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Methods Applying AHRQ Quality Indicators to Healthcare Cost and Utilization Project (HCUP) Data for the Fifth (2007) National Healthcare Quality Report

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The Agency for Healthcare Research and Quality (AHRQ) Quality Indicators (QIs) were applied to the HCUP hospital discharge data for several measures in this report. The AHRQ QIs are measures of quality associated with processes of care that occurred in an outpatient or an inpatient setting. The QIs rely solely on hospital inpatient administrative data and, for this reason, are screens for examining quality that may indicate the need for more in-depth studies. The AHRQ QIs used for this report include four sets of measures:

- Prevention Quality Indicators (PQIs)—or ambulatory care sensitive conditions—identify hospital admissions that evidence suggests could have been avoided, at least in part, through high-quality outpatient care (AHRQ, 2006).
- Inpatient Quality Indicators (IQIs) reflect quality of care inside hospitals and include measures of utilization of procedures for which there are questions of overuse, underuse, or misuse (AHRQ, 2006).
- Patient Safety Indicators (PSIs) reflect quality of care inside hospitals, by focusing on surgical complications and other iatrogenic events (AHRQ, 2006).
- Pediatric Quality Indicators (PDIs) reflect quality of care inside hospitals and identify potentially avoidable hospitalizations among children (AHRQ, 2006).

The QI measures selected for this report are described in Table 1 at the end of this methods section.

The Healthcare Cost and Utilization Project (HCUP) is a family of healthcare databases and related software tools and products developed through a Federal-State-Industry partnership and sponsored by AHRQ. HCUP databases bring together the data collection efforts of State data organizations, hospital associations, private data organizations, and the Federal government to create a national information resource of discharge-level health care data. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. These databases enable research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to health care programs, and outcomes of treatments at the national, State and local market levels.

Two HCUP discharge datasets were used in this report:

- The HCUP Nationwide Inpatient Sample (NIS), a nationally stratified *sample* of hospitals (with all of their discharges) from States that contribute data to the NIS dataset (37 States in the 2004 NIS).

- The HCUP State Inpatient Databases (SID), a *census* of hospitals (with all of their discharges) from 37 participating States in 2004.

For 2004, the NIS contains roughly 8.0 million discharges from more than 1000 hospitals and the SID contains about 32.5 million discharges (approximately 84 percent of the 38.6 million discharges in the United States). Data from 1994, 1997, and 2000-2004 were used in this report. Limited reporting was done at the state-specific level. For the list of the HCUP data sources, see Table 2 at the end of this methods section.

To apply the AHRQ Quality Indicators to HCUP hospital discharge data, several steps were taken: 1) QI software review and modification, 2) acquisition of population-based data, 3) general preparation of HCUP data, and 4) identification of statistical methods. These steps, described briefly below, are presented in greater detail in the *Technical Specifications for HCUP Measures in the 2007 National Healthcare Quality Report and the National Healthcare Disparities Report* (Barrett, Houchens, Coffey, et al., 2007), available from AHRQ on request.

1. **QI Software Review and Modification.** For this report, we started with the following QI software versions: PQI Version 3.0, IQI Version 3.0, PSI Version 3.0, and PDI Version 3.0b. Because each of these software modules was developed for State and hospital-level rates, rather than national rates, some changes to the QI calculations were necessary. (For details, see Barrett, Houchens, Coffey, et al., 2007). We also added two indicators particularly relevant to the structure of the NHQR, for patients age 65 years and older: immunization-preventable influenza and adult asthma admissions.
2. **Acquisition of Population-Based Data.** The next step was to acquire data for the numerator and denominator populations for the QIs. A QI is a measure of an event that occurs in a hospital, requiring a numerator count of the event of interest and a denominator count of the population (within the hospital or within the geographic area) to which the event relates. For the numerator counts of the AHRQ QIs, we used the HCUP NIS for national estimates and the SID for state-level estimates.

We identified two sources of denominator counts for all reporting categories and for all adjustment categories listed in the HCUP-based tables. The HCUP data were used for State- and national-level discharge denominator counts for QIs that related to *providers*. Population ZIP-Code-level counts by age and gender from Claritas (a vendor that compiles and adds value to Bureau of Census data for sale) were used for denominator counts for QIs that related to *geographic areas*. For the area-based QIs, we also used the Claritas population data for risk adjustment by age and male-female gender.

Claritas uses intra-census methods to estimate ZIP-Code-level statistics (Claritas, Inc., 2004). ZIP-Code-level counts were necessary for statistics by median income and urban-rural location of the patient's ZIP Code.

3. **Preparation of HCUP Data.** Next, the HCUP SID were modified to create analytic files consistent with the NIS and across States.
 - *Subset to Community Hospitals.* We selected community¹ hospitals and eliminated rehabilitation hospitals from the SID. For the NIS, starting in 1998, rehabilitation

¹ *Community* hospitals are defined by the AHA as “non-Federal, short-term, general, and other specialty hospitals, excluding hospital units of institutions.” Specialty hospitals included among community

hospitals were excluded because the completeness of reporting for rehabilitation hospitals was inconsistent across States. For the 1994 and 1997 NIS, rehabilitation hospitals could not be excluded from the nationwide databases because the sample weights assumed the presence of these hospitals. (See “Caveats,” below).

- *Weight for Missing Hospitals.* Because some statewide data organizations do not report data for all community hospitals in the State, for state estimates we weighted hospitals in the SID to the State’s universe of hospitals in the American Hospital Association Annual Survey of Hospitals based on hospital characteristics.
- *Weight for Missing Quarters.* Discharges from hospitals operating for the entire year but not contributing data for one or more quarters were weighted up to annual estimates for that institution.

In addition the following issues had to be resolved in the NIS and SID before applying the QI algorithms:

- *Impute for Missing Characteristics.* For missing age, gender, ZIP Code, and payer data that occurred on a small proportion of discharge records, we used a “hot deck” imputation method (which draws donors from strata of similar hospitals and patients) to assign values while preserving the variance within the data.
- *Assign Additional Measures for Reporting.* We assigned median household income using the Claritas ZIP Code data linked to patient’s ZIP Code in the SID. We also added the urban-rural location of the hospitals. The urban-rural location of the patient was already on the SID.

The four AHRQ QI program modules were applied to the prepared SID data using all available diagnoses and procedures. The QI indicators from the SID were then linked to the appropriate discharge records on the NIS. During this linkage, any additional information for reporting was also added to the NIS.

