

# **Technical Document**

## **Readmissions to Utah Hospitals: 2005-2007**

**Office of Health Care Statistics  
Health Data Committee  
Utah Department of Health  
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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 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 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.

Inpatients spend at least one night in the hospital. Discharge data records are submitted to the office quarterly. The data elements are based on discharges occurring in a calendar quarter.

Colleagues at the University Huntsman Cancer Institute linked the statewide hospital discharge database by patient for the analyses for this report.

## **Readmission Measure**

Senate Bill 132, the Health Care Consumer Report Bill passed in 2005, mandates that hospital comparison reports use nationally recognized measures. While currently no nationally recognized measure of readmission exists, several states use the 3M Potentially Preventable Readmission software (PPR) for health care research and reporting, and additional states are considering it. This software counts readmitted patients for All Patient Refined Diagnosis Related Groups (APR-DRGs), which encompass a wide range of medical conditions and procedures.

### **APR-DRGs**

All Patient Refined Diagnosis Related Groups (APR-DRGs) organize about 20,000 clinical diagnoses and procedures into 314 mutually exclusive groups. Patients are assigned an APR-DRG based on their most serious medical condition and their most extensive use of hospital resources. For example, a patient who had a heart bypass surgery with heart catheterization would be assigned APR-DRG 165, whereas a heart attack patient would be assigned APR-DRG 190. Each APR-DRG has four levels for severity of illness: minor, moderate, major and extreme. APR-DRG software is widely used across the nation in health care research and reporting. Read more about APR-DRGs at

[http://solutions.3m.com/wps/portal/3M/en\\_US/3M\\_Health\\_Information\\_Systems/HIS/Products/APRDRG\\_Software/](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, whereas more recent reports, such as the Utah Inpatient Hospital Utilization and Charges Profile, Hospital Detail report for 2005 and more recent years, the online hospital comparison reports and this readmission report, use APR-DRG Version 20.0.

This report includes across hospital readmissions for 16 inpatient conditions and procedures (APR-DRGs).

### **Potentially Preventable Readmissions**

The PPR software identifies readmissions within a specified readmission time interval

from the discharge date of a previous hospital stay for clinically related reasons for 236 of the 314 APR-DRGs (Version 25.0). This report includes information about across hospital readmissions of adult inpatients who are residents of Utah. Across hospital readmissions include readmissions of patients to any short-term, acute-care hospital in Utah, whether the readmission was to the same hospital as the patient's previous admission or a different hospital. Adult inpatients are patients who are at least 18 years of age and who spent at least one night in the hospital per hospital stay. For this report, short-term, acute-care hospitals exclude psychiatric, long-term care and children's hospitals.

The PPR software does not count some patients such as transfer patients; patients who left the hospital against medical advice during a previous hospital stay; patients about whom the medical community is not in agreement regarding potentially preventable readmissions, such as women giving birth and newborns; and patients for whom readmission is part of a plan of care, such as patients with serious burns, multiple trauma or advanced cancer.

The readmission time interval is the maximum number of days after the discharge date from a previous hospital stay that a return to the hospital is counted as a readmission. This report uses 30 days for the readmission time interval. For example, a patient with diabetes who was readmitted 30 days after the discharge date of a previous hospital stay for diabetes would count as a readmission, while the same patient readmitted 31 days after the discharge date of a previous hospital stay for diabetes would not count.

Some groups of patients were globally excluded if they were assigned APR-DRGs for any of the following conditions or treatments:

- Patients for whom readmission is an accepted plan of care, such as patients with advanced cancer, serious burns or serious multiple injuries
- Newborn, maternity and pediatric readmissions.

Other groups of patients were globally excluded if they had the following discharge statuses:

- Patients who were transferred from one short-term, acute-care hospital to another such hospital during their previous hospital stay
- Patients who left the hospital against medical advice and were readmitted
- Patients who died during their previous hospital stay, as they cannot be readmitted.

Readmissions that did not meet the PPR criteria for potentially preventable readmissions were also globally excluded:

- Patients who were readmitted for reasons not clinically related to their previous hospital stay, as determined by the PPR
- Patients who were readmitted to another kind of health care facility, such as a skilled nursing facility.

A panel of physicians advised the developers of PPR regarding clinically related readmissions based on the APR-DRG assigned to each patient. A clinically related readmission counts as a potentially preventable readmission, unless it was excluded according to the above criteria.

