0.012145 =$$

$$\text{rate} + 0.023804$$

Example for Expected Rate Calculation for Quality Indicators

The expected rate comes from a logistic regression AHRQ analysts have run on all inpatients in the National Inpatient Database 2006. The logistic regression produces coefficients (or weights) for each variable for each AHRQ Inpatient Quality Indicator (IQI) and Patient Safety Indicator (PSI). The variables vary by Indicator. Each Indicator has selection criteria for which patients to include. The AHRQ software assigns coefficients for each included inpatient, depending on the inpatient’s values for each of the indicator’s variables. The sum of the inpatient’s coefficients gives this inpatient’s contribution to the expected rate for a particular indicator for the hospital at which this inpatient was treated. The sum of all the hospital’s inpatients’ contributions is the hospital’s expected rate. In this way, the expected rate shows the expected rate for other similar inpatients nationwide, providing a national comparison for each Utah hospital and Utah overall.

For Hip Joint Replacement Death (IQI 14), the logistic regression equation is

$$M = I + C1 + C2 + C3 + C4$$

where

- M = inpatient's contribution to the expected rate
- I = intercept
- C1 = age coefficient
- C2 = sex coefficient
- C3 = age sex interaction coefficient
- C4 = APR-DRG risk of mortality interaction coefficient

For example, among all hip replacement patients IQI 14 includes in its denominator, a hip replacement male inpatient, age 62, with a minor level of risk of mortality contributes to his hospital's expected rate

$$-7.664 = -7.664 + 0.000 + 0.000 + 0.000$$

and a hip replacement female inpatient, age 87, with an extreme level of risk of mortality contributes to her hospital's expected rate

$$-1.517 = -7.664 + (-0.462) + 0.715 + (-0.023) + 5.917$$

for all hip replacement patients. The M values for all IQI 14 hip replacement inpatients are combined using the following formula to give the hospital's expected death rate for hip replacement. See

http://www.qualityindicators.ahrq.gov/downloads/iqi/iqi_covariates_v31.pdf

$$ER = \frac{\sum(\text{Exp}(M))}{(1.000 + \text{Exp}(M)) / P}$$

where

- ER = expected death rate
- Exp = exponent function, in this case, e raised to the power of M
- M = inpatient's contribution to the expected rate
- P = number of patients this indicator includes for this hospital

The expected death rate for Utah overall is the above formula for all Utah inpatients selected for this AHRQ hip replacement indicator.

Limitations of Quality Indicators

Many factors affect a hospital's performance on quality and safety measures as well as charges. Such factors include the hospital's size, the number of hip and knee cases treated, available specialists, teaching status and especially how ill the hospital's patients are. Hospitals that treat high-risk (very ill) patients may have higher percentages of deaths than hospitals that transfer these patients. Hospitals that treat patients with do-not-resuscitate (DNR) orders may have higher percentages of deaths. Hospitals may report patient diagnosis codes differently, which could impact the comparison of quality measurement among hospitals. The quality indicators adjust for how ill each hospital's patients are, but the adjustment may not capture the full complexity of the patient's

condition. The Utah Hospital Discharge Database includes up to nine diagnoses and up to six procedures for each patient. Some patients have additional diagnoses and procedures that are not included in this database. As a result, the measures of patient illness may not be complete. See Glossary for more about specific indicators.

Method of Reporting Charges

Use of All-patient Refined Diagnosis Related Group (APR-DRG)

The APR-DRG classification system is used in the Utah health care consumer reports to categorize discharge records into different disease/condition groups of patients.

□ Diagnosis Related Group (DRG)

The DRGs were developed for the Health Care Financing Administration as a patient classification scheme which provides a means of relating the type of patients a hospital treats (i.e., its case mix) to the costs incurred by the hospital. While all patients are unique, groups of patients have common demographic, diagnostic and therapeutic attributes that determine their resource needs. All patient classification schemes capitalize on these commonalities and utilize the same principle of grouping patients by common characteristics.

The use of DRGs as the basic unit of payment for Medicare patients represents a recognition of the fundamental role a hospital's "sicker" patients play in determining resource usage and costs, at least on average. "The DRGs, as they are now defined, form a manageable, clinically coherent set of patient classes that relate a hospital's case mix to the resource demands and associated costs experienced by the hospital." (*Diagnosis Related Groups, Seventh Rev., Definitions Manual*, page 15.)

Each discharge in the Utah Health Discharge Database was assigned into a DRG based on the principal diagnosis, secondary diagnoses, surgical procedures, age, sex, and discharge status of the patient.

