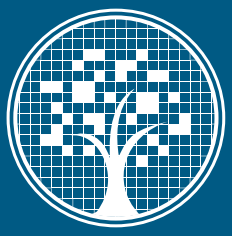

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HEALTHCARE COST AND UTILIZATION PROJECT

# HCUP Methods Series

## Methods Applying AHRQ Quality Indicators to Healthcare Cost and Utilization Project (HCUP) Data for the 2014 National Healthcare Quality and Disparities Report (QDR)

## Report # 2015-02


Agency for Healthcare Research and Quality


U.S. Department of Health and Human Services
Agency for Healthcare Research and Quality

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Recommended Citation: Coffey R, Barrett M, Houchens R, Moy E, Andrews R, Moles E, Coenen N. *Methods Applying AHRQ Quality Indicators to Healthcare Cost and Utilization Project (HCUP) Data for the 2014 National Healthcare Quality and Disparities Report (QDR)*. 2015. HCUP Methods Series Report # 2015-02 ONLINE. April 13, 2015. U.S. Agency for Healthcare Research and Quality. Available: http://www.hcup-us.ahrq.gov/reports/methods/methods.jsp.

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# Methods Applying AHRQ Quality Indicators to Healthcare Cost and Utilization Project (HCUP) Data for the 2014 National Healthcare Quality and Disparities Report (QDR)

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Revised: April 10, 2015

The Agency for Healthcare Research and Quality (AHRQ) Quality Indicators (QIs) were applied to the Healthcare Cost and Utilization Project (HCUP) hospital discharge data for selected measures in the National Healthcare Quality and Disparities Report (QDR). The report measures and tracks trends in quality and disparities in seven key areas of health care: patient safety, person-centered care, care coordination, effective treatment, healthy living, care affordability, and access to health care. Beginning with this 2014 report, findings that previously appeared in two separate reports (the *National Healthcare Quality Report* and the *National Healthcare Disparities Report*) have been integrated into a single document that provides a comprehensive overview of the quality of health care received by the general population and disparities in care experienced by different racial, ethnic, and socioeconomic groups. Information on individual measures will available through chartbooks.

The AHRQ QIs are measures of quality associated with processes of care that occur 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 the QDR 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, 2012).
- 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, 2012).
- Patient Safety Indicators (PSIs) reflect quality of care inside hospitals, by focusing on surgical complications and other iatrogenic events (AHRQ, 2012).
- Pediatric Quality Indicators (PDIs) reflect quality of care inside hospitals and identify potentially avoidable hospitalizations among children (AHRQ, 2012).

The QI measures generated for possible inclusion in the QDR are described in Table 1 at the end of this methods report. Not all of these QIs were used in the reports.

## PREPARATION OF HCUP DATABASES

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 are derived from administrative data and contain encounter-level, clinical and nonclinical information including all-listed diagnoses and procedures, discharge status, patient demographics, and charges for all patients, regardless of payer (e.g., Medicare, Medicaid, private insurance, uninsured), 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, patient safety, access to health care programs, and outcomes of treatments at the national, State and local market levels.

Three HCUP discharge datasets were used as the source of data for the QDR:

- 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 (data years 2000–2011 were used for trends).
- The HCUP State Inpatient Databases (SID), a census of hospitals (with all of their discharges) from 45 participating States in 2012.[1]
- The HCUP Nationwide Emergency Department Sample (NEDS), a nationally stratified sample of hospital-based emergency departments (with information for both treat-and-release visits and those resulting in a hospital admission) from 30 states in 2011.

For each year from 2000-2011, the NIS contains roughly 8.0 million unweighted discharges from more than 1,000 hospitals. The combined SID contain over 35 million discharges a year (approximately 97 percent of the discharges in the United States). The NEDS contains approximately 30 million ED events from over 950 hospital-based emergency departments.

For the QDR, a quality analysis file was constructed using all available HCUP SID from 2012. The quality analysis file was used in place of the 2012 NIS for consistency with earlier years in trend analyses. Beginning with 2012, the sampling design of the NIS was revised.[2] To provide consistency with the previously developed QI estimates from earlier years of NIS, the quality analysis file was needed that applied the same sampling approach as in previous years. The quality analysis file provides 2012 national estimates using weighted records from a sample of hospitals from 44 States, and using the same methodology employed for the 2000-2011 NIS. Unweighted, the QDR 2012 quality analysis file contains roughly 7.6 million discharges from more than 1,000 hospitals. Weighted, it estimates more than 38 million hospitalizations nationally.

