Technical Document

Maternity and Newborn Care in Utah Hospitals: Quality, Charges and Patient Safety, 2008

Office of Health Care Statistics
Health Data Committee
Utah Department of Health
December 2009

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Introduction

Mandates for Publishing Utah Health Care Consumer Reports:

Utah Senate Bill 132, titled "Health Care Consumer Report" and 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 health care consumer reports, that is, 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 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 reports and 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) or Patient Safety Indicator (PSI) 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 and PSIs use different inclusion and exclusion criteria than some similarly named APR-DRGs. Third, some PSIs are based on three years of data, because the annual number of injuries is often small. For example, women with vaginal delivery with sterilization or dilation and curettage received APR-DRG 541 (Vaginal Delivery With Sterilization and/or Dilation and Curettage) and women with vaginal deliveries and no other procedures received APR-DRG 540 (Vaginal Delivery).

Sources of Quality and Safety Indicators

In compliance with SB 132, the Senate Bill for health care consumer reports, 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 (IQIs] and Patient Safety Indicators (PSIs)

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

This report includes two of the AHRQ IQIs and three of the AHRQ PSIs for maternity and newborn cases.

Definitions and Codes for Each Quality Indicator

The following pages for the quality indicators used in this report are from
AHRQ Quality Indicators, Guide to Inpatient Quality Indicators: Quality of Care in Hospitals, 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

Cesarean Delivery Rate (IQI 33)

Cesarean delivery is the most common operative procedure performed in the United States and is associated with higher costs than vaginal delivery. Despite a recent decrease in the rate of Cesarean deliveries, many organizations have aimed to monitor and reduce the rate.

Relationship to Quality	Cesarean delivery has been identified as an overused procedure. As such, lower rates represent better quality.
Benchmark	State, regional, or peer-group average.
Definition	Provider-level number of [Mother's First-time] Cesarean deliveries per 100 deliveries.
Numerator	Number of Cesarean deliveries, identified by DRG, or by ICD-9-CM procedure codes if they are reported without a 7491 hysterotomy procedure, among cases meeting the inclusion and exclusion rules for the denominator.
Denominator	All deliveries. Exclude cases: • abnormal presentation, preterm, fetal death, multiple gestation diagnosis codes • breech procedure codes • previous Cesarean delivery diagnosis in any diagnosis field.
Type of Indicator	Provider Level, Procedure Utilization Indicator

Primary Cesarean Delivery Rate (IQI 33)

Numerator:

Number of Cesarean deliveries, identified by DRG, or by ICD-9-CM procedure codes if they are reported without a 7491 hysterotomy procedure, among cases meeting the inclusion and exclusion rules for the denominator.

Cesarean delivery DRGs:

370	CESAREAN SECTION W CC
371	CESAREAN SECTION W/O CC

ICD-9-CM Cesarean delivery procedure codes:

740	CLASSICAL C-SECTION	744	CESAREAN SECTION NEC
741	LOW CERVICAL C-SECTION	7499	CESAREAN SECTION NOS
742	EXTRAPERITONEAL C-SECT		

Exclude:

ICD-9-CM procedure codes:

7491	HYSTEROTOMY TO TERMIN PG

Denominator:

All deliveries.

All delivery DRGs:

370	CESAREAN SECTION W CC	373	VAG DELIVERY W/O COMPL
371	CESAREAN SECTION W/O CC	374	VAG DELIV W STERIL OR DC
372	VAGINAL DELIVERY W COMPL	375	VAG DELIV W OTH OR PROC

Exclude cases:

- abnormal presentation, preterm delivery, fetal death, multiple gestation diagnosis codes
- breech procedure codes
- previous Cesarean delivery diagnosis in any diagnosis field

See Appendix A: Problem Deliveries

Control-click (Word) or click (PDF) to view the Appendix. Links are provided to return to the IQI Detailed Definition.