□ APR-DRG and Patient Severity Level

APR-DRG stands for All Patient Refined Diagnosis Related Group, software widely used in health services research. The APR-DRG software organizes about 20,000 clinical diagnoses and procedures into about 300 hierarchical, mutually exclusive groups. As stated previously, each inpatient is assigned a single APR-DRG that reflects the most complex care that the inpatient received and the most hospital resources used to care for the inpatient. An inpatient may not belong to more than one APR-DRG. For example, if a patient had hip joint replacement surgery without other major procedures, that patient received the APR-DRG 301 (Hip Joint Replacement). Other hip joint replacement patients may have received the APR-DRG 912 (Musculoskeletal and Other Procedures for Multiple Significant Trauma) or another APR-DRG depending on the treatment they received in addition to hip joint replacement surgery.

Each APR-DRG has four levels for severity of illness. The severity of illness and risk of mortality subclasses have levels of 1 to 4, indicating minor, moderate, major and extreme, respectively. In the consumer reports, patients are assigned to one of two groups. Patients with a minor or moderate level of severity of illness are in the Minor/Moderate group and patients who are assigned a major or extreme level of severity of illness are in the Major/Extreme group. Patients whose care is classified in the Major/Extreme group are those who have multiple conditions, diseases, illnesses or are much sicker than patients who are classified in the Minor/Moderate group. This report uses APR-DRG version 20.0 for expected deaths, because AHRQ uses this version for risk adjustment in the Inpatient Quality Indicators. This report also uses APR-DRG version 20.0 for average charges.

Read more about APR-DRGs at

http://solutions.3m.com/wps/portal/3M/en_US/3M_Health_Information_Systems/HIS/Products/APRDRG_Software/.

Note that other Health Data Committee reports, such as the Utah Inpatient Hospital Utilization and Charges Profile, Hospital Detail report for 2004 and previous years, use APR-DRG Version 15.0.

Excluding Outlier Cases from Calculating Hospital Average Charges

Some patients have exceptionally short or long lengths of stay or total facility (hospital) charges. A hospital's charges can be affected by just a few unusually long (or short) or expensive (or inexpensive) cases. These high or low values could be a result of coding or data submittal errors, particularly in length of stay, total charges, or data elements that affect APR-DRG assignments. Other reasons for exceptionally low charges could be due to death or transfer to another hospital. Exceptionally high charges could be due to a catastrophic condition. Whatever the reason, these values, referred to as "outliers," distort the averages and were excluded from calculations. Following the "industry standards" and research conventions in statistics, high charge outliers are defined in this report, as well as those preceding and succeeding it, as values above 2.5 standard deviations from the state mean for each of the four levels of severity of illness for each APR-DRG. Means and standard deviations are APR-DRG-specific and calculated on a statewide basis for a specific calendar year. For this report, the high outlier cases for both charge and length of stay are excluded from calculation of hospital average charges.

Facility Charge is Used for the Consumer Reports

The Utah Hospital Discharge Database contains two types of charge summary information:

- (1) Total Charges: Sum of all charges included in the billing form, including both facility (hospital) charges and professional fees and patient convenience items. This is different from *cost* of treatment or *payment* received by the hospital. Cost of treatment can include additional care after the patient leaves the hospital.

- (2) Facility Charges: Sum of all charges related to using a facility. Facility charge is calculated by subtracting professional fees and patient convenience item charges from total charge.

The facility charge is used for public reporting on hospital charges.

Payment received by the hospital may be less than the total charges billed for the patient's hospital stay due to contractual agreements with the insurance plans and/or charity/hardship programs available.

Average Charge:

Average charge is the calculated average for all services for which patients in a particular severity of illness group (one of two groups in this report, minor/moderate or major/extreme) were billed as the facility charges at a particular hospital for a given condition or procedure. The average was calculated by adding the facility charges for all services billed at that hospital for a given condition or procedure and then dividing by the total number of patients in this severity of illness group for that condition or procedure. For example, the average facility charge for knee joint replacement patients with a moderate level of severity of illness at Hospital A would be the sum of the facility charges for this hospital's knee joint replacement patients with a moderate level of severity of illness divided by the sum of Hospital A's knee joint replacement patients with a moderate level of severity of illness.

The method of calculating the average facility charge is identical to the method used in the Health Data Committee's standard report: Utah Hospital Utilization and Charge Profile, Hospital Details, Table ST 1-3. In other words, both publications report average facility charges at APR-DRG and patient severity level (one of four levels for each APR-DRG) without high outliers.