For the QDR, a disparities analysis file designed to provide national estimates by race/ethnicity was constructed using the HCUP SID from participating States that report patient race/ethnicity. This 2012 file was created using a stratified, weighted sample of hospitals from the 38 HCUP States that report patient race/ethnicity.

Data tables were constructed for the QDR from these HCUP databases:

- National trends in QI estimates used data from the 2000-2011 NIS and 2012 quality analysis file.
- The State-level trends used data from the 2004, 2011, and 2012 SID, for States that agreed to participate.
- National trends within subpopulations used data from the 2000-2011 NIS and 2012 quality analysis file.

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[1] Maine, Mississippi, and New Hampshire data were not available in time to be included in 2012 national estimates using the HCUP data for the 2014 QDR.

[2] The previous NIS design contained all discharge records from a sample of hospitals participating in HCUP. The revised NIS contains a sample of discharge records from hospitals participating in HCUP. The definition of the discharge universe was also revised to exclude long-term acute care hospitals. Information on the design on the 2000-2011 NIS is provided at http://www.hcup-us.ahrq.gov/db/nation/nis/NIS_Introduction_2011.jsp.

- National trends for priority populations by community income quartile used the 2000-2011 NIS and the 2012 quality analysis file.
- National trends for priority populations by race/ethnicity used the 2001-2012 disparities analysis files.
- National trends within subpopulations by race/ethnicity used the 2012 disparities analysis file.
- For the special analyses, national trends for differences in QI rates for inpatient and emergency department settings were estimated from the 2011 NIS and the NEDS.

For the list of data organizations that contribute to the HCUP databases, see Table 2 at the end of this methods report.

In preparation for the QDR, and derivative products, the HCUP databases needed to be customized as indicated below:

1. The HCUP SID were modified to create analytic files consistent across States.
   - *Subset to Community Hospitals*. For the SID, we selected community hospitals[3] and eliminated rehabilitation hospitals.
   - *Weight for Missing Hospitals*. Because some statewide data organizations do not report data for all community hospitals in the State, we weighted hospitals in the SID to the State's universe of hospitals in the American Hospital Association (AHA) Annual Survey Database 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 the SID.
2. The SID and prior years of the NIS were augmented as necessary for the QDR analyses:
   - *Impute for Missing Characteristics*. For missing age, gender, race/ethnicity, ZIP Code, and expected primary 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 quartile by linking Nielsen ZIP Code demographic data to patient's ZIP Code in the SID.
3. For the QDR, the HCUP SID were used to create a quality analysis file for 2012 designed to provide national-level estimates for overall and subpopulation reporting (for all groups except by race/ethnicity). This file was used in place of the 2012 NIS to provide consistency with the previously developed QI estimates from earlier years of the NIS. The quality

[3] *Community* hospitals are defined by the AHA as "non-Federal, short-term, general, and other specialty hospitals, excluding hospital units of institutions." The specialty hospitals included in the AHA definition of "community hospitals" are: obstetrics-gynecology, ear-nose-throat, short-term rehabilitation, orthopedic, and pediatric institutions. The AHA also groups public hospitals and academic medical centers with community hospitals. Starting in 2005, the AHA included long term acute care facilities in the definition of community hospitals, therefore such facilities are included in the NIS sampling frame. These facilities provide acute care services to patients who need long term hospitalization (stays of more than 25 days). Excluded from the AHA definition of "community hospitals" are long-term non-acute care hospitals, psychiatric hospitals, and alcoholism/chemical dependency treatment facilities. For the QDR analyses, we selected all AHA-defined "community hospitals" with the exception of short-term rehabilitation hospitals (beginning with 1998 HCUP data).

analysis file was designed to provide 2012 national estimates for the QDR using weighted records from a sample of hospitals from 44 States with 2012 SID available at the time the file was constructed, and using the same methodology employed for the 2000-2011 NIS.[4]

4. For the QDR, the HCUP SID for States that reported race/ethnicity were used to create disparities analysis files designed to provide national- and State-level estimates for the report and derivative products. Of the 44 States participating in the 2012 SID, the following 38 HCUP States report race/ethnicity of discharges:

   - Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Iowa, Illinois, Indiana, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Missouri, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming.

   A disparities analysis file was designed to provide *national estimates* for the QDR, using a weighted sample of hospitals from these 38 HCUP States. Appendix A to this report provides detail on the creation of the disparities analysis file for national estimates. The individual SID were used to create additional disparities analysis files for State-level reporting by race/ethnicity. Appendix B to this report provides detail on the creation of disparities analysis files for State-level estimates.