4. **Statistical Methods.** Identification of statistical issues included the following: age-gender adjustment for all QIs; severity/comorbidity adjustment for the discharge-based IQIs, PSIs, and PDIs; and derivation of standard errors and appropriate hypothesis tests.
 - *Age-Gender Adjustment.* For the PQIs and area-based IQIs, PSIs, and PDIs, age-gender adjustments were made for age and gender differences across population subgroups and were based on methods of direct standardization (Fleiss, 1973). Age was categorized into 18 five-year increments (described in Appendix C, Age Groupings for Risk Adjustment). The AHRQ QI software uses a similar, but different approach, to adjust the area-based QIs. We relied on direct standardization because of the additional reporting categories and population denominators required in the NHQR.
 - *Age, Gender, Severity, and Comorbidity Adjustment.*
For the discharge-based *PSIs*, adjustments were made for age, gender, age-gender interaction, DRG cluster, and comorbidity, using the regression-based standardization that is part of the AHRQ PSI software.

hospitals are obstetrics-gynecology, ear-nose-throat, short-term rehabilitation, orthopedic, and pediatric institutions. Also included are public hospitals and academic medical centers. Excluded are short-term rehabilitation hospitals (beginning with 1998 HCUP data), long-term hospitals, psychiatric hospitals, and alcoholism/chemical dependency treatment facilities.

For the discharge-based *IQIs*, adjustments were made for age, gender, age-gender interaction, and 3M™ All Patient Refined Diagnosis Related Groups (APR-DRGs) risk of mortality or severity score using the regression-based standardization that is part of the AHRQ IQI software.

For the discharge-based *PDIs*, adjustments were made for age, gender, DRG and MDC clusters, and comorbidity, using the regression-based standardization that is part of the AHRQ PDI software. Measure-specific stratification by risk group, clinical category, procedure type was also applied.

- *Standard Errors and Hypothesis Tests.* Standard errors calculations for the rates were based on the HCUP report entitled “Calculating Nationwide Inpatient Sample (NIS) Variances” (Houchens, et al., 2005). There is no sampling error associated with Claritas census population counts. The appropriate statistics were obtained through the Statistical Analysis System (SAS) procedure called PROC SURVEYMEANS. The threshold selected for reporting estimates in this report is a relative standard error less than 30% and at least 10 unweighted cases in the denominator. Statistical calculations are explained in Appendix A to this report and in Barrett, Houchens, and Coffey et al. (2007).

Caveats

Some caution should be used in interpreting the AHRQ QI statistics presented in this report. Some caveats relate to the how the QIs were applied, some relate to ICD-9-CM coding changes and inter-State differences in data collection, and others are more general issues:

Rehabilitation Hospitals: These hospitals are excluded from the 2000 to 2004 NIS but included in the 1994 and 1997 NIS because of the change in the NIS sampling strategy (beginning in the 1998 NIS). Patients treated in rehabilitation hospitals tend to have lower mortality rates and longer lengths of stay than patients in other community hospitals, and the completeness of reporting for rehabilitation hospitals is very uneven across the States. The elimination of rehabilitation hospitals in 2000 to 2004 may affect trends in the QIs but the effect is likely small since only 3 percent of community hospitals are involved.

ICD-9-CM Coding Changes: A number of Quality Indicators are based on diagnoses and procedures for which ICD-9-CM coding has generally become more specific over the period of this study. Essentially all of the changes occur between the years 1994 and 1997. Thus, some 1994 estimates may not be comparable to the later estimates. These inconsistencies are noted in the footnotes of the tables with information on the direction of the bias when it can be determined.

Data Collection Differences among States: Organizations that collect statewide data generally collect data using the Uniform Bill (UB-92) format and, for earlier data, the Uniform Hospital Discharge Data Set (UHDDS) format. However, not every statewide data organization collects all data elements nor codes them the same way. For this report, uneven availability of a few data elements underlie some estimates, as noted next.

Data Elements Needed in Some QIs: Two data elements not available in every State that are required for certain QIs are: “secondary procedure day” and “admission type” (elective, urgent, and emergency). These data elements are used to exclude specific cases from some QI measures. The PSIs that use secondary procedure day were modified to not use this information for any State. Admission type of elective and newborn are used in four PSIs. We

imputed the missing admission type using available information. For all States except California, an admission type of “elective” was assigned if the DRG did not indicate trauma, delivery, or newborn. An admission type of newborn was assigned if the DRG indicated a newborn. For California, which did not provide any information on admission type, information on scheduled admissions was used to identify elective admissions and DRGs were used to identify newborn admissions.

Number of Clinical Fields: Another data collection issue relates to the number of fields that statewide data organizations permit for reporting patients’ diagnoses and procedures during the hospitalization and whether they specifically require coding of external-cause of injury (E codes). The SID for different States contain as few as 6 or as many as 30 fields for reporting diagnoses and procedures, as shown in Table 3 at the end of this methods section. The more fields used, the more quality-related events that can be captured in the statewide databases. However, even for States with 30 diagnosis fields available in the year 2000, 95 percent of their discharge records captured all of patients’ diagnoses in 10 to 13 data elements. For States with 30 procedure fields available, 95 percent of records captured all of patients’ procedures in 5 fields. Thus, limited numbers of fields available for reporting diagnoses and procedures are unlikely to have much effect on results, because all statewide data organizations participating in HCUP allow at least 9 diagnoses and 6 procedures. We decided not to truncate artificially the diagnosis and procedure fields reported, so that the full richness of the databases would be used.

Another issue relates to external cause of injury reporting. Eight of the 27 Patient Safety Indicators use external cause of injury (E code) data to help identify complications of care or to exclude cases (e.g., poisonings, self-inflicted injury, trauma) from numerators and denominators, as shown in Table 4 at the end of this methods section. Although E codes in the AHRQ PSI software have been augmented wherever possible with the related non-E codes in the ICD-9-CM system, see Table 4 for specific details. E codes are still included in some AHRQ PSI definitions, and uneven capture of these data has the potential of affecting some PSI rates and should be kept in mind when judging the level of these events.

Effects of Adding New States to the NIS over Time: Over time HCUP has expanded with the participation of additional statewide data organizations. Because each yearly NIS is a sample of hospitals from the States participating in that year (and weighted to the universe of community hospitals nationally), potential exists for different practice patterns across States to influence national measures over time related to clinical practice. The table below lists the States that were added to HCUP between the years used in this report.

| Period | States |
|-------------|---|
| 1994 | AZ, CA, CO, CT, FL, IL, IA, KS, MD, MA, NJ, NY, OR, PA, SC, WA, WI, |
| 1995 – 1997 | Added GA, HI, MO, TN, UT |
| 1998 – 2000 | Added KY, ME, NC, TX, VA, WV |
| 2001 | Added MI, MN, NE, RI, VT |
| 2002 | Added NV, OH, SD (AZ data not available) |
| 2003 | Added AZ, IN, NH (ME data not available) |
| 2004 | Added AR (PA data not available) |

For the first NHQR, we calculated QI rates using two methods to test this hypothesis, first with data from the full set of States in HCUP in 2000 and second with data from the set of States in HCUP in all three years, where that subset of States was re-weighted to obtain national estimates. For most QIs, the results differed very little. These results are presented in detail in the Technical Specifications for HCUP Measures in the National Healthcare Quality Report and the National Healthcare Disparities Report (Barrett, Houchens, Coffey, et al., 2007), available from AHRQ on request.

