

Indicators of Inpatient Quality in Texas Hospitals

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Abstract

The Texas Health Care Information Council (THCIC) is charged with producing reports on the quality of Texas hospitals. The methodology used to measure hospital quality is required by statute to include case-mix qualifiers and severity adjustment factors to accurately reflect hospital quality. This paper describes the application of SAS software developed for the federal Agency for Healthcare Research and Quality which satisfies those requirements to Texas hospital inpatient discharge data collected by THCIC. The SAS software was used to produce risk-adjusted rates for 25 indicators of inpatient quality in Texas hospitals. A report released in May 2003 includes data for years 1999 through 2001 for the 25 indicators.

The indicators are grouped into four categories:

- Volume of certain intensive, high-technology, or highly complex procedures for which evidence suggests that hospitals performing more of these procedures may have better outcomes;
- Mortality for inpatient procedures;
- Mortality for inpatient conditions; and
- Utilization indicators for which questions have been raised about overuse, under use, or misuse.

Texas Health Care Information Council

The Texas Health Care Information Council (THCIC) was established to address the needs and recommendations of various business and consumer interest groups. During the early 1990's these interested groups agreed that consumers, defined broadly to include both individuals and employers, need objective information on health care providers, both hospitals and health maintenance organizations, to make informed decisions when considering the use of health care services. In legislation effective September 1, 1995, the Council was charged with the collection of data on discharges from most Texas hospitals and on services provided by HMOs. More than 400 of the State's licensed hospitals are required by statute to report certain administrative data from patient discharge records. Most rural hospitals are exempt from reporting. Hospital data collection began in 1998 and data for discharges in 1999 were the first released.

THCIC is required by statute to publish hospital quality reports. The methodology for measuring quality is required to include severity adjustment factors and other factors necessary to accurately reflect hospital quality.

Agency for Healthcare Research and Quality

The Agency for Healthcare Research and Quality (AHRQ) is the nation's lead federal agency for research on health care quality, costs, outcomes, and patient safety. It is the health services research arm of the U.S. Department of Health and Human Services (HHS), complementing the biomedical research mission of its sister agency, the National Institutes of Health. Its research centers specialize in major areas of health care research including quality improvement and patient safety, outcomes and effectiveness of care, and primary care and preventive services. AHRQ develops strategies to strengthen quality measurement and improvement by providing hospitals, health data organizations, and states with enhanced quality assessment tools that they can use with their own hospital administrative data to highlight potential quality concerns and track changes over time in three areas: ambulatory care sensitive conditions, inpatient quality (volume, mortality, and utilization), and patient safety.

The first inpatient quality indicators were developed by AHRQ in the early 1990s in response to requests for a quality assessment tool that could be used with hospital administrative data. These first AHRQ quality indicators consisted of 33 clinical performance measures that could be used to inform hospitals' self-assessments of inpatient quality of care as well as state and community assessments of access to primary care. The three groups of measures examined:

- potentially avoidable adverse hospital outcomes, including mortality rates among low-risk patients receiving common elective procedures and complication rates during hospitalizations;
- potentially inappropriate utilization of hospital procedures, including utilization rates for procedures for which there are concerns of overuse or under use; and
- potentially avoidable hospitalizations, hospital admissions for conditions that are thought to be avoidable with adequate primary care in the community.

The second generation of quality indicators, released in 2002, conceptually separate then expand upon the initial indicators and include three groups of indicators: inpatient quality indicators (IQIs), prevention quality indicators, and patient safety indicators. The IQIs, the focus of this paper, reflect quality of care within the inpatient hospital setting. They are a set of measures that can be used with hospital inpatient discharge data to provide a perspective on quality and include the following:

- **Volume** indicators (seven indicators) are proxy, or indirect, measures of quality. They are based on evidence suggesting that hospitals performing more of certain intensive, high technology, or highly complex procedures may have better outcomes for those procedures. Volume indicators simply represent counts of admissions in which these procedures were performed.
 - Esophageal Resection Volume
 - Pancreatic Resection Volume