5. The SID were also used for reporting overall and by priority populations within State (race/ethnicity, community income quartile, and expected primary payer). Given the varied distribution of race, ethnicity, and socioeconomic groups across states, policymakers increasingly want to know if and how quality of care varies for these different populations. State-level QI estimates are only reported for participating HCUP Partners that agree to release information.

6. The NIS and NEDS were used to calculate selected PQIs and PDIs in the inpatient and emergency department setting. A description of the data preparation and methods used for national estimates from the NEDS is included in Appendix C.

## STEPS TAKEN TO APPLY AHRQ QUALITY INDICATORS TO THE HCUP DATA

To apply the AHRQ Quality Indicators to HCUP hospital discharge data for the QDR, several steps were taken: (1) QI software review and modification, (2) acquisition of population-based data, (3) assignment of QIs to the HCUP databases, and (4) identification of statistical methods.

1. **Review and Modify the AHRQ QI Software.** For the 2014 QDR, we started with the following QI software versions: PQI Version 4.4, IQI Version 4.4, PSI Version 4.4, and PDI Version 4.4. 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.

   In addition, we did not utilize the present on admission (POA) estimation module for the IQIs, PDIs, and PSIs since POA indicators were not uniformly available from States that contribute to the HCUP databases. Specific modifications are noted as footnotes in the

[4] SID for 2012 from Maine, Mississippi, and New Hampshire were not available when the 2012 quality analysis file was constructed.

tables. 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.

We added three indicators particularly relevant to the structure of the QDR. One indicator was created for discharges age 65 years and older: immunization-preventable influenza, age 65 and over. Two additional indicators were created to facilitate longitudinal analyses by modifying the chronic and overall PQI composite measures to exclude chronic obstructive pulmonary disease (COPD). Because of ICD-9-CM coding changes, chronic obstructive pulmonary disease estimates (PQI 05) for data prior to 2005 are not compatible with rates for 2005 forward.

2. **Acquire Population-Based Data for Denominators and Risk-Adjustment.** The next step was to acquire data for the numerator and denominator populations for the QIs. The AHRQ QIs measure an event that occurs in a hospital, requiring a numerator count of the event of interest and a denominator count of the population (within a hospital or geographic area) to which the event relates.

   For the numerator counts of the AHRQ QIs, we used the quality analysis file (2012), the HCUP NIS (2000–2011), and the QDR disparities analysis file to create national estimates and used the SID for State-level estimates. For the denominator counts, we identified two sources for all reporting categories and for all adjustment categories listed in the HCUP-based tables. For QIs that related to *providers,* the HCUP data were used for State- and national-level discharge denominator counts. For QIs that related to *geographic areas,* population ZIP-Code-level counts from demographic update data provided by Nielsen (a vendor that compiles and adds value to the U.S. Bureau of Census data) were used for denominator counts. Nielsen uses intra-census methods to estimate household and demographic statistics for geographic areas (The Nielsen Company, 2012). We also used the Nielsen population data for risk adjustment by age and gender for the area-based QIs.

3. **Assign QI Indicators to the HCUP Databases.** The four AHRQ QI program modules were applied to the prepared SID data using all available diagnoses and procedures reported by each State. The QI indicators from the SID were then linked to the corresponding discharge records on the NIS.

4. **Adapt Statistical Methods to HCUP Data.** Several statistical issues needed to be addressed when applying the AHRQ QI software to the HCUP data, including: 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 Risk Adjustment.* For the PQIs and area-based IQIs, PSIs, and PDIs, the observed rates were risk-adjusted 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 Table 3, Age Groupings for Risk Adjustment). Although the AHRQ QI software uses a similar approach to adjust the area-based QIs, we relied on direct standardization because of the additional reporting categories and denominators for priority populations required in the QDR.
   - *Age, Gender, Severity, and Comorbidity Risk Adjustment*. For the discharge-based *PSI*s, the observed rates were risk-adjusted for age, gender, age-gender interaction, DRG cluster, and comorbidity using the regression-based standardization that is part of the AHRQ PSI software, with the following exceptions. When reporting by age, the risk adjustment includes all of the above except age. When reporting by gender, the risk adjustment includes all of the above except gender.

For the discharge-based *IQIs*, risk adjustments were made for age, gender, age-gender interaction, and the 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, with the following exceptions. When reporting by age, the risk adjustment includes all of the above except age. When reporting by gender, the risk adjustment includes all of the above except gender.