Variation among State QI Rates. Variation in State rates can be caused by many factors, including differences in practice patterns, underlying disease prevalence, health behaviors, access to health insurance, income levels of the population, demographics, spending on health services, supply of health care resources, coding conventions, and so on. To understand some of the variation in State rates, we analyzed the 2001 State rates in relation to these types of factors. Appendix B shows for each Prevention Quality Indicator included in the NHQR, the analyses performed and the result in terms of whether the factors (with each tested separately because of the limited number of observations) were positively, negatively, or not significantly related to the QIs. This is intended to help readers understand some of the external factors that may be driving some of the State differences in PQI rates.

Table 1. AHRQ Quality Indicators Selected for the National Healthcare Quality Report

| QI No. | Description |
|--------------------------------------|---|
| Prevention Quality Indicators | |
| PQI 1 | Admissions for diabetes with short-term complications* (excluding obstetric admissions and transfers from other institutions) per 100,000 population, age 18 years and older * Ketoacidosis, hyperosmolarity, or coma. |
| PQI 3 | Admissions for diabetes with long-term complications* (excluding obstetric admissions and transfers from other institutions) per 100,000 population, age 18 years and older * Renal, eye, neurological, circulatory, or other unspecified complications. |
| PQI 8 | Admissions for congestive heart failure (excluding patients with cardiac procedures, obstetric and neonatal conditions, and transfers from other institutions) per 100,000 population, age 18 years and older |
| PQI 14 | Admissions for uncontrolled diabetes without complication* (excluding obstetric and neonatal admissions and transfers from other institutions) per 100,000 population, age 18 years and older * Without short-term (ketoacidosis, hyperosmolarity, coma) or long-term (renal, eye, neurological, circulatory, other unspecified) complications. |
| PQI 15 | Adult asthma admissions (excluding patients with cystic fibrosis or anomalies of the respiratory system, obstetric admissions, and transfers from other institutions) per 100,000 population, age 18 years and older |
| PQI 15 (modified) | Asthma admissions (excluding patients with cystic fibrosis or anomalies of the respiratory system, obstetric admissions and transfers from other institutions) per 100,000 population, age 65 years and older |
| PQI 18 (Added) | Immunization-preventable influenza admissions (excluding transfers from other institutions) per 100,000 population, age 18 years and older |
| Pediatric Quality Indicators | |
| PDI 6 | Deaths per 1000 pediatric heart surgery admissions, patients age less than 18 years (excluding obstetric admission; patients with transcatheter interventions as single cardiac procedures, performed without bypass but with catheterization; patients with septal defects as single cardiac procedures without bypass; heart transplant; premature infants with patent ductus arteriosus (PDA) closure as only cardiac procedure; and age less than 30 days with PDA closure as only cardiac procedure; transfers to another hospital; patients with unknown disposition; and neonates with a birth weight less than 500 grams) |
| PDI 14 | Pediatric asthma admissions (excluding patients with cystic fibrosis or anomalies of the respiratory system and transfers from other institutions) per 100,000 population, age 2 years to 17 years |
| PDI 15 | Admissions for diabetes with short-term complications* (excluding transfers from other institutions) per 100,000 population, age 6 years to 17 years * Ketoacidosis, hyperosmolarity, or coma. |
| PDI 16 | Admissions for pediatric gastroenteritis (excluding patients with gastrointestinal abnormalities or bacterial gastroenteritis, and transfers from other institutions) per 100,000 population, age 4 months to 17 years |
| Inpatient Quality Indicators | |
| IQI 8 | Deaths per 1000 admissions with esophageal resection for cancer (excluding obstetric and neonatal admissions and transfers to another hospital), age 18 years and older |
| IQI 9 | Deaths per 1000 admissions with pancreatic resection for cancer (excluding obstetric and neonatal admissions and transfers to another hospital), age 18 years and older |
| IQI 11 | Deaths per 1000 admissions with abdominal aortic aneurysm (AAA) repair (excluding obstetric and neonatal admissions and transfers to another hospital), age 18 years or older |
| IQI 12 | Deaths per 1000 admissions with coronary artery bypass graft (excluding obstetric and neonatal admissions and transfers to another hospital), age 40 and older |
| IQI 15 | Deaths per 1000 admissions with acute myocardial infarction (AMI) as principal diagnosis (excluding transfers to another hospital), age 18 and older |
| IQI 16 | Deaths per 1000 admissions with congestive heart failure (CHF) as principal diagnosis (excluding obstetric and neonatal admissions and transfers to another hospital), age 18 and older |

| QI No. | Description |
|----------------------------------|--|
| IQI 20 | Deaths per 1000 admissions with pneumonia as principal diagnosis (excluding obstetric and neonatal admissions and transfers to another hospital), age 18 and older |
| IQI 30 | Deaths per 1000 adult admissions age 40 and older with percutaneous transluminal coronary angioplasties (PTCA) (excluding obstetric and neonatal admissions and transfers to another hospital) |
| Patient Safety Indicators | |
| PSI 1 | Complications of anesthesia in any secondary diagnosis per 1000 surgical discharges (excluding patients with anesthesia complications as a principal diagnosis and patients with self-inflicted injury, poisoning due to anesthetics, and active drug dependence or abuse), age 18 years or older or obstetric admissions |
| PSI 2 | Deaths per 1000 admissions in low mortality DRGs (DRGs with a NIS 1997 benchmark of less than 0.5% mortality, excluding trauma, immunocompromised, and cancer patients), age 18 years or older or obstetric admissions |
| PSI 3 | Decubitus ulcers per 1000 discharges of length 5 or more days (excluding transfers, patients admitted from long-term-care facilities, patients with diseases of the skin, subcutaneous tissue, and breast, and obstetrical admissions*), age 18 years or older * Also excludes admissions specifically for decubitus ulcers, such as cases from earlier admissions or from other hospitals. |
| PSI 4 | Failure to rescue or deaths per 1000 discharges having developed specified complications of care during hospitalization (excluding patients transferred in or out, patients admitted from long-term-care facilities), age 18 years to 74 years |
| PSI 5 | Foreign body accidentally left in during procedure per 1000 medical and surgical discharges*, age 18 years or older or obstetric admissions * Also excludes admissions specifically for treatment of foreign body left, such as cases from earlier admissions or from other hospitals. |
| PSI 6 | Iatrogenic pneumothorax per 1000 discharges (excluding obstetrical admissions and patients with trauma, thoracic surgery, lung or pleural biopsy, or cardiac surgery*), age 18 years or older * Also excludes admissions specifically for iatrogenic pneumothorax, such as cases from earlier admissions or from other hospitals. Includes barotrauma (including acute respiratory distress syndrome) and central line placement. |
| PSI 7 | Selected infections due to medical care per 1000 medical and surgical discharges (excluding immunocompromised and cancer patients, stays under 2 days, and admissions specifically for such infections*), age 18 years or older or obstetric admissions * Also excludes admissions specifically for such infections, such as cases from earlier admissions, from other hospitals, or from other settings. |
| PSI 8 | Postoperative hip fracture for adults per 1000 surgical patients age 18 years and older who were not susceptible to falling* (excluding obstetrical admissions) * That is, excluding patients with musculoskeletal disease; those admitted for seizures, syncope, stroke, coma, cardiac arrest, poisoning, trauma, delirium, psychoses, anoxic brain injury; patients with metastatic cancer, lymphoid malignancy, bone malignancy, and self-inflicted injury. |
| PSI 9 | Postoperative hemorrhage or hematoma with surgical drainage or evacuation, not verifiable as following surgery*, per 1000 surgical discharges (excluding obstetrical admissions), age 18 years or older * Postoperative hemorrhage or hematoma is not verifiable as following surgery because information on day of procedure is not available for all discharges. Also, excludes admissions specifically for such problems, such as cases from earlier admissions, from other hospitals, or from other settings. |
| PSI 10 | Postoperative physiologic and metabolic derangements per 1000 elective surgical discharges (excluding some serious disease* and obstetric admissions), age 18 years and older * That is, excluding patients with diabetic coma and patients with renal failure who also were diagnosed with AMI, cardiac arrhythmia, cardiac arrest, shock, hemorrhage, or gastrointestinal hemorrhage. |