ICD-9-CM previous cesarean delivery diagnosis codes:

65420	PREV C-SECT NOS-UNSPEC
65421	PREV C-SECT NOS-DELIVER

Primary Cesarean Delivery Rate (IQI 33)
65423 PREV C-SECT NOS-ANTEPART

END IQI 33

Vaginal Birth after Cesarean Rate, All (IQI 34)

The policy of recommending vaginal birth after Cesarean delivery (VBAC) represents to some degree a matter of opinion on the relative risks and benefits of a trial of labor in patients with previous Cesarean delivery.

Relationship to Quality	VBAC has been identified as a potentially underused procedure. As such, higher rates represent better quality.
Benchmark	State, regional, or peer-group average.
Definition	Provider-level vaginal births per 100 discharges with a diagnosis of previous Cesarean delivery.
Numerator	Number of vaginal births in women among cases meeting the inclusion and exclusion rules for the denominator.
Denominator	All deliveries with a previous Cesarean delivery diagnosis in any diagnosis field.
Type of Indicator	Provider Level, Procedure Utilization Indicator

Vaginal Birth after Cesarean (VBAC) Delivery, All (IQI 34)

Numerator:

Number of vaginal births in women among cases meeting the inclusion and exclusion rules for the denominator.

Vaginal delivery DRGs:

372	VAGINAL DELIVERY W/ CC
373	VAGINAL DELIVERY W/O CC
374	VAGINAL DELIVERY W/ STERILIZATION OR D&C
375	VAGINAL DELIVERY W/ OTHER O.R. PROCEDURE

Denominator:

All deliveries with a previous cesarean delivery diagnosis in any diagnosis field.

All delivery DRGs:

370	CESAREAN SECTION W CC	373	VAG DELIVERY W/O COMPL
371	CESAREAN SECTION W/O CC	374	VAG DELIV W STERIL OR DC
372	VAGINAL DELIVERY W COMPL	375	VAG DELIV W OTH OR PROC

ICD-9-CM previous Cesarean delivery diagnosis codes:

65420	PREV C-SECT NOS-UNSPEC
65421	PREV C-SECT NOS-DELIVER
65423	PREV C-SECT NOS-ANTEPART

END IQI 34

Definitions and Codes for Each Patient Safety Indicator

The following pages for the quality indicator used in this report are from
AHRQ Quality Indicators—Guide to Patient Safety Indicators, Rockville, MD: Agency for Healthcare Research and Quality, 2003, Version 3.1 (March 2007)
http://www.qualityindicators.ahrq.gov/downloads/iqi/iqi_guide_v31.pdf

AHRQ Quality Indicators – Patient Safety Indicators Technical Specifications, 2003, Version 3.2 (March 2008)
http://www.qualityindicators.ahrq.gov/downloads/iqi/iqi_technical_specs_v32.pdf

Birth Trauma—Injury to Neonate (PSI 17)

Definition	Cases of birth trauma, injury to neonate, per 1,000 live born births.
Numerator	Discharges among cases meeting the inclusion and exclusion rules for the denominator with ICD-9-CM code for birth trauma in any diagnosis field. Exclude infants • with a subdural or cerebral hemorrhage (subgroup of birth trauma coding) **and** any diagnosis code of pre-term infant (denoting birth weight of less than 2,500 grams and less than 37 weeks gestation or 34 weeks gestation or less). • with injury to skeleton (767.3, 767.4) **and** any diagnosis code of osteogenesis imperfecta (756.51).
Denominator	All live born births (newborns). The definition of newborn is any neonate with either 1) an ICD-9-CM diagnosis code for an in-hospital live born birth or 2) an admission type of newborn (ATYPE=4), age in days at admission equal to zero, and not an ICD-9-CM diagnosis code for an out-of-hospital birth. A neonate is defined as any discharge with age in days at admission between zero and 28 days (inclusive). If age in days is missing, then a neonate is defined as any DRG in MDC 15, an admission type of newborn (ATYPE=4), or an ICD-9-CM diagnosis code for an in-hospital live born birth.
Type of Indicator	Provider level
Empirical Performance	Bias: Did not undergo empirical testing of bias
Risk Adjustment	Sex

Birth Trauma—Injury to Neonate (PSI 17)

Numerator:

Discharges among cases meeting the inclusion and exclusion rules for the denominator with ICD-9-CM codes for birth trauma in any diagnosis field.