For the discharge-based *PDIs*, risk 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, and procedure type was also applied, with the following exceptions. When reporting by age, the risk adjustment includes all of the above except age. When reporting by gender, the risk adjustment includes all of the above except gender.

- *Standard Errors and Hypothesis Tests*. Standard error 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 Nielsen census population counts; therefore, appropriate statistics were obtained through the Statistical Analysis System (SAS) procedure called PROC SURVEYMEANS.
- *Masking Rates for Statistical Reliability, Data Quality, and Confidentiality*. QI estimates were included in the QDR if they reached a threshold defined by a relative standard error less than 30% and at least 11 unweighted cases in the denominator. Estimates that did not satisfy these criteria were masked (set to DSU, for "data statistically unreliable"). Statistical calculations are explained in Appendix D to this report.

## SPECIAL ANALYSES

### Calculating Costs Associated with Quality Indicators

The QDR includes trends in total national costs from 2000 to 2012 for the three PQI composite measures — for acute, chronic, and overall conditions (AHRQ, 2011). Total national costs associated with potentially avoidable hospitalizations were calculated overall for the U.S., by income quartile and by race/ethnicity.

Total charges were converted to costs using the hospital-level HCUP Cost-to-Charge Ratios based on Hospital Cost Report data from the Centers for Medicare & Medicaid Services (CMS).[5] Costs reflect the actual costs of production, while charges represent what the hospital billed for the stay. Hospital charges reflect the amount the hospital charged for the entire hospital stay and do not include professional (physician) fees. The total cost is the product of the number of stays for each QI measure and the mean cost for each QI measure. This approach compensates for stays for which charges (and thus estimated costs) are not available. Costs were adjusted to 2012 dollars for all years using the price indexes for the gross domestic product (downloaded from the Bureau of Economic Analysis, U.S. Department of Commerce).

[5] HCUP Cost-to-Charge Ratio Files. Healthcare Cost and Utilization Project (HCUP). August 2014. Agency for Healthcare Research and Quality, Rockville, MD. Available: www.hcup-us.ahrq.gov/db/state/costtocharge.jsp.

### Calculating IQI and PSI Summary Measures

To examine national and State-level trends in inpatient mortality and patient safety events, risk-adjusted rates for select Inpatient Quality Indicators (IQIs) and Patient Safety Indicators (PSIs) were summarized. The three QDR summary measures include: (1) Mortality for *selected conditions* based on select IQIs; (2) Mortality for *selected procedures* based on select IQIs; and (3) Patient Safety based on select PSIs. These summary measures were calculated as a weighted sum of risk-adjusted rates for individual IQIs and PSIs. Additional information on the calculation of IQI and PSI Summary Measures is provided in Appendix E.

### Determining Benchmarks for State Performance for the Quality Indicators

Based on a recommendation from the Institute of Medicine's report on *Future Directions for the National Healthcare Quality and Disparities Reports*, benchmarks based on a straight average of the top 10 percent of reporting States were determined. For a benchmark to be calculated, rates for at least 30 States needed to be available.

### Inpatient and Emergency Department Rates for Selected Conditions

Beginning in the 2009 NHQR, the HCUP Nationwide Emergency Department Sample (NEDS) and NIS data were used to examine national and regional differences in inpatient and emergency department rates for selected PQIs and PDIs. Beginning with the 2011 NHQR, there was an additional analysis on mental illness and substance use disorders. Details for these analyses are provided in Appendix C.

## CAVEATS

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

***ICD-9-CM Coding Changes:*** A number of the AHRQ QIs are based on diagnoses and procedures for which ICD-9-CM coding has generally become more specific over the period of this study. If coding changes cause earlier estimates to be non-comparable to the later estimates, then the earlier estimates are not reported. For this reason, *the following measures are not reported prior to 2005*: the PQI for chronic obstructive pulmonary disease (PQI 5), the overall PQI composite (PQI 90), and chronic PQI composite (PQI 92), the PSI for death among surgical inpatients (PSI 4), and the PSI for post-operative pulmonary embolism or deep vein thrombosis (PSI 12). *The following measure is not reported prior to 2004*: birth trauma (PSI 17). QIs for sepsis (PDI 10 and PSI 13) and blood stream infections (NQI 3, PDI 12, PSI 7, and PSI 23) are *not reported before 2008*. In addition the QIs for pressure ulcer (PDI 2 and PSI 3) are not *reported for any year* because numerous coding changes between 2000 and 2012 make longitudinal analysis impossible.