| QI No. | Description |
|--------|--|
| PSI 11 | Postoperative respiratory failure per 1000 elective surgical discharges with an operating room procedure (excluding patients with respiratory disease, circulatory disease, neuromuscular disorders, obstetric conditions, and admissions specifically for acute respiratory failure), age 18 years and older |
| PSI 12 | Postoperative pulmonary embolus (PE) or deep vein thrombosis (DVT) per 1000 surgical discharges (excluding patients admitted for DVT, obstetrics, and plication of vena cava before or after surgery*), age 18 years or older * Also excludes admissions specifically for such thromboemboli, such as cases from earlier admissions, from other hospitals, or from other settings. |
| PSI 13 | Postoperative sepsis per 1000 elective-surgery discharges with an operating room procedure (excluding patients admitted for infection; patients with cancer or immunocompromised states, obstetric conditions, stays under 4 days, and admissions specifically for sepsis), age 18 years or older |
| PSI 14 | Reclosure of postoperative abdominal wound dehiscence per 1000 abdominopelvic-surgery discharges (excluding immunocompromised patients, stays under 2 days, and obstetric conditions*), age 18 years or older * Also excludes admissions specifically for such wound dehiscence, such as cases from earlier admissions or from other hospitals. |
| PSI 15 | Accidental puncture or laceration during procedures per 1000 discharges (excluding obstetric admissions*), age 18 years or older * Also excludes admissions specifically for such problems, such as cases from earlier admissions or from other hospitals. |
| PSI 16 | Transfusion reactions per 1000 discharges, age 18 years or older or obstetric admissions* * Also excludes admissions specifically for transfusion reactions, such as cases from earlier admissions or from other hospitals. |
| PSI 17 | Birth trauma - injury to neonate per 1000 live births (excluding preterm and osteogenesis imperfecta births) |
| PSI 18 | Obstetric trauma with 3rd or 4th degree lacerations per 1000 instrument-assisted vaginal deliveries |
| PSI 19 | Obstetric trauma with 3rd or 4th degree lacerations per 1000 vaginal deliveries without instrument assistance |
| PSI 20 | Obstetric trauma with 3rd or 4th degree lacerations per 1000 Cesarean deliveries |
| PSI 21 | Foreign body accidentally left in during procedure* per 100,000 population, age 18 years or older or obstetric admissions * Includes admissions specifically for treatment of foreign body left, such as cases from earlier admissions or from other hospitals. |
| PSI 22 | Iatrogenic pneumothorax cases* per 100,000 population (excluding obstetrical admissions and patients with trauma, thoracic surgery, lung or pleural biopsy, or cardiac surgery), age 18 years or older * Includes admissions specifically for iatrogenic pneumothorax, such as cases from earlier admissions or from other hospitals. Also, includes barotrauma (including acute respiratory distress syndrome) and central line placement. |
| PSI 23 | Selected infections due to medical care* per 100,000 population (excluding immunocompromised and cancer patients and neonates), age 18 years or older or obstetric admissions * Includes admissions specifically for such infections, such as cases from earlier admissions, from other hospitals, or from other settings. |
| PSI 24 | Reclosure of postoperative abdominal wound dehiscence* (excluding immunocompromised and obstetric patients) per 100,000 population, age 18 years or older * Includes admissions specifically for such wound dehiscence, such as cases from earlier admissions or from other hospitals. |

| QI No. | Description |
|--------|---|
| PSI 25 | Accidental puncture or laceration during procedures* (excluding obstetric admissions) per 100,000 population, age 18 years or older * Includes admissions specifically for such problems, such as cases from earlier admissions or from other hospitals. |
| PSI 26 | Transfusion reactions per 100,000 population, age 18 years or older |
| PSI 27 | Postoperative hemorrhage or hematoma with surgical drainage or evacuation, per 100,000 population, age 18 years or older |

Table 2. Sources of HCUP Data

| State | Data Source |
|----------------|---|
| Arizona | Arizona Department of Health Services |
| Arkansas | Arkansas Department of Health & Human Services |
| California | Office of Statewide Health Planning & Development |
| Colorado | Colorado Hospital Association |
| Connecticut | Chime, Inc. |
| Florida | Florida Agency for Health Care Administration |
| Georgia | Georgia Hospital Association |
| Hawaii | Hawaii Health Information Corporation |
| Illinois | Illinois Department of Public Health |
| Indiana | Indiana Hospital&Health Association |
| Iowa | Iowa Hospital Association |
| Kansas | Kansas Hospital Association |
| Kentucky | Kentucky Cabinet for Health and Family Services |
| Maryland | Health Services Cost Review Commission |
| Massachusetts | Division of Health Care Finance and Policy |
| Michigan | Michigan Health & Hospital Association |
| Minnesota | Minnesota Hospital Association |
| Missouri | Hospital Industry Data Institute |
| Nebraska | Nebraska Hospital Association |
| New Hampshire | New Hampshire Department of Health & Human Services |
| New Jersey | New Jersey Department of Health & Senior Services |
| New York | New York State Department of Health |
| Nevada | Nevada Department of Health and Human Services |
| North Carolina | North Carolina Department of Health and Human Services |
| Ohio | Ohio Hospital Association |
| Oregon | Oregon Association of Hospitals & Health Systems |
| Rhode Island | Rhode Island Department of Health |
| South Carolina | South Carolina State Budget & Control Board |
| South Dakota | South Dakota Association of Healthcare Organizations |
| Tennessee | Tennessee Hospital Association |
| Texas | Texas Department of State Health Services |
| Utah | Office of Health Care Statistics, Utah Department of Health |
| Vermont | Vermont Association of Hospitals and Health Systems |
| Virginia | Virginia Health Information |
| Washington | Washington State Department of Health |
| West Virginia | West Virginia Health Care Authority |
| Wisconsin | Wisconsin Department of Health & Family Services |