ICD-9-CM Birth Trauma diagnosis codes:

7670 SUBDURAL AND CEREBRAL HEMORRHAGE (DUE TO TRAUMA OR TO INTRAPARTUM ANOXIA OR HYPOXIA)
76711 EPICRANIAL SUBAPONEUROTIC HEMORRHAGE (MASSIVE) OCT03-
7673 INJURIES TO SKELETON (EXCLUDES CLAVICLE)
7674 INJURY TO SPINE AND SPINAL CORD
7677 OTHER CRANIAL AND PERIPHERAL NERVE INJURIES
7678 OTHER SPECIFIED BIRTH TRAUMA
7679 BIRTH TRAUMA, UNSPECIFIED

Note: Because 767.1 was not previously included in the numerator specification, the addition of 767.11 may cause an increase in the rate.

Exclude infants:

- with a subdural or cerebral hemorrhage (subgroup of birth trauma coding) **and** any diagnosis code of pre-term infant (denoting birth weight of less than 2,500 grams and less than 37 weeks gestation or 34 weeks gestation or less).
- with injury to skeleton (767.3, 767.4) **and** any diagnosis code of osteogenesis imperfecta (756.51).

ICD-9-CM Preterm Infant diagnosis codes:

76501 EXTREME IMMATURITY, LESS THAN 500 GRAMS
76502 EXTREME IMMATURITY, 500 – 749 GRAMS
76503 EXTREME IMMATURITY, 750 – 999 GRAMS
76504 EXTREME IMMATURITY, 1000 – 1249 GRAMS
76505 EXTREME IMMATURITY, 1250 – 1499 GRAMS
76506 EXTREME IMMATURITY, 1500 – 1749 GRAMS
76507 EXTREME IMMATURITY, 1750 – 1999 GRAMS
76508 EXTREME IMMATURITY, 2000 – 2499 GRAMS
76511 OTHER PRETERM INFANTS, LESS THAN 500 GRAMS
76512 OTHER PRETERM INFANTS, 500 – 749 GRAMS
76513 OTHER PRETERM INFANTS, 750 – 999 GRAMS
76514 OTHER PRETERM INFANTS, 1000 – 1249 GRAMS
76515 OTHER PRETERM INFANTS, 1250 – 1499 GRAMS
76516 OTHER PRETERM INFANTS, 1500 – 1749 GRAMS
76517 OTHER PRETERM INFANTS, 1750 – 1999 GRAMS
76518 OTHER PRETERM INFANTS, 2000 – 2499 GRAMS
76521 LESS THAN 24 COMPLETED WEEKS OF GESTATION
76522 24 COMPLETED WEEKS OF GESTATION
76523 25-26 COMPLETED WEEKS OF GESTATION
76524 27-28 COMPLETED WEEKS OF GESTATION

Birth Trauma—Injury to Neonate (PSI 17)

76525	29-30 COMPLETED WEEKS OF GESTATION
76526	31-32 COMPLETED WEEKS OF GESTATION
76527	33-34 COMPLETED WEEKS OF GESTATION

Denominator:

All live born births (newborns).

The definition of newborn is any neonate with either 1) an ICD-9-CM diagnosis code for an in-hospital live born birth or 2) an admission type of newborn (SID ATYPE=4), age in days at admission equal to zero, and not an ICD-9-CM diagnosis code for an out-of-hospital birth. A neonate is defined as any discharge with age in days at admission between zero and 28 days (inclusive). If age in days is missing, then a neonate is defined as any DRG in MDC 15, an admission type of newborn (SID ATYPE=4), or an ICD-9-CM diagnosis code for an in-hospital live born birth.