***Data Collection Differences Among States:*** Organizations providing statewide data generally collect the data using the Uniform Billing format (UB-04) and, for earlier years, the UB-92 or Uniform Hospital Discharge Data Set (UHDDS) format. However, not every statewide data organization collects all data elements nor codes them the same way. For the QDR, uneven availability of a few data elements underlie some estimates, as noted next.

***Data Elements for Exclusions:*** Three data elements required for certain QIs were not available in every State: "secondary procedure day," "admission type" (elective, urgent, newborn, and emergency), and "present on admission." We modified the AHRQ QI software in instances where these data elements are used to exclude specific cases from the QI measures:

- Some of the PSIs and PDIs use procedure days to determine the timing of a patient safety event. In States without procedure days, the patient safety event cannot be verified as following surgery.[6] Affected PSIs and PDIs are shown in Table 4. PSI 4 "Deaths per 1,000 elective-surgery admissions having developed specified complications of care during hospitalization" uses the day of the principal procedure or type of admission to identify an elective admission. All of the states that do not report data of principal procedure do report type of admission.
- For QIs that use *admission type* "elective" and "newborn," 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.
- For QIs that use *present on admission* (POA), we modified the AHRQ QI software to calculate indicators without considering whether the condition was present at admission. PSIs and PDIs that use POA are shown in Table 5.

***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. The SID for different States generally contain as few as 6 or as many as 30 or more fields for reporting diagnoses and procedures, as shown in Table 6. The more fields used, the more quality-related events that can be captured in the statewide databases. However, in an earlier analysis, 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 artificially truncate the diagnosis and procedure fields used for the QDR analyses, so that the full richness of the databases would be used.

***E Codes:*** Another issue relates to external cause-of-injury reporting. Five of the 25 PSIs and one of the PDIs use E code data to help identify complications of care or to exclude cases (e.g., poisonings, self-inflicted injury, and trauma) from numerators and denominators, as shown in Table 7 at the end of this methods report. Although E codes in the AHRQ PSI and PDI software have been augmented wherever possible with the related non-E codes in the ICD-9-CM system, some E codes are still included in some AHRQ PSI and PDI definitions. Uneven capture of these data has the potential of affecting rates and should be kept in mind when judging the level of these events.

[6] Several States are missing data on day of procedure. The states without procedure days in the 2004-2012 SID include: Oklahoma, Utah, and West Virginia. For 2004-2011, Ohio did not have procedure days. For 2004, Illinois, Kansas, and Washington did not have procedure days.

While all HCUP States report E Codes, the policies on reporting medical misadventures and adverse effects can vary:

- California (through 2009) and Washington do not require hospitals to report E codes in the range E870-E879 (medical misadventures and abnormal reactions).
- Georgia does not report E codes in the range E870-E879 (medical misadventures and abnormal reactions) and E930-E949 (adverse effects).
- South Carolina (through 2007) did not report E codes in the range E870-E876 (medical misadventures).

***Adding New States to the NIS and Disparities Analysis File:*** Over time, HCUP has expanded through the participation of additional statewide data organizations. Because each 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 related to clinical practice over time.

Similarly, the disparities analysis file contains a sample of hospitals from States that report race and ethnicity in that year (and weighted to the universe of community hospitals nationally), which also presents the possibility that variation across States could influence national measures related to clinical practice over time.

The table below lists the States that were added to these HCUP databases between the years used in this report.

| Period | States in HCUP NIS |
|---|---|
| 2000 | AZ, CA, CO, CT, FL, GA, HI, IL, IA, KS, KY,MD, MA, ME, MO, NC, NJ, NY, OR, PA, SC, TN, TX, UT, VA, WA, WI, WV |
| 2001 | Added MI, MN, NE, RI, VT |
| 2002 | Added NV, OH, SD<br>(AZ data not available) |
| 2003 | Added AZ, IN, NH<br>(ME data not available) |
| 2004 | Added AR<br>(PA data not available) |
| 2005 | Added OK<br>(VA data not available) |
| 2006 | Added ME, VA |
| 2007 | Added WY |
| 2008 | Added LA, PA |
| 2009 | Added MT, NM |
| 2010 | Added AK, MS<br>(NH data not available) |
| 2011 | Added ND |

| Period | States in Quality Analysis File |
|---|---|
| 2012 | AK, AR, AZ, CA, CO, CT, FL, GA, HI, IA, IL, IN, KS, KY, LA, MA, MD, MI, MN, MO, MT, NC, ND, NE, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY<br>(ME, MS data not available) |

| Period | States in Disparities Analysis File |
|---|---|
| 2001 | AZ, CA, CO, CT, FL, GA, HI, KS, MA, MD, MI, MO, NJ, NY, PA, RI, SC, TN, TX, VA, VT, WI |
| 2002 | No changes |
| 2003 | Added NH<br>(PA data not available) |
| 2004 | Added AR |
| 2005 | Added OK<br>(VA data not available) |
| 2006 | Added UT, VA |
| 2007 | Added WY |
| 2008 | Added KY, ME, NV, OR, PA |
| 2009 | Added IA, IL, NM, SD, WA |
| 2010 | Added AK, IN, MS, NC<br>(ME, NH, WA data not available) |
| 2011 | Added ME, WA |
| 2012 | No new States<br>(MS data not available) |