- Pediatric Heart Surgery Volume
 - Abdominal Aortic Aneurysm (AAA) Repair Volume
 - Coronary Artery Bypass Graft (CABG) Volume
 - Percutaneous Transluminal Coronary Angioplasty (PTCA) Volume
 - Carotid Endarterectomy Volume
- **Mortality indicators for inpatient procedures** (seven indicators) provide mortality rates for patients who died at a hospital after undergoing a specific type of surgery. Better quality may be associated with lower mortality rates.
 - Esophageal Resection Mortality
 - Pancreatic Resection Mortality
 - Pediatric Heart Surgery Mortality
 - Abdominal Aortic Aneurysm (AAA) Repair Mortality
 - CABG Mortality
 - Craniotomy Mortality
 - Hip Replacement Mortality
- **Mortality indicators for inpatient conditions** (six indicators) provide mortality rates for patients who died at a hospital while being treated for certain conditions.
 - Acute Myocardial Infarction (AMI) Mortality
 - Congestive Heart Failure (CHF) Mortality
 - Acute Stroke Mortality
 - Gastrointestinal (GI) Hemorrhage Mortality
 - Hip Fracture Mortality
 - Pneumonia Mortality
- **Utilization** indicators (five indicators) examine procedures whose use varies across hospitals and for which questions have been raised about overuse, under use, or misuse.
 - Cesarean Section Delivery Rate
 - Vaginal Birth After Cesarean (VBAC) Rate
 - Laparoscopic Cholecystectomy Rate
 - Incidental Appendectomy in the Elderly Rate
 - Bilateral Cardiac Catheterization Rate

Staff from the Evidence-based Practice Center (EPC) at UCSF-Stanford performed the evidence review, completed the empirical evaluation, and created the programming code and technical documentation for the new IQIs. The SAS code and technical documentation are available on AHRQ's website at www.ahrq.gov. An important improvement over the first IQIs is the inclusion of age, sex, severity of illness, and risk of mortality adjustments of the data. The risk-adjusted rate is the best estimate of what the hospital's performance would have been if the hospital had a mix of patients identical to a national-average patient mix for the year. This allows for a better comparison of hospitals. This inclusion satisfied THCIC's quality reporting requirements. THCIC released its first hospital quality report in October 2002 using data for hospital discharges

in 2000 and the AHRQ methodology. A second report was released in May 2003 for discharges in 1999 through 2001.

Software

The IQI software was written to process hospital administrative data typically submitted to payers in the uniform bill known as the UB-92, also called the HCFA-1450. The UB-92 was developed and approved for use in 1992 and has been used since 1993 by hospitals and other providers to bill Medicare and subsequently other third-party payers. THCIC collects data from hospitals in the UB-92 format.

The software requires a specific set of variables coded with specific values, for example, a numeric data element named SEX with values coded 1 for male and 2 for female. Diagnoses and procedures must be coded using the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) and the codes must be character strings, should not contain any decimal points, and should be left justified. Missing values must be represented by standard SAS values for missing data. The software also requires values from version 15 of 3M's All Patient Refined Diagnosis Related Groups (APR DRG) software to calculate the risk-adjusted rates. These values include severity of illness and risk of mortality scores and other APR DRG categories necessary for the risk-adjustment of the indicators. The data elements, their characteristics, and values expected by the software are described in the following table.

Data Elements and Coding Conventions

Variable name	Description	Format	Value description	Comments
KEY	Sequence number Unique case identifier	Numeric	User defined unique numeric identifier for each discharge record	Not used by the IQI programs, but facilitates possible exploration and trouble shooting.
AGE	Age in years at admission	Numeric	Age in years	If missing, excluded from the analysis.
RACE	Race of patient	Numeric 1 2 3 4 5 6	White Black Hispanic Asian or Pacific Island Native American Other	The values of 1,2,3 are used directly in the IQI software. All other ethnicity codes are mapped to an 'other' category.
SEX	Sex of patient	Numeric 1 2	Male Female	If missing, excluded from the analysis.
PAY1	Expected primary payer	Numeric 1 2 3 4 5 6	Medicare Medicaid Private, incl. HMO Self-pay No charge Other	The values of 1,2,3,4 are used directly in the IQI software. All other payer codes are mapped to an 'other' category. Used to stratify the IQIs (IQI01-IQI25).