Table 3. Number of diagnosis and procedure fields by State, 2004

| State | Maximum number of diagnoses | Maximum number of procedures |
|----------------|------------------------------------|-------------------------------------|
| Arizona | 9 | 6 |
| Arkansas | 9 | 6 |
| California | 25 | 21 |
| Colorado | 15 | 15 |
| Connecticut | 30 | 30 |
| Florida | 10 | 10 |
| Georgia | 10 | 6 |
| Hawaii | 20 | 20 |
| Illinois | 9 | 6 |
| Indiana | 15 | 15 |
| Iowa | 9 | 6 |
| Kansas | 30 | 25 |
| Kentucky | 9 | 6 |
| Maryland | 15 | 15 |
| Massachusetts | 15 | 15 |
| Michigan | 30 | 30 |
| Minnesota | 9 | 6 |
| Missouri | 30 | 25 |
| Nebraska | 9 | 6 |
| Nevada | 14 | 9 |
| New Hampshire | 10 | 6 |
| New Jersey | 9 | 8 |
| New York | 15 | 15 |
| North Carolina | 18 | 6 |
| Ohio | 15 | 9 |
| Oregon | 9 | 6 |
| Rhode Island | 11 | 11 |
| South Carolina | 10 | 10 |
| South Dakota | 9 | 6 |
| Tennessee | 9 | 6 |
| Texas | 25 | 25 |
| Utah | 9 | 6 |
| Vermont | 20 | 20 |
| Virginia | 9 | 6 |
| Washington | 9 | 6 |
| West Virginia | 9 | 6 |
| Wisconsin | 9 | 6 |

Table 4. Use of E codes in the Patient Safety Indicators, Version 3.0

| PSI * | Codes used for defining the numerator | | Codes used for defining exclusions | |
|-------|---------------------------------------|------------------------|--|------------------------|
| | E codes | Similar ICD-9-CM codes | E codes | Similar ICD-9-CM codes |
| 1 | E8763, E8551, E9381 – E9389 | 9681-9684, 9687 | Self-inflicted injury (E95nn) | None |
| 5 | E8710 – E8719 | 9984, 9987 | None | None |
| 8 | None | None | Self-inflicted injury (E95nn) Poisoning (E85nn, E86nn, E95nn, E96nn, E98nn) | 9600-9799 |
| 15 | E8700 – E8709 | 9982 | None | None |
| 16 | E8760 | 9996-9997 | None | None |
| 21 | E8710 – E8719 | 9984, 9987 | None | None |
| 25 | E8700 – E8709 | 9982 | None | None |
| 26 | E8760 | 9996-9997 | None | None |

* All other PSIs do not use E codes.

References

Agency for Healthcare Research and Quality. AHRQ Quality Indicators—Guide to Prevention Quality Indicators: Hospital Admission for Ambulatory Care Sensitive Conditions, Version 3.0a. Rockville, MD: Agency for Healthcare Research and Quality, 2006.

Agency for Healthcare Research and Quality. AHRQ Quality Indicators—Guide to Inpatient Quality Indicators: Quality of Care in Hospitals—Volume, Mortality, and Utilization, Version 3.0. Rockville, MD: Agency for Healthcare Research and Quality, 2006.

Agency for Healthcare Research and Quality. AHRQ Quality Indicators—Guide to Patient Safety Indicators, Version 3.0. Rockville, MD: Agency for Healthcare Research and Quality, 2006.

Agency for Healthcare Research and Quality. AHRQ Quality Indicators—Guide to Pediatric Quality Indicators, Version 3.0b. Rockville, MD: Agency for Healthcare Research and Quality, 2006.

Barrett ML, Houchen R, Coffey RM, Andrews R, Kelley E, Moles E. Technical Specifications for HCUP Measures in the Fifth National Healthcare Quality Report and the National Healthcare Disparities Report. Washington, DC: The Medstat Group, Inc., 2007.

Barrett ML, Houchen R, Coffey RM, Kelley E, Andrews R, Moy E, Kosiak B, Remus D. Technical Specifications for HCUP Measures in the National Healthcare Quality Report and the National Healthcare Disparities Report. HCUP Contract Task 290-00-004 Deliverable #185. Washington, DC: The Medstat Group, Inc., January 2003.

Claritas, Inc. The Claritas Demographic Update Methodology, May 2004.

Fleiss JL. Statistical Methods for Rates and Proportions. New York: Wiley, 1973

Houchens R, Elixhauser A. Final Report on Calculating Nationwide Inpatient Sample (NIS) Variances, 2001. HCUP Methods Series Report #2003-2. ONLINE. June 2005 (revised June 6, 2005). U.S. Agency for Healthcare Research and Quality.
Available: <http://www.hcup-us.ahrq.gov/reports/methods.jsp>

Appendix A

Statistical Methods

This appendix explains the statistical methods and gives formulas for the calculations of standard errors and hypothesis tests. These statistics are derived from multiple databases: the NIS, the SID, and Claritas (a vendor that compiles and adds value to Bureau of Census data). For NIS estimates, the standard errors are calculated as described in the HCUP report entitled “Calculating Nationwide Inpatient Sample (NIS) Variances” (Houchens, et al., 2005). We will refer to this report simply as the NIS Variance Report throughout this appendix. This method takes into account the cluster and stratification aspects of the NIS sample design when calculating these statistics using the SAS procedure PROC SURVEYMEANS. For the SID we used the same procedure omitting the cluster and stratification features. For population counts based on Claritas data, there is no sampling error.

Even though the NIS contains discharges from a finite sample of hospitals and most of the SID databases contain nearly all discharges from nearly all hospitals in the state, we treat the samples as though they were drawn from an infinite population. We do not employ finite population correction factors in estimating standard errors. We take this approach because we view the outcomes as a result of myriad processes that go into treatment decisions rather than being the result of specific, fixed processes generating outcomes for a specific population and a specific year. We consider the NIS and SID to be samples from a “super-population” for purposes of variance estimation. Further, we assume the counts (of QI events) to be binomial.

1. Area Population QIs using Claritas Population Data

a. Standard error estimates for discharge rates per 100,000 population using the 2004 Claritas population data.

The observed rate was calculated as follows:

$$R = 100,000 \cdot \frac{\sum_{i=1}^n w_i x_i}{N} = 100,000 \cdot \frac{S}{N}. \quad (\text{A.1})$$

w_i and x_i , respectively, are the weight and variable of interest for patient i in the NIS or SID. To obtain the estimate of S and its standard error, SE_S , we followed instructions in the NIS Variance Report (modified for the SID, as explained above)

The population count in the denominator is a constant. Consequently, the standard error of the rate R was calculated as:

$$SE_R = 100,000 \cdot SE_S / N. \quad (\text{A.2})$$

b. Standard error estimates for age/sex adjusted inpatient rates per 100,000 population using the 2004 Claritas population data.

We adjusted rates for age and sex using the method of direct standardization (Fleiss, 1973). We estimated the observed rates for each of 36 age/sex categories (described in Appendix

C, Age Groupings for Risk Adjustment). We then calculated the weighted average of those 36 rates using weights proportional to the percentage of a standard population in each cell. Therefore, the adjusted rate represents the rate that would be expected for the observed study population if it had the same age and sex distribution as the standard population.

For the standard population we used the age and sex distribution of the U.S. as a whole according to the year 2000. In theory, differences among adjusted rates were not attributable to differences in the age and sex distributions among the comparison groups because the rates were all calculated with a common age and sex distribution.