***Non-Resident Discharges in State-Level Estimates:*** HCUP databases include discharges from all hospitals in a State, and may include non-residents, including foreign patients, which can bias the results for QIs using area-based denominators (State populations). We had no way to adjust the HCUP data to consistently exclude the non-resident discharges and include discharges for residents hospitalized in other States. Therefore, non-resident discharges were retained in the SID databases for the QDR analyses. Based on an analysis performed with the 2012 SID, the percent of non-resident discharges is between 1% and 23% within a State. Most States were below 10%, but in five States (ND, SD, TN, VT, WV) more than 10% of patients were non-residents.

***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. For more information on this study, refer to the *Methods Applying AHRQ Quality Indicators to the Healthcare Cost and Utilization Project (HCUP) Data for the Ninth (2011) NHQR and NHDR* (Coffey et al., 2011). The report includes an appendix that describes analyses performed for each Prevention Quality Indicator (PQI) included in the NHQR, 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.

In a subsequent analysis, we investigated sources of variation in Patient Safety Indicator (PSI) rates across States using 2004 data. The analysis concluded there were few state factors (such as state policy, hospital characteristics, coding practices, and socio-demographics) with strong patterns of association to State-level variation in the nine PSI rates studied. The strongest result occurred with coding practices — the number of diagnosis fields coded. Only one in five correlations between the PSIs and State factors were statistically significant, although there is generally no pattern. For more information on this study, refer to the *Methods Applying AHRQ Quality Indicators to the Healthcare Cost and Utilization Project (HCUP) Data for the Ninth (2011) NHQR and NHDR* (Coffey et al., 2011). The report includes the executive summary from the report, *Patient Safety in Hospitals in 2004: Toward Understanding Variation Across States*.

These analyses are intended to help readers understand some of the external factors that may be driving some of the State differences in PQI and PSI rates.

# TABLES

## Table 1. AHRQ Quality Indicators Applied to the HCUP Data for the National Healthcare Quality and Disparities Report (QDR)

*This table includes the list of all version 4.4 AHRQ Quality Indicators (QIs) calculated using HCUP data. Not all of the AHRQ QIs listed below were included in the 2014 QDR.*

| QI No. | Description | Footnote |
|---|---|---|
| **Prevention Quality Indicators[7]** | | |
| PQI 1 | Admissions with diabetes with short-term complications[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, diabetes must be the principal diagnosis and short-term complications include ketoacidosis, hyperosmolarity, or coma. Transfers from other institutions are excluded. |
| PQI 2 | Admissions with perforations or abscesses of appendix per 1,000 admissions with appendicitis[a], age 18 and over | [a] Consistent with the AHRQ PQI software, obstetric discharges and transfers from other institutions are excluded. |
| PQI 3 | Admissions with diabetes with long-term complications[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, diabetes must be the principal diagnosis and long-term complications include renal, eye, neurological, circulatory, or other unspecified complications. Transfers from other institutions are excluded. |
| PQI 5 | Admissions with chronic obstructive pulmonary disease (COPD)[a] or asthma per 100,000 population, age 40 and over | [a] Consistent with the AHRQ PQI software, the principal diagnosis must be COPD, asthma, or acute bronchitis with COPD as a secondary diagnosis. Transfers from other institutions are excluded. |
| PQI 7 | Admissions with hypertension[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, hypertension must be the principal diagnosis and exclusions include the following: admissions with kidney disease with dialysis access procedures, admissions with cardiac procedures, and transfers from other institutions. |
| PQI 8 | Admissions for congestive heart failure (CHF)[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, CHF must be the principal diagnosis and exclusions include the following: admissions with cardiac procedures and transfers from other institutions. |
| PQI 9 | Low birth weight infants per 1,000 newborns[a] | [a] Consistent with the AHRQ PQI software, exclusions include transfers from other institutions. |
| PQI 10 | Admissions for dehydration[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, dehydration may be a principal diagnosis or a secondary diagnosis with a principal diagnosis of hyperosmolality and/or hypernatremia, gastroenteritis, or acute kidney injury. Exclusions include the following: admissions with a diagnosis code for chronic renal failure and transfers from other institutions. |
| PQI 11 | Admissions for bacterial pneumonia[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, bacterial pneumonia must be the principal diagnosis and exclusions include the following: admissions for sickle cell disease or HB-S disease, admissions in an immunocompromised state, and transfers from other institutions. |
| PQI 12 | Admissions for urinary tract infection (UTI)[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, UTI must be the principal diagnosis and exclusions include the following: admissions with kidney or urinary tract disorders, admissions in an immunocompromised state, and transfers from other institutions. |
| PQI 13 | Admissions for angina without cardiac procedure[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, angina must be the principal diagnosis, and exclusions include admissions with cardiac procedures and transfers from other institutions. |