HOSPSTCO	Hospital location (FIPS State/county code)	Numeric ssccc	Modified Federal Information Processing Standards State/county code	Available at: http://www.census.gov/population/estimates/fips.txt
HOSPID	Data Source hospital number	Numeric	Hospital identification number	Assigned by THCIC
DISP	Disposition of patient	Numeric 1 2 3 4 5 6 7 20	Routine Short-term hospital Skilled nursing facility Intermediate care Another type of facility Home health care Against medical advice Died in the hospital	The values 2 and 20 are referenced by the IQI code (to identify transfers to another short-term hospital, and patients who died in the hospital).
APRDRG	APR-DRG category	Numeric	APR-DRG from 3M software.	Although the IQI module will operate without these variables, the variable is required to calculate risk-adjusted rates.
SEVERE	APR-DRG Severity Score	Numeric	APR-DRG Severity Score from 3M software.	Although the IQI module will operate without these variables, the variable is required to calculate risk-adjusted rates.
MORTAL	APR-DRG Mortality Score	Numeric	APR-DRG Risk of Mortality Score from 3M Software.	Although the IQI module will operate without these variables, , the variable is required to calculate risk-adjusted rates.
DRG	Diagnosis Related Group	Numeric	DRG from federal DRG Grouper	
MDC	Major Diagnostic Category	Numeric	MDC from federal DRG grouper	
DX1 – DX30	Diagnoses ICD-9-CM codes DX1 is the principal diagnosis, DX2-DX30 are secondary diagnoses.	String, 5 character	Diagnoses code	Users with more or fewer secondary diagnoses should modify the parameter &NDX in CONTROL.SAS to reflect the number of diagnoses.
PR1 – PR30	Procedure ICD-9-CM codes PR1 is the principal diagnosis, PR2-PR30 are secondary procedures.	String, 4 character	Procedure code	Users with more or fewer secondary procedures should modify the parameter &NPR in CONTROL.SAS to reflect the number of diagnoses.

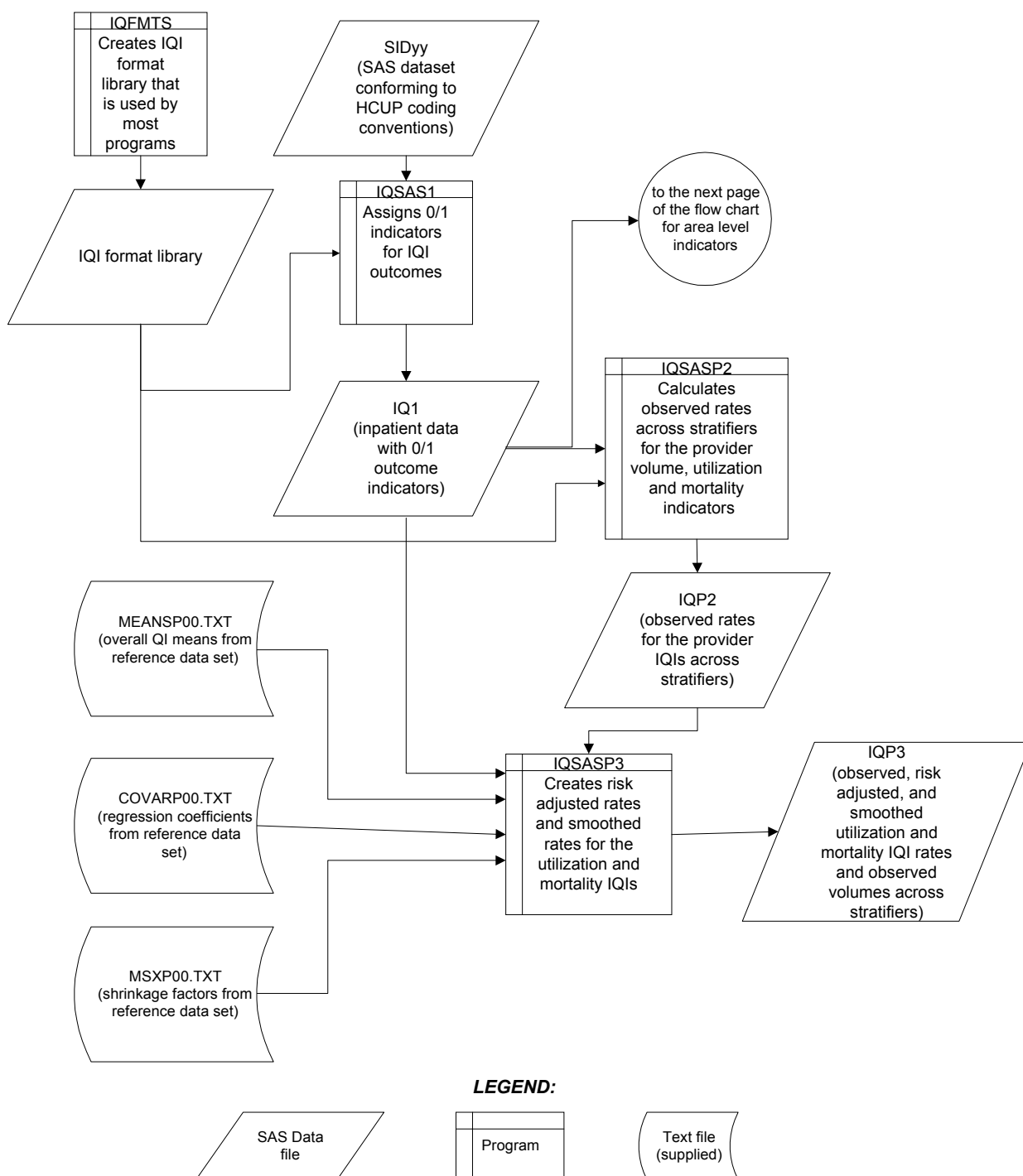
The processing steps are described in the following flow chart. Conceptually, four steps are necessary to produce the IQI rates reported by THCIC.