Some examples follow.

A heart attack patient who was readmitted for another heart attack 30 days after being discharged from the previous hospitalization counts as a clinically related readmission.

A heart attack patient who was readmitted for diabetes 30 days after discharge counts as a clinically related readmission, because heart disease and diabetes are associated.

A heart bypass surgery patient who was readmitted 30 days after being discharged for a post surgical infection and readmitted again 30 days after discharge for diabetes from the readmission would be counted once as a “Readmitted” patient. The PPR software flags both readmissions which patient record reviewers can identify and examine.

A heart attack patient who was hit by a car while crossing the street 30 days after discharge and was readmitted for a broken leg would not count as a readmission.

For more information on PPRs, see

[http://solutions.3m.com/wps/portal/3M/en\\_US/3M\\_Health\\_Information\\_Systems/HIS/Products/PPR/](http://solutions.3m.com/wps/portal/3M/en_US/3M_Health_Information_Systems/HIS/Products/PPR/).

### **Actual Percentage of Readmitted Patients**

Each hospital’s actual percentage of readmitted patients is the number of readmitted patients divided by the number of patient admissions at risk for readmission for a specified APR-DRG. A readmitted patient is counted once, though the patient may have been readmitted more than once. Admissions at risk for readmission exclude some groups of patients, as described previously. The actual percentage of readmitted patients is not risk adjusted.

For example, from 2005 through 2007, Hospital 1 had 1,781 admissions for knee joint replacement (APR-DRG 302) at risk for readmission, of which 8 were readmitted. The actual percentage of readmitted patients is  $8/1,781=0.45\%$ .

### **Expected Percentage of Readmitted Patients**

Each hospital's expected percentage of readmitted patients is the number of expected readmitted patients divided by the number of patient admissions at risk for readmission for a specified APR-DRG. The expected number of readmitted patients is the number of readmitted patients expected for each of four severity of illness levels for each APR-DRG, if the hospital had the same percentage of readmitted patients for each severity of illness level as Utah overall.

For example, from 2005 through 2007, Hospital 1 had 1,781 admissions for knee joint replacement (APR-DRG 302) at risk for readmission, of which 8 were readmitted (0.45%). Utah overall had 16,703 admissions for knee joint replacement, of which 349 were readmitted ( $349/16,703=2.08\%$ ). For Utah overall readmitted patients were distributed across the four severity of illness levels as follows:

“minor:” (139 readmitted /9,455 at risk =1.47%)  
 “moderate:” (175 readmitted /6,602 at risk =2.65%)  
 “major:” ( 32 readmitted/599 at risk =5.34%)  
 “extreme:” ( 1 readmitted/47 at risk =2.13%).

To calculate the expected percentage of readmitted patients for Hospital 1, determine the number of expected readmissions for Hospital 1. Multiply the number of admissions at risk for Hospital 1 by the Utah overall actual percentage of readmitted patients for each severity of illness level :

“minor”: 978 at risk \* 1.47%=14.38 expected readmissions  
 “moderate: 758 at risk \* 2.65%=20.09 expected readmissions  
 “major”: 43 at risk \* 5.34%= 2.30 expected readmissions  
 “extreme: 2 at risk \* 2.13%= 0.04 expected readmissions.

Sum the number of expected readmissions:  $14.38 + 20.09 + 2.30 + 0.04 = 36.81$  expected readmissions for Hospital 1.

Divide the summed number of expected readmissions by the number of admissions at risk for readmission for Hospital 1 across the four severity of illness levels. Hospital 1's expected percentage of readmitted patients for hip joint replacement is  $36.81/1,781=2.07\%$ .

For more information on PPRs, see

[http://solutions.3m.com/wps/portal/3M/en\\_US/3M\\_Health\\_Information\\_Systems/HIS/Products/PPR/](http://solutions.3m.com/wps/portal/3M/en_US/3M_Health_Information_Systems/HIS/Products/PPR/)

## **Statistical Rating**

The star rating system in the report is based on the Exact 95% Confidence Interval, a test of statistical significance. This test shows whether the difference between a hospital's readmission rate and the Utah overall rate is likely to be real or just due to chance.

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 for 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:

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

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

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 at 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 Data Committee reports may use other methods and tests.