Newborn in Hospital Live Birth Codes

V3000	SINGLE LB IN-HOSP W/O CS OCT05-	V3401	OTH MULT LB-IN HOSP W CS OCT05-
V3001	SINGLE LB IN-HOSP W CS OCT05-	V3500	OTH MULT SB-HOSP W/O CS OCT05-
V3100	TWIN-MATE LB-HOSP W/O CS OCT05-	V3501	OTH MULT SB-IN HOSP W CS OCT05-
V3101	TWIN-MATE LB-IN HOS W CS OCT05-	V3600	MULT LB/SB-IN HOS W/O CS OCT05-
V3200	TWIN-MATE SB-HOSP W/O CS OCT05-	V3601	MULT LB/SB-IN HOSP W CS OCT05-
V3201	TWIN-MATE SB-HOSP W CS OCT05-	V3700	MULT BRTH NOS-HOS W/O CS OCT05-
V3300	TWIN-NOS-IN HOSP W/O CS OCT05-	V3701	MULT BIRTH NOS-HOSP W CS OCT05-
V3301	TWIN-NOS-IN HOSP W CS OCT05-	V3900	LIVEBORN NOS-HOSP W/O CS OCT05-
V3400	OTH MULT LB-HOSP W/O CS OCT05-	V3901	LIVEBORN NOS-HOSP W CS OCT05-

OR

SID Admission type recorded as (4) and Age in Days at Admission equal to zero:

AND NOT

Newborn out of Hospital codes:

V301	SINGL LIVEBRN-BEFORE ADM OCT05-	V342	OTH MULTIPLE NB-NONHOSP OCT05-
V302	SINGLE LIVEBORN-NONHOSP OCT05-	V351	OTH MULT SB-BEFORE ADM OCT05-
V311	TWIN, MATE LB-BEFORE ADM OCT05-	V352	OTH MULTIPLE SB-NONHOSP OCT05-
V312	TWIN, MATE LB-NONHOSP OCT05-	V361	MULT NB/SB-BEFORE ADM OCT05-
V321	TWIN, MATE SB-BEFORE ADM OCT05-	V362	MULTIPLE NB/SB-NONHOSP OCT05-
V322	TWIN, MATE SB-NONHOSP OCT05-	V371	MULT BRTH NOS-BEFORE ADM OCT05-
V331	TWIN NOS-BEFORE ADMISSN OCT05-	V372	MULT BIRTH NOS-NONHOSP OCT05-
V332	TWIN NOS-NONHOSP OCT05-	V391	LIVEBORN NOS-BEFORE ADM OCT05-
V341	OTH MULT NB-BEFORE ADM OCT05-	V392	LIVEBORN NOS-NONHOSP OCT05-

Note: The AHRQ PSI 17 definition of newborn changed in an earlier version of software (3.0). However, the software did not reflect this change until Version 3.1. Hence, number of newborns and rate of injury may differ substantially from those from previous years.

END PSI 17

Obstetric Trauma—Vaginal Delivery with Instrument (PSI 18)

Definition	Cases of obstetric trauma (3rd or 4th degree lacerations) per 1,000 instrument-assisted vaginal deliveries.
Numerator	Discharges among cases meeting the inclusion and exclusion rules for the denominator with ICD-9-CM code for 3rd and 4th degree obstetric trauma in any diagnosis or procedure field.
Denominator	All vaginal delivery discharges with any procedure code for instrument-assisted delivery.
Type of Indicator	Provider level
Empirical Performance	Bias: Did not undergo empirical testing of bias
Risk Adjustment	Age, comorbidity categories

Obstetric Trauma—Vaginal Delivery with Instrument (PSI 18)

Numerator:

Discharges among cases meeting the inclusion and exclusion rules for the denominator with ICD-9-CM codes for 3rd and 4th degree obstetric trauma in any diagnosis or procedure field.

ICD-9-CM Obstetric Trauma diagnosis codes:

66420,1,4 TRAUMA TO PERINEUM AND VULVA DURING DELIVERY, THIRD DEGREE PERINEAL LACERATION
66430,1,4 TRAUMA TO PERINEUM AND VULVA DURING DELIVERY, FOURTH DEGREE PERINEAL LACERATION

ICD-9-CM Obstetric Trauma procedure codes:

7550 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF UTERUS
7551 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CERVIX
7552 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CORPUS UTERI
7561 REPAIR OF CURRENT OBSTETRIC LACERATION OF BLADDER AND URETHRA
7562 REPAIR OF CURRENT OBSTETRIC LACERATION OF RECTUM AND SPHINCTER ANI

Denominator:

All vaginal delivery discharges with any procedure code for instrument-assisted delivery.