1. **Identify outcomes in inpatient records** Inpatient records are marked to indicate whether they contain the outcome of interest (numerator) for each of the measures by setting a series of flag variables for each inpatient discharge record. For the seven volume indicators this first step is the only step required.

2. **Identify populations at risk** The populations at risk (the denominators for calculating the IQI rates) are determined from the inpatient discharge records.
3. **Calculate observed (raw) IQI rates** Using the output data from step 1 and the hospital discharge data from step 2, the observed IQI rates for each hospital are calculated.
4. **Risk adjust the IQI rates** Overall means and regression coefficients from a baseline database are applied to the observed rates to risk-adjust the observed rates. These baseline means and regression coefficients are provided by AHRQ. The risk-adjusted rates can be compared directly to one another.

A fifth step to create MSX smoothed rates was not used by THCIC. Smoothed rates will be used when more years of hospital data are available for analysis. To protect patient confidentiality, the number of cases was not reported if a hospital had fewer than five cases for an indicator. Rates based on fewer than 30 cases were not reported.

Processing Steps for the Inpatient Quality Indicators



Note: This flow chart includes references to area level indicators that were not used by THCIC.

THCIC used five SAS programs made available by AHRQ to assign and calculate the IQIs:

Program 1. CONTROL.SAS

This code contains all of the SAS statements that must be modified to run the remaining IQI module programs. It is automatically included in the remaining programs when they are executed. It is not run as a separate program. The program has a collection of parameters that allow the reading in of SAS datasets and the writing out of SAS datasets.

Program 2. IQFMTS.SAS

This program defines a format library that contains the diagnosis and procedure screens necessary for assigning the outcomes of interest for each indicator. This format library is used by the following programs.

Program 3. IQSAS1.SAS

This program processes the inpatient discharge data using the format library and flags records if they contain outcomes of interest. It produces a SAS dataset containing inpatient records with input variables and flag indicators for the outcomes of interest that will later form the numerators for the IQI rates. It also produces a PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of all of the numeric variables in the output data file.

Program 4. IQISASP2.SAS

For all but the volume indicators, this program calculates the observed or raw rates for the IQIs. The program first totals the indicator flags created by the previous program and then divides these totals by the discharges in the universe for the indicator. A SAS dataset is created with summary records that contain observed rates, the counts of outcomes that formed the numerators of the rates, and the totals that formed the denominators of the rates. It also produces a PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of all of the summary records that shows statistics for the observed rates.

Program 5. IQISASP3.SAS

This program calculates age, sex, and APR-DRG risk-adjusted rates for all but the volume indicators. The program uses a file provided by AHRQ that contains overall means for use in the risk adjustment process. It also uses a file provided by AHRQ that contains regression coefficients from a regression that was run on a national reference dataset. These coefficients are also used in the risk adjustment process. A SAS dataset that contains the observed rates and the risk-adjusted rates is created. It also produces a PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of all of the summary records that shows statistics for the observed and risk-adjusted rates and statistics for the numerators and denominators of the observed rates.

Indicators of Inpatient Care in Texas Hospitals

The number of cases for the volume indicators, the risk-adjusted mortality rates, and the risk-adjusted utilization rates were calculated for over 400 Texas hospitals that report

inpatient discharge data to THCIC. The data were made available to the hospitals for their review and comment and were publicly released on the THCIC website at www.thcic.state.tx.us. The rates are presented in a bar chart for each indicator and the state rate for each indicator is also shown. Comments on the report submitted by hospitals are available on the website. A table of characteristics of the hospitals included in the report is also available. The data can also be searched on the website by hospital and by geographic area and the results can be sorted by hospital name, number of cases, mortality or utilization rate, or by city.

References:

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. AHRQ Pub. No. 02-R0204.

AHRQ Quality Indicators—Inpatient Quality Indicators: Software Documentation. Rockville, MD: Agency for Healthcare Research and Quality, 2002. AHRQ Pub. No. 02-R0205.