[7] Indicators PQI 4 and PQI 6 are not assigned by the PQI software, version 4.

| QI No. | Description | Footnote |
|---|---|---|
| PQI 14 | Admissions for uncontrolled diabetes without complications[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, diabetes without complications must be the principal diagnosis and exclusions include transfers from other institutions. |
| PQI 15 | Admissions for asthma[a] per 100,000 population, age 18 to 39 | [a] Consistent with the AHRQ PQI software, asthma must be the principal diagnosis on admissions ages 18 to 39 years old, and the following cases are excluded: admissions with cystic fibrosis or anomalies of the respiratory system and transfers from other institutions. |
| PQI 16 | Lower extremity amputations among admissions for diabetes[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PQI software, a procedure code for lower-extremity amputation and a diagnosis of diabetes must be present. Exclusions include admissions for toe amputation or traumatic amputations of the lower extremity, obstetric discharges, and transfers from other institutions. |
| PQI 17 (Added) | Admissions for immunization-preventable pneumococcal pneumonia[a] per 100,000 population, age 65 and over | [a] Immunization-preventable pneumococcal pneumonia may be reported as either the principal diagnosis or a secondary diagnosis. Exclusions include transfers from other institutions. |
| PQI 18 (Added) | Admissions for immunization-preventable influenza[a] per 100,000 population, age 65 and over | [a] Immunization-preventable influenza may be reported as either the principal diagnosis or a secondary diagnosis. Exclusions include transfers from other institutions. |
| PQI 90 | AHRQ overall Prevention Quality Indicator (PQI) composite[a] per 100,000 population, age 18 and over | [a] Based on the twelve AHRQ PQIs for angina, asthma, bacterial pneumonia, chronic obstructive pulmonary disease, congestive heart failure, dehydration, diabetes, hypertension, and urinary tract infection. |
| PQI 90x (Added) | AHRQ modified[a] overall Prevention Quality Indicator (PQI) composite per 100,000 population, age 18 and over | [a] Based on the eleven AHRQ PQIs for angina, asthma, bacterial pneumonia, congestive heart failure, dehydration, diabetes, hypertension, and urinary tract infection. For consistency of longitudinal reporting, the modified overall composite does not include AHRQ PQI 5 for chronic obstructive pulmonary disease because it is affected by ICD-9-CM coding changes. |
| PQI 91 | AHRQ acute Prevention Quality Indicator (PQI) composite[a] per 100,000 population, age 18 and over | [a] Based on the three AHRQ PQIs for bacterial pneumonia, dehydration, and urinary tract infection. |
| PQI 92 | AHRQ chronic Prevention Quality Indicator (PQI) composite[a] per 100,000 population, age 18 and over | [a] Based on the nine AHRQ PQIs for angina, asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes, and hypertension. |
| PQI 92x (Added) | AHRQ modified[a] chronic Prevention Quality Indicator (PQI) composite per 100,000 population, age 18 and over | [a] Based on the eight AHRQ PQIs for angina, asthma, congestive heart failure, diabetes, and hypertension. For consistency of longitudinal reporting, the modified overall composite does not include AHRQ PQI 5 for chronic obstructive pulmonary disease because it is affected by ICD-9-CM coding changes. |
| **Pediatric Quality Indicators[8]** | | |
| PDI 01 | Admissions with accidental puncture or laceration during procedure per 1,000 medical and surgical admissions,[a] age less than 18 years | [a] The AHRQ PDI software requires that the accidental puncture or laceration be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PDI software, the following cases are excluded: obstetric admissions, admissions involving spinal surgery, normal newborns, and neonates with a birth weight less than 500 grams. |