Vaginal Delivery DRGs:

372 VAGINAL DELIVERY W/ COMPLICATING DIAGNOSES
373 VAGINAL DELIVERY W/O COMPLICATING DIAGNOSES
374 VAGINAL DELIVERY W/ STERILIZATION AND/OR D AND C
375 VAGINAL DELIVERY W/ OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C

Obstetric Trauma—Vaginal Delivery with Instrument (PSI 18)

ICD-9-CM Instrument-Assisted Delivery procedure codes:

720	LOW FORCEPS OPERATION
721	LOW FORCEPS OPERATION W/ EPISIOTOMY
7221	MID FORCEPS OPERATION W/ EPISIOTOMY
7229	OTHER MID FORCEPS OPERATION
7231	HIGH FORCEPS OPERATION W/ EPISIOTOMY
7239	OTHER HIGH FORCEPS OPERATION
724	FORCEPS ROTATION OF FETAL HEAD
7251	PARTIAL BREECH EXTRACTION W/ FORCEPS TO AFTERCOMING HEAD
7253	TOTAL BREECH EXTRACTION W/ FORCEPS TO AFTERCOMING HEAD
726	FORCEPS APPLICATION TO AFTERCOMING HEAD
7271	VACUUM EXTRACTION W/ EPISIOTOMY
7279	VACUUM EXTRACTION DELIVERY NEC
728	OTHER SPECIFIED INSTRUMENTAL DELIVERY
729	UNSPECIFIED INSTRUMENTAL DELIVERY

END PSI 18

Obstetric Trauma—Vaginal Delivery without Instrument (PSI 19)

Definition	Cases of obstetric trauma (3rd or 4th degree lacerations) per 1,000 vaginal deliveries without instrument assistance.
Numerator	Discharges among cases meeting the inclusion and exclusion rules for the denominator with ICD-9-CM code for 3rd and 4th degree obstetric trauma in any diagnosis or procedure field.
Denominator	All vaginal delivery discharges. Exclude cases: • with instrument-assisted delivery.
Type of Indicator	Provider level
Empirical Performance	Population Rate (2003): 46.340 per 1,000 population at risk Bias: Did not undergo empirical testing of bias
Risk Adjustment	Age, comorbidity categories

Obstetric Trauma—Vaginal Delivery without Instrument (PSI 19)

Numerator:

Discharges among cases meeting the inclusion and exclusion rules for the denominator with ICD-9-CM codes for 3rd and 4th degree obstetric trauma in any diagnosis or procedure field.

ICD-9-CM Obstetric Trauma diagnosis codes:

66420,1,4 TRAUMA TO PERINEUM AND VULVA DURING DELIVERY, THIRD DEGREE PERINEAL LACERATION
66430,1,4 TRAUMA TO PERINEUM AND VULVA DURING DELIVERY, FOURTH DEGREE PERINEAL LACERATION

ICD-9-CM Obstetric Trauma procedure codes:

7550 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF UTERUS
7551 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CERVIX
7552 REPAIR OF CURRENT OBSTETRIC LACERATIONS OF CORPUS UTERI
7561 REPAIR OF CURRENT OBSTETRIC LACERATION OF BLADDER AND URETHRA
7562 REPAIR OF CURRENT OBSTETRIC LACERATION OF RECTUM AND SPHINCTER ANI

Denominator:

All vaginal delivery discharge patients.

Vaginal Delivery DRGs:

Obstetric Trauma—Vaginal Delivery without Instrument (PSI 19)

372 VAGINAL DELIVERY W/ COMPLICATING DIAGNOSES
373 VAGINAL DELIVERY W/OCOMPLICATING DIAGNOSES
374 VAGINAL DELIVERY W/ STERILIZATION AND/OR D AND C
375 VAGINAL DELIVERY W/ OR PROCEDURE EXCEPT STERILIZATION AND/OR D AND C

Exclude cases:

- with instrument-assisted delivery.