The adjusted rate was calculated as follows (and subsequently multiplied by 100,000):

$$A = \frac{\sum_{g=1}^{36} N_{g,std} \sum_{i=1}^{n(g)} \frac{w_{g,i} x_{g,i}}{N_{g,obs}}}{\sum_{g=1}^{36} N_{g,std}} = \frac{\sum_{g=1}^{36} \sum_{i=1}^{n(g)} \frac{N_{g,std}}{N_{g,obs}} w_{g,i} x_{g,i}}{N_{std}} = \frac{\sum_{g=1}^{36} \sum_{i=1}^{n(g)} w_{g,i}^* x_{g,i}}{N_{std}} = \frac{S^*}{N_{std}}. \quad (A.3)$$

g = index for the 36 age/sex cells.

$N_{g,std}$ = Standard population for cell g (year 2000 total US population in cell g).

$N_{g,obs}$ = Observed population for cell g (year 2000 subpopulation in cell g , e.g., females, state of California, etc.).

$n(g)$ = Number in the sample for cell g .

$x_{g,i}$ = Observed quality indicator for observation i in cell g (e.g., 0 or 1 indicator).

$w_{g,i}$ = NIS or SID discharge weight for observation i in cell g .

The estimates for the numerator, S^* , and its standard error, SE_{S^*} , were calculated in similar fashion to the unadjusted estimates for the numerator S in formula A.1. The only difference was that the weight for patient i in cell g was redefined as:

$$w_{g,i}^* = \frac{N_{g,std}}{N_{g,obs}} \cdot w_{g,i} \quad (A.4)$$

Following instructions in the NIS Variance Report (modified for the SID, as explained above), we used PROC SURVEYMEANS to obtain the estimate of S^* , the weighted sum in the numerator using the revised weights, and the estimate SE_{S^*} , the standard error of the weighted sum S^* . The denominator is a constant. Therefore, the standard error of the adjusted rate, A , was calculated as

$$SE_A = 100,000 \cdot SE_{S^*} / N_{std}. \quad (A.5)$$

2. Provider-based QIs using Weighted Discharge Data (SID and NIS)

a. Standard error estimates for inpatient rates per 1,000 discharges using discharge counts in both the numerator and the denominator.

We calculated the observed rate as follows:

$$R = 1,000 \cdot \frac{\sum_{i=1}^n w_i x_i}{\sum_{i=1}^n w_i} = 1,000 \cdot \frac{S}{N}. \quad (\text{A.6})$$

Following instructions in the HCUP NIS Variance Report (modified for the SID, as explained above), we used PROC SURVEYMEANS to obtain estimates of the weighted mean, S/N , and the standard error of the weighted mean, $SE_{S/N}$. We multiplied this standard error by 1,000.

b. Standard error estimates for age/sex adjusted inpatient rates per 1,000 discharges using inpatient counts in both the numerator and the denominator.

We used the full NIS sample estimates for the standard inpatient population age-sex distribution. For each of the 36 age-sex categories, we estimated the number of U.S. inpatient discharges, $\hat{N}_{g,std}$, in category g . We calculated the directly adjusted rate:

$$A = 1,000 \cdot \frac{\sum_{g=1}^{36} \hat{N}_{g,std} \frac{\sum_{i=1}^{n(g)} w_{g,i} x_{g,i}}{n(g)}}{\sum_{g=1}^{36} \hat{N}_{g,std}} = 1,000 \cdot \sum_{g=1}^{36} \hat{P}_{g,std} \frac{\sum_{i=1}^{n(g)} w_{g,i} x_{g,i}}{\sum_{i=1}^{n(g)} w_{g,i}}. \quad (\text{A.7})$$

g = index for the 36 age/sex cells.

$\hat{N}_{g,std}$ = Standard inpatient population for cell g (NIS estimate of the total inpatient population for cell g).

$n(g)$ = Number in the sample for cell g .

$x_{g,i}$ = Observed quality indicator for observation i in cell g .

$w_{g,i}$ = NIS or SID discharge weight for observation i in cell g .

Note that $\hat{P}_{g,std} = \frac{\hat{N}_{g,std}}{\sum_{g=1}^{36} \hat{N}_{g,std}}$ is the proportion of the standard inpatient population in cell g .

Consequently, the adjusted rate is a weighted average of the cell-specific rates with cell

weights equal to $\hat{P}_{g,std}$. These cell weights are merely a convenient, reasonable standard inpatient population distribution for the direct standardization. Therefore, we treat these cell weights as constants in the variance calculations:

$$SE(A) = \sqrt{Var(A)} = 1,000 \cdot \sqrt{Var \left(\sum_{g=1}^{36} \hat{P}_{g,std} \frac{\sum_{i=1}^{n(g)} w_{g,i} x_{g,i}}{\sum_{i=1}^{n(g)} w_{g,i}} \right)} = 1,000 \cdot \sqrt{\sum_{g=1}^{36} \hat{P}_{g,std}^2 \cdot Var \left(\frac{\sum_{i=1}^{n(g)} w_{g,i} x_{g,i}}{\sum_{i=1}^{n(g)} w_{g,i}} \right)}. \quad (A.8)$$

The variance of the ratio enclosed in parentheses was estimated separately for each cell g by squaring the SE calculated using the method of section 2.a:

$$SE(A) = 1,000 \cdot \sqrt{\sum_{g=1}^{36} \hat{P}_{g,std}^2 \cdot \{SE(R_g)\}^2}$$

$$R_g = \frac{\sum_{i=1}^{n(g)} w_{g,i} x_{g,i}}{\sum_{i=1}^{n(g)} w_{g,i}} \quad (A.9)$$

Following instructions in the HCUP NIS Variance Report (modified for the SID, as explained above), we used PROC SURVEYMEANS to obtain estimates of the weighted means, R_g , and their standard errors.

3. Significance tests.

Let R_1 and R_2 be either observed or adjusted rates calculated for comparison groups 1 and 2, respectively. Let SE_1 and SE_2 be the corresponding standard errors for the two rates. We calculated the test statistic and (two-sided) p-value:

$$t = \frac{R_1 - R_2}{\sqrt{SE_1^2 + SE_2^2}} \quad (A.10)$$

$$p = 2 * \text{Prob}(Z > |t|)$$

where Z is a standard normal variate.

Note: the following functions calculate p in SAS and EXCEL:

SAS: $p = 2 * (1 - \text{PROBNORM}(\text{ABS}(t)))$;

EXCEL: $= 2*(1 - \text{NORMDIST}(\text{ABS}(t), 0, 1, \text{TRUE}))$

Appendix B: State-Level Bivariate Analysis - State PQI Rates Related to Other Factors, Taken One at a Time

This appendix shows the factors for which State-specific data could be found to compare to the State-specific Prevention Quality Indicators (PQI) included in the 2005 NHQR based on 2001 discharge data from the SID. State-level PQI rates are shown below with whether or not they were correlated with these factors. The results shaded in yellow below denote statistically significant correlations. The direction of the relationship and the percent of variation across States explained by the data element are also shown.