[8] Indicator PDI 4 is not assigned by the PDI software, version 4. Incidence measures PDI 2 (pressure ulcer), PDI 3 (foreign body), and PDI 13 (transfusion reaction) are not calculated. Volume measure PDI 7 (pediatric heart surgery) is also not calculated.

| QI No. | Description | Footnote |
|---|---|---|
| PDI 05 | Admissions with iatrogenic pneumothorax per 1,000 medical and surgical admissions,[a] age less than 18 years | [a] The AHRQ PDI software requires that the iatrogenic pneumothorax be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PDI software, the following cases are excluded: obstetric admissions, normal newborns, neonates with a birth weight less than 2500 grams, and admissions with chest trauma, pleural effusion, thoracic surgery, lung/pleural biopsy, diaphragmatic surgery repair, or cardiac surgery. |
| PDI 06 | Deaths per 1,000 heart surgery admissions,[a] age less than 18 years | [a] Consistent with the AHRQ PDI software, exclusions include obstetric admissions; admissions with transcatheter interventions as a single cardiac procedure or performed without bypass, but with catheterization; admissions with septal defects as single cardiac procedures without bypass; admissions with an atrial septal defect or ventricular septal defect repair with patent ductus arteriosus as the only cardiac procedure; heart transplants; premature infants with patent ductus arteriosus (PDA) closure as only cardiac procedure; infants age less than 30 days with PDA closure as only cardiac procedure; transfers to another hospital; and neonates with a birth weight less than 500 grams. |
| PDI 08 | Postoperative hemorrhage or hematoma with surgical drainage or evacuation per 1,000 elective surgical admissions,[a] age less than 18 years | [a] The AHRQ PDI software requires that the hemorrhage or hematoma complicating procedure be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. In addition, the control of the hemorrhage or hematoma is not verifiable as following surgery. Consistent with the AHRQ PDI software, the following cases are excluded: obstetric conditions, neonates with a birth weight less than 500 grams, and admissions in which the control of the hemorrhage or hematoma is the only operating room procedure or occurs before the first operating room procedure. |
| PDI 09 | Postoperative respiratory failure per 1,000 elective-surgery admissions,[a] age less than 18 years | [a] The AHRQ PDI software requires that the respiratory failure be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. In addition, the tracheostomy is not verifiable as following surgery. Consistent with the AHRQ PDI software, the following cases are excluded: admissions with respiratory disease; circulatory disease; craniofacial anomalies with laryngeal or pharyngeal surgery, or with a procedure on face and a diagnosis of craniofacial abnormalities; admissions with a procedure for esophageal resection, lung cancer, or nose, mouth, and pharynx; admissions with degenerative neurological disorders; neuromuscular disorders; neonates with a birth weight less than 500 grams; and admissions in which the tracheostomy is the only operating room procedure. |

| QI No. | Description | Footnote |
|---|---|---|
| PDI 10 | Postoperative sepsis per 1,000 surgery admissions of length 4 or more days,[a] age less than 18 years | [a] The AHRQ PDI software requires that the sepsis be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. In addition, the sepsis is not verifiable as following surgery. Consistent with the AHRQ PDI software, the following cases are excluded: admissions with a principal diagnosis of infection; admissions with a procedure for appendicitis, infectious or parasitic diseases, or post-operative infections; obstetric admissions; and neonates. |
| PDI 11 | Reclosure of postoperative abdominal wound dehiscence per 1,000 abdominopelvic-surgery admissions of length 2 or more days,[a] age less than 18 years | [a] Reclosure of abdominal wound dehiscence is not verifiable as following surgery and may have occurred on or before the abdominopelvic procedure. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric admissions; neonates with a birth weight less than 500 grams; admissions in an immunocompromised state or having a procedure code for transplant; admissions with hepatic failure consisting of cirrhosis and hepatic coma or heatorenal syndrome; and admissions with gasroschisis or umbilical hernia repair in newborns. |
| PDI 12 | Admissions with central venous catheter-related bloodstream infection per 1,000 medical and surgical discharges of length 2 or more days,[a] age less than 18 years | [a] The AHRQ PDI software requires that the central venous catheter-related bloodstream infection be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PDI software, the following cases are excluded: normal newborns, neonates with a birth weight less than 500 grams, and obstetric admissions. |
| PDI 14 | Admissions for asthma[a] per 100,000 population, ages 2-17 | [a] Consistent with the AHRQ PDI software, asthma must be the principal diagnosis and the following cases are excluded: admissions with cystic fibrosis or anomalies of the respiratory system, transfers from other