For the statistical rating in the report tables, the upper and lower limits of the exact 95% confidence interval were calculated for each actual percentage of readmitted patients by APR-DRG and hospital. We can be 95% certain these limits include the "true" hospital percentage of readmitted patients. The exact 95% confidence interval for each hospital was then compared to the hospital's expected percentage of readmissions, if the hospital had treated patients as ill as those for Utah overall. If the upper limit of the 95% confidence interval of a hospital's actual percentage of readmitted patients is less than its expected percentage of readmitted patients, the hospital's actual percentage is significantly lower than expected. It is rated as three stars, "\*\*\*." If the lower limit of the 95% confidence interval of a hospital's percentage of readmitted patients is greater than its expected percentage of readmitted patients, the hospital rate is significantly higher than expected. It is rated as one star, "\*." If a hospital's confidence interval upper and lower limits include its expected percentage of readmitted patients, its actual and expected percentage values are not significantly different.. It is rated as two stars, "\*\*."

Some examples follow.

For hip joint replacements (APR-DRG 301), Hospital 1 has an actual percentage of readmitted patients of 0.45% (8 of 1,781 admissions at risk for readmission) with a lower limit of 0.19% and an upper limit of 0.88%. The upper limit (0.88%) is less than the expected rate of 2.1% for Hospital 1, so we can be 95% confident that the observed percentage of 0.45% for Hospital 1 is significantly lower than its expected percentage.

Hospital 2 has an actual percentage of 6.6% (10 of 151) with a lower limit of 3.2% and an upper limit of 11.8%. Its lower limit is greater than the expected percentage of 2.0, so we can be 95% confident that its actual percentage of readmitted patients is significantly higher than the expected percentage.

Hospital 3 has an actual percentage of 2.1% (20 of 1,197) with a lower limit of 1.1% and an upper limit of 2.6%. Because the lower and upper limits include the expected percentage of 1.7%, the difference between the observed and expected percentage of readmitted patients is not statistically significant.

## **Limitations of Readmission Measure**

Many factors affect a hospital's percentage of readmitted patients. Readmissions can vary according to the kinds of patients admitted to the hospital, how ill the patients are and medical treatment patients receive before, during and after a hospital stay. For example, the actual percentages of patients readmitted for knee joint replacement, pneumonia and heart valve procedures differ considerably. This report includes hospital readmission tables by APR-DRG, but patients may vary within a particular APR-DRG. To address this variation, this report compares each hospital's actual percentage of readmitted patients and its expected percentage of readmitted patients. Each hospital's expected percentage of readmitted patients is calculated based on the number of readmitted patients expected if the hospital's patients were as ill as patients for Utah overall, based on distribution over four severity of illness levels per APR-DRG. However, this method may not capture the complexity of each patient's condition or treatment.

While the PPR software excludes some patients for whom readmission is part of an accepted plan of care, it may not exclude all such patients. The software may also miss some patients who were readmitted with related conditions. This report includes information about adult Utah resident inpatients, that is, patients who spend at least one night in the hospital, are residents of Utah and are at least 18 years of age. The software does not include mothers giving birth, newborns, patients who are less than 18 years of age, emergency department patients or outpatients, that is, patients who do not spend at least one night in the hospital.

Readmission may reflect variations in patterns of practice among hospital physicians. Hospital readmission may be the best option for patients who cannot access other forms of appropriate care such as a skilled nursing facility, have complex medical issues or are near the end of life. Also, hospitals may report patient diagnosis and procedure codes differently, which could impact the comparison of readmissions among hospitals. The Utah Hospital Discharge Database, the data source for this report, 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 and treatment may not be complete. While verification tests of the patient linked data show a high level of accurate links, some links may have been missed and others may be incorrect. The PPR software and method of determining readmissions used in this report adjust for patient condition and treatment by APR-DRG and severity of illness level, which may not capture the full complexity of the patient's condition.

Differences in actual and expected percentage of readmitted patients may reflect variations in patterns of practice among hospital physicians. Hospital readmission may be the best option for patients who cannot access other forms of appropriate care. Hospitals may code patient diagnoses and procedures differently. 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 and treatment may not be complete. The readmission measure used in this report includes hospital tables by APR-DRG, which may not capture the full complexity of the patient's condition. See Glossary and Technical Document for more information.