(Highlighted text denotes statistically significant results)

Key to Conclusions about Associations Found in Appendix A, Tables 1-3, column 3:

- + = positive association, statistically significant at $p < 0.05$, between QI rates and rates of the other characteristics across the states
- = negative association, statistically significant as explained above
- ns = "Not Significant", denotes a statistically insignificant association.

Additional Notations:

- ** Number of cases reported by States was insufficient to complete analysis
- *** Data unavailable for four (4) States; regressions run using remaining 29 States

State-Level Bivariate Analysis of AHRQ Prevention Quality Indicators (PQIs) based on 2001 Discharge Data Reported in the 2004 and 2005 NHQR

| AHRQ Prevention Quality Indicators (PQIs) | Characteristics of State Populations | Conclusions About Associations | Percent of State Variation Explained (R-square) |
|--|---|--------------------------------------|---|
| PQI 1 – Adult Admissions for Short-term Diabetes Complications | Prevalence of Obesity in Adults | + | 43.63% |
| | Adult Diabetes Prevalence (Diagnosed) | + | 25.92% |
| | Percent of Population 65 Years and Over | ns | 0.24% |
| | Source of Insurance: Uninsured (as a Percent of the Population) | + | 12.09% |
| | Percent of People Below the Poverty Line in the Past 12 Months | + | 33.70% |
| | Hospital Bed Supply (Rate/100,000) | ns | 5.21% |
| | Race/Ethnicity: White (as a Percent of the Population) | ns | 0.38% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 46.13% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 1.32% |
| | Race/Ethnicity: API (as a Percent of the Population) | - | 12.52% |
| | Race/Ethnicity: Other (as a Percent of the Population) | ns | 3.96% |
| Race/Ethnicity: Minority (as a Percent of the Population) | ns | 0.38% | |
| PQI 3 – Adult Admissions for Long-term Diabetes Complications | Percent of Adult Population at Risk for Heart Disease*** | + | 15.28% |
| | Cardiac Deaths (Rate/100,000) | + | 55.56% |
| | Prevalence of Obesity in Adults | + | 28.29% |
| | Adult Diabetes Prevalence (Diagnosed) | + | 32.36% |
| | Percent of Population 65 Years and Over | ns | 3.18% |
| | Source of Insurance: Uninsured (as a Percent of the Population) | ns | 8.41% |
| | Percent of People Below the Poverty Line in the Past 12 Months | + | 26.40% |
| | Hospital Bed Supply (Rate/100,000) | ns | 10.75% |
| | Race/Ethnicity: White (as a Percent of the Population) | ns | 5.69% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 28.56% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 0.45% |
| Race/Ethnicity: API (as a Percent of the Population) | ns | 1.38% | |
| Race/Ethnicity: Other (as a Percent of the Population) | ns | 8.82% | |
| Race/Ethnicity: Minority (as a Percent of the Population) | ns | 5.69% | |

| AHRQ Prevention Quality Indicators (PQIs) | Characteristics of State Populations | Conclusions About Associations | Percent of State Variation Explained (R-square) |
|--|---|---|--|
| PQI 4 – Pediatric Asthma Admissions | Adult Asthma Prevalence | ns | 1.23% |
| | Emphysema Prevalence | ns | 0.97% |
| | Chronic Bronchitis Prevalence | ns | 5.38% |
| | Percent Reporting Cigarette Use in the Past Month | + | 13.57% |
| | HMO Penetration | ns | 2.65% |
| | Percent of People Below the Poverty Line in the Past 12 Months | ns | 7.44% |
| | Percent Without Telephone Access | + | 15.27% |
| | Source of Insurance: Uninsured (as a Percent of the Population) | ns | 3.25% |
| | Hospital Bed Supply (Rate/100,000) | ns | 4.22% |
| | Air Quality - Particulate Annual Mean | ns | 0.96% |
| | Air Quality - Particulate 24 Hour Average | ns | 0.64% |
| | Air Quality - Ozone 1 Hour Average | + | 16.99% |
| | Race/Ethnicity: White (as a Percent of the Population) | ns | 5.35% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 38.75% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 0.00% |
| | Race/Ethnicity: API (as a Percent of the Population) | ns | 1.63% |
| | Race/Ethnicity: Other (as a Percent of the Population) | - | 20.45% |
| Race/Ethnicity: Minority (as a Percent of the Population) | ns | 5.35% | |
| PQI 6 – Pediatric Gastroenteritis Admissions | HMO Penetration | ns | 6.86% |
| | Percent of People Below the Poverty Line in the Past 12 Months | + | 24.91% |
| | Percent of Population that is Foreign-Born | ns | 1.78% |
| | Source of Insurance: Uninsured (as a Percent of the Population) | ns | 2.78% |
| | Hospital Bed Supply (Rate/100,000) | + | 40.32% |
| | Race/Ethnicity: White (as a Percent of the Population) | ns | 0.25% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 12.06% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 2.32% |
| | Race/Ethnicity: API (as a Percent of the Population) | ns | 0.37% |
| | Race/Ethnicity: Other (as a Percent of the Population) | ns | 10.38% |
| | Race/Ethnicity: Minority (as a Percent of the Population) | ns | 0.25% |
| PQI 8 – Adult Admissions for Congestive Heart Failure | Percent of Adult Population at Risk for Heart Disease*** | + | 41.70% |
| | Cardiac Deaths (Rate/100,000) | + | 76.95% |
| | Percent Reporting Cigarette Use in the Past Month | + | 27.46% |
| | Percent Reporting Past Month 'Binge' Alcohol Use | ns | 2.92% |
| | Percent of Population 65 Years and Over | ns | 8.62% |
| HMO Penetration | ns | 0.51% | |

| AHRQ Prevention Quality Indicators (PQIs) | Characteristics of State Populations | Conclusions About Associations | Percent of State Variation Explained (R-square) |
|---|---|--------------------------------------|---|
| PQI 8 – cont'd | Percent of People Below the Poverty Line in the Past 12 Months | + | 18.67% |
| | Percent of Population that is Foreign-Born | ns | 2.57% |
| | Physician Specialist (Rate/100,000) | ns | 0.99% |
| | Medicare Hospital Payment per Beneficiary | + | 47.98% |
| | Race/Ethnicity: White (as a Percent of the Population) | ns | 0.33% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 34.20% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 3.43% |
| | Race/Ethnicity: API (as a Percent of the Population) | ns | 4.07% |
| | Race/Ethnicity: Other (as a Percent of the Population) | - | 25.83% |
| | Race/Ethnicity: Minority (as a Percent of the Population) | ns | 0.33% |
| PQI 14 – Adult Admissions for Uncontrolled Diabetes Without Complications | Prevalence of Obesity in Adults | + | 35.10% |
| | Adult Diabetes Prevalence (Diagnosed) | + | 12.38% |
| | Percent of Population 65 Years and Over | ns | 4.62% |
| | Source of Insurance: Uninsured (as a Percent of the Population) | ns | 9.16% |
| | Percent of People Below the Poverty Line in the Past 12 Months | + | 27.49% |
| | Hospital Bed Supply (Rate/100,000) | + | 25.47% |
| | Race/Ethnicity: White (as a Percent of the Population) | ns | 3.29% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 35.54% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 0.01% |
| | Race/Ethnicity: API (as a Percent of the Population) | ns | 3.94% |
| Race/Ethnicity: Other (as a Percent of the Population) | - | 14.55% | |
| Race/Ethnicity: Minority (as a Percent of the Population) | ns | 3.29% | |
| PQI 15 – Adult Asthma Admissions | Adult Asthma Prevalence | ns | 0.02% |
| | Emphysema Prevalence | ns | 0.25% |
| | Chronic Bronchitis Prevalence | - | 12.23% |
| | Percent Reporting Cigarette Use in the Past Month | + | 12.29% |
| | HMO Penetration | ns | 1.28% |
| | Percent of People Below the Poverty Line in the Past 12 Months | ns | 6.86% |
| | Percent Without Telephone Access | + | 15.69% |
| | Source of Insurance: Uninsured (as a Percent of the Population) | ns | 0.05% |
| | Hospital Bed Supply (Rate/100,000) | ns | 9.98% |
| | Percent of Population 65 Years and Over | + | 11.24% |
| Air Quality - Particulate Annual Mean | ns | 2.31% | |
| Air Quality - Particulate 24 Hour Average | ns | 1.64% | |
| Air Quality - Ozone 1 Hour Average | ns | 8.06% | |
| Race/Ethnicity: White (as a Percent of the Population) | ns | 6.46% | |