ICD-9-CM Instrument-Assisted Delivery procedure codes

720 LOW FORCEPS OPERATION
721 LOW FORCEPS OPERATION W/ EPISIOTOMY
7221 MID FORCEPS OPERATION W/ EPISIOTOMY
7229 OTHER MID FORCEPS OPERATION
7231 HIGH FORCEPS OPERATION W/ EPISIOTOMY
7239 OTHER HIGH FORCEPS OPERATION
724 FORCEPS ROTATION OF FETAL HEAD
7251 PARTIAL BREECH EXTRACTION W/ FORCEPS TO AFTERCOMING HEAD
7253 TOTAL BREECH EXTRACTION W/ FORCEPS TO AFTERCOMING HEAD
726 FORCEPS APPLICATION TO AFTERCOMING HEAD
7271 VACUUM EXTRACTION W/ EPISIOTOMY
7279 VACUUM EXTRACTION DELIVERY NEC
728 OTHER SPECIFIED INSTRUMENTAL DELIVERY
729 UNSPECIFIED INSTRUMENTAL DELIVERY

END PSI 19

AHRQ Rates for Quality and Patient Safety 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 identify 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 death 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 deaths than the reference population for that particular indicator. Users may want to focus on these indicators for quality improvement.

If the observed death 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 deaths than the reference population. Users may want to focus on these indicators for identifying best practices.

If the observed use rate is higher than the expected rate, then the implication is that the provider had more patients with the specified procedure than the reference population for that particular indicator. If the observed use rate is lower than the expected rate, the implication is that the provider had fewer patients with the specified procedure than the reference population for that particular indicator.

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, then 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 Utilization Percentage

Expected utilization (use) percentage is the number of cases expected per 100 patients who had a certain procedure if the hospital performed the same as other hospitals in the nation with similar patients. Expected use percentage adjusts for the hospital's case mix (patients' age, gender and how ill the patients are). For example, in these health care consumer reports, a hospital's first-time Cesarean birth expected use percentage is the number of women expected to have a first-time Cesarean birth per 100 women giving birth in that hospital if it performed similarly with mothers and newborns 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.

Expected Injury Rate

Expected injury rate is the number of cases with specified injuries expected per 100 patients who had a certain procedure if the hospital performed the same as similar patients nationwide. Expected injury rate adjusts for the hospital's case mix (patients' age, gender and how ill the patients are). For example, in these health care consumer reports, a hospital's injuries to

newborns expected rate is the expected number of newborns with specified injuries per 100 newborns born in that hospital if it performed like similar hospitals 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 and Patient Safety 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, in the health care consumer reports a hospital that cares for a higher portion of high-risk patients may have a higher rate for a quality or safety indicator than hospitals that care for a lower portion 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])

Formulas used in an Excel spread sheet to calculate the values for indicators based on number of patients per 100 are:

95% CI Lower Limit = (x/(x+(n-x+1)*finv(0.025, (2*(n-x)+2), 2*x))*100
95% CI Upper Limit = ((x+1)/(x+1+(n-x)/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

For indicators based on number of patients per 1000, the formulas are the same except that the last term is 1000 instead of 100.

The health care consumer reports use the values that these formulas produce. An exception is cases in which the lower limit is a negative value. These negative values are converted to zero.

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(RATEij*(1-RATEij))

where RATEij 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 (Nij)

where Nij 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:

Lower confidence interval = "Hospital J" observed rate – (1.96 * SE)
Upper confidence interval = "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:

0.10 - 1.96 * sqrt[(0.10 * (1-0.10)) / 200] =
0.10 - 1.96 * 0.021213 =
0.10 - 0.041578

and the upper bound 95% CI is:

0.10 + 1.96 * sqrt[(0.10 * (1-0.10)) / 200] =
0.10 + 1.96 * 0.021213 =
0.10 + 0. 041578