Average Length of Stay:

The average length of stay was the sum of days all patients stayed in the hospital for a certain condition or procedure divided by the total number of patients who were treated for that condition or procedure. For example, the average length of stay for knee joint replacement patients with a moderate level of severity of illness at Hospital A would be the sum of the days of stay for this hospital's knee joint replacement patients with a moderate level of severity of illness divided by the sum of Hospital A's knee joint replacement patients with a moderate level of severity of illness.

The method of calculating the average length of stay is the identical method used in the Health Data Committee's standard report: Utah Hospital Utilization and Charge Profile, Hospital Details (ST-1) Table ST 1-3. The average facility length of stay excludes high outliers by APR-DRG and patient severity level. In other words, outlier charges and length of stay are excluded for each of the four levels of patient severity of illness for each APR-DRG.

Limitations of Charge Indicators

The average charge shown in this report differs from “costs,” “reimbursement,” “price” and “payment.” Many factors will affect the cost of your hospital stay, including whether you have health insurance, the type of insurance and the billing procedures at the hospital. This report excludes outlier (unusually high) charge cases and length of stay cases from the calculation of average charge (see Glossary).

This report shows total billed facility charges. Billed charges are to be used as only one indicator of hospital performance. All patients, or insurance plans, do not pay the same amount for similar treatments, supplies, services and procedures, even though they may be billed the same amount. Different payers have varied arrangements with each hospital for payment. Hospitals offer a variety of contracts, many with discount arrangements based on volume. Because of this, the data reflect pre-contractual prices for hospitalization and not the actual payment between providers and payers. Each patient may have additional charges from physicians, such as the surgeon and the anesthesiologist.

This report can be used to compare broad measures of utilization for all hospitals, but more detailed data are needed to look at specific performance comparisons between hospitals. This information serves as an important first step toward consumers’ taking a more active role in health care decision-making.

The price of hospital services, while important, is not the only consideration in making inpatient hospital decisions. Other factors can influence hospital services, including: the type of condition treated, the physicians who practice at the hospital, and the insurance company’s managed care policies. The health plan subscriber should be familiar with his or her health plan long before hospital care is needed. For additional information on managed care performance, please contact the Office of Health Care Statistics at 801-538-7048.

Bilateral Knee Joint Replacement

Some patients can have bilateral knee joint replacements; that is, both right and left knee joint replacement surgeries during a single hospital stay. Advantages include less total time in the hospital -- less time than for two separate hospital stays for one knee replacement at a time. Disadvantages include greater stress on the patient from two major surgeries at the same time. Also, bilateral knee joint patients need more assistance after surgery, such as longer stays in rehabilitation or nursing facilities. Surgeons usually consider only patients who are physically strong, otherwise in good health, and slender for bilateral knee joint replacements.

In Utah, 6,821 inpatients had knee replacements in 2008. Of these, 392 (5.7%) inpatients had bilateral total knee joint replacement. The 379 inpatients with minor/moderate severity of illness had an average hospital charge of \$51,311 and an average length of stay of 3.5 days. The 13 inpatients with major/extreme severity of illness had an average

hospital charge of \$64,975 and an average length of stay of 5.9 days. These averages include patients with high outlier hospital charge and high outlier length of stay, because bilateral joint replacements tend to be among the most expensive and lengthy knee replacement hospitalizations. The averages do not include revision of knee joint replacement.

Bilateral Hip Joint Replacement

Though less common than bilateral knee joint replacement, some patients can have bilateral hip joint replacements, that is, both right and left hip joint replacement surgeries during a single hospital stay. Advantages include less total time in the hospital. Having both hips replaced during a single hospital stay usually requires less time in the hospital than the total days in the hospital for replacing one hip during the first hospitalization and the other hip during a second hospitalization. Disadvantages include greater stress on the patient from two major surgeries at the same time. Also, these patients need more assistance after surgery, such as longer stays in rehabilitation or nursing facilities. Surgeons usually consider only patients who are physically strong, otherwise in good health, and slender for bilateral knee joint replacements. Also, bilateral hip joint replacement surgery requires specialized surgical equipment and instruments.

In Utah, 3,300 inpatients had hip replacements in 2008. Of these, 19 (0.6%) inpatients had bilateral hip joint replacement. These patients had any combination of total or partial hip joint replacements, that is, both total hip joint replacements, both partial hip joint replacements and one total and one partial hip joint replacement. The 19 inpatients with minor/moderate severity of illness had an average hospital charge of \$56,737 and an average length of stay of 3.6 days. No inpatients with major/extreme severity of illness had a bilateral hip joint replacement. The average includes patients with high outlier hospital charge and high outlier length of stay, because bilateral joint replacements tend to be among the most expensive and lengthy hip replacement hospitalizations. The averages do not include revision of hip joint replacement.