| AHRQ Prevention Quality Indicators (PQIs) | Characteristics of State Populations | Conclusions About Associations | Percent of State Variation Explained (R-square) |
|--|--|--------------------------------------|---|
| PQI 15 – cont'd | Race/Ethnicity: Black (as a Percent of the Population) | + | 27.39% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 0.60% |
| | Race/Ethnicity: API (as a Percent of the Population) | ns | 0.19% |
| | Race/Ethnicity: Other (as a Percent of the Population) | - | 19.90% |
| | Race/Ethnicity: Minority (as a Percent of the Population) | ns | 6.46% |
| PQI 15-65 – Adult Asthma Admissions, Age 65+ | Adult Asthma Prevalence | ns | 4.23% |
| | Emphysema Prevalence | ns | 3.02% |
| | Chronic Bronchitis Prevalence | ns | 10.90% |
| | Percent Reporting Cigarette Use in the Past Month | ns | 0.60% |
| | HMO Penetration | ns | 0.05% |
| | Percent of People Below the Poverty Line in the Past 12 Months | ns | 10.92% |
| | Percent Without Telephone Access | + | 11.62% |
| | Source of Insurance: Uninsured (as a Percent of the Pop.) | ns | 3.71% |
| | Hospital Bed Supply (Rate/100,000) | ns | 3.69% |
| | Percent of Population 65 Years and Over | ns | 0.37% |
| | Air Quality - Particulate Annual Mean | ns | 0.39% |
| | Air Quality - Particulate 24 Hour Average | ns | 0.01% |
| | Air Quality - Ozone 1 Hour Average | ns | 2.73% |
| | Race/Ethnicity: White (as a Percent of the Population) | - | 28.23% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 21.23% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 0.79% |
| | Race/Ethnicity: API (as a Percent of the Population) | + | 12.93% |
| Race/Ethnicity: Other (as a Percent of the Population) | - | 14.27% | |
| Race/Ethnicity: Minority (as a Percent of the Population) | + | 28.23% | |
| PQI 16 - Diabetes- Related Lower Extremity Amputations | PQI 14: Adult Admissions for Uncontrolled Diabetes Without Complications | + | 30.61% |
| | PQI 1: Adult Admissions for Short-term Diabetes Complications | + | 42.17% |
| | PQI 3: Adult Admissions for Long-term Diabetes Complications | + | 60.26% |
| | Percent of Adult Population at Risk for Heart Disease*** | + | 13.16% |
| | Cardiac Deaths (Rate/100,000) | + | 33.45% |
| | Prevalence of Obesity in Adults | + | 15.71% |
| | Adult Diabetes Prevalence (Diagnosed) | + | 25.88% |
| | Percent of Population 65 Years and Over | ns | 0.00% |
| | Source of Insurance: Uninsured (as a Percent of the Pop.) | ns | 3.60% |
| | Percent of People Below the Poverty Line in the Past 12 Months | ns | 8.30% |

| AHRQ Prevention Quality Indicators (PQIs) | Characteristics of State Populations | Conclusions About Associations | Percent of State Variation Explained (R-square) |
|---|---|--------------------------------------|---|
| | Hospital Bed Supply (Rate/100,000) | ns | 0.61% |
| | HMO Penetration | ns | 0.93% |
| PQI 16 – cont'd | Race/Ethnicity: White (as a Percent of the Population) | - | 14.17% |
| | Race/Ethnicity: Black (as a Percent of the Population) | + | 48.27% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | ns | 0.54% |
| | Race/Ethnicity: API (as a Percent of the Population) | ns | 0.62% |
| | Race/Ethnicity: Other (as a Percent of the Population) | - | 19.00% |
| | Race/Ethnicity: Minority (as a Percent of the Population) | + | 14.17% |
| (Added) - Immunization- Preventable Influenza Admissions Among Elderly | Percent of Adult Population at Risk for Heart Disease*** | + | 20.95% |
| | Cardiac Deaths (Rate/100,000) | ns | 5.26% |
| | Emphysema Prevalence | ns | 0.99% |
| | Chronic Bronchitis Prevalence | ns | 0.89% |
| | Percent Reporting Cigarette Use in the Past Month | ns | 6.70% |
| | Percent Reporting Past Month 'Binge' Alcohol Use | ns | 9.58% |
| | Source of Insurance: Uninsured (as a Percent of the Population) | ns | 1.90% |
| | HMO Penetration | - | 17.28% |
| | Percent of People Below the Poverty Line in the Past 12 Months | ns | 11.02% |
| | Race/Ethnicity: White (as a Percent of the Population) | ns | 5.74% |
| | Race/Ethnicity: Black (as a Percent of the Population) | ns | 2.27% |
| | Race/Ethnicity: Hispanic (as a Percent of the Population) | - | 14.01% |
| | Race/Ethnicity: API (as a Percent of the Population) | ns | 0.81% |
| | Race/Ethnicity: Other (as a Percent of the Population) | ns | 2.90% |
| | Race/Ethnicity: Minority (as a Percent of the Population) | ns | 5.74% |

Appendix C, Age Groupings for Risk Adjustment

This appendix shows the 18 categories of patient age, in five-year increments, that are used for risk adjustment. The 36 age-gender categories for risk adjustment use the 18 age categories with the male-female gender.

| Age Groups |
|-------------|
| 0-4 |
| 5-9 |
| 10-14 |
| 15-17 |
| 18-24 |
| 25-29 |
| 30-34 |
| 35-39 |
| 40-44 |
| 45-49 |
| 50-54 |
| 55-59 |
| 60-64 |
| 65-69 |
| 70-74 |
| 75-79 |
| 80-84 |
| 85 or older |