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/Nij) = RMSE/ SQRT (Nij)

   where Nij 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:

   Lower confidence interval = "Hospital J" risk-adjusted rate – (1.96 * SE)
   Upper confidence interval = "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:

   rate - 1.96 * (0. 171757 / sqrt(200)) =
   rate - 1.96 * 0.012145 =
   rate - 0.023804

   and the upper bound 95% CI is:

   rate + 1.96 * (0. 171757 / sqrt(200)) =
   rate + 1.96 * 0.012145 =
   rate + 0.023804

Example of Expected Rate Calculation for Quality and Patient Safety 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 Obstetric Injury – Vaginal Delivery Without Instrument (PSI 19), the logistic regression equation is

$M = I + C1 + C2$

where

M = inpatient's contribution to the expected rate
I = intercept
C1 = age coefficient
C2 = comorbidity (other serious illness or condition) coefficient

For example, among all mothers PSI 19 includes in its denominator,
a mother, age 24, with no other serious illnesses or conditions contributes to her hospital's expected rate

$-2.981 = -2.981 + 0.000 + 0.000$

and a mother, age 24, with an ulcer contributes to her hospital's expected rate

$-1.652 = -2.981 + 0.000 + 1.329.$

for all other mothers who had vaginal deliveries without instruments. The M values for all PSI 19 mothers who had vaginal deliveries without instruments are combined using the following formula to give the hospital's expected death rate for mothers who had vaginal deliveries without instruments.

$ER = sum(Exp(M) / (1.000 + Exp(M)) / P)$

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 rate for mothers who had vaginal injuries without instruments for Utah overall is the above formula for all Utah inpatients selected for this AHRQ indicator.

Limitations of Quality and Patient Safety Indicators

Many factors affect a hospital's performance on utilization measures. Such factors include the hospital's size, the number of mother and newborn hospital stays, available specialists, teaching status and especially the medical history of the hospital's patients and how ill the hospital's patients are. Hospitals that treat high-risk (very ill) patients may have higher Cesarean delivery and injury rates for mothers and newborns than hospitals that transfer these patients. Hospitals may report patient diagnosis codes differently, which could impact the comparison of utilization measurement among hospitals. 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 inpatient illness may not be complete.

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 DRG, developed for the federal Health Care Financing Administration, is a patient classification scheme that relates 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 software is 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 mother or newborn is assigned a single APR-DRG that reflects the most complex care received and the most hospital resources used. A mother may not belong to more than one APR-DRG, nor may a newborn. For example, most normal newborns who weigh at least 5.5 lbs. receive the APR-DRG 640 (Normal Newborn). Mothers who have a vaginal delivery without additional procedures receive the APR-DRG 560 (Vaginal Delivery).

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, mothers and newborns are assigned to one of two groups. Mothers or newborns with a minor or moderate level of severity of illness are in the Minor/Moderate group. Mothers and newborns who are assigned a major or extreme level of severity of illness are in the Major/Extreme group. Mothers or infants whose care is classified in the Major/Extreme group are those who have multiple conditions, diseases, illnesses or are much sicker than mothers and infants 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 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. Note that some facilities offer a combined charge for a mother and her newborn.

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 the services for which patients in a particular severity of illness group (one of two groups in this report, /moderate or major/extreme) were billed as the facility charges for all the services billed at that hospital for a given condition or procedure and then dividing by the total number of patients who were treated for that condition or procedure. For example, the average facility charge for Cesarean delivery mothers with a moderate level of severity of illness at Hospital A would be the sum of the facility charges for this hospital's Cesarean delivery mothers with a moderate level of severity of illness divided by the sum of Hospital A's Cesarean delivery mothers with a moderate level of severity of illness.

The method of calculating the average facility charge is identical to the method used in the HDC 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 level for severity of illness (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 normal newborns with a moderate level of severity of illness at Hospital A would be the sum of the days this hospital's normal newborns with a moderate level of severity of illness stayed divided by the sum of Hospital A's normal newborns with a moderate level of severity of illness.

The method of calculating the average length of stay is the identical method used in the HDC 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. 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.

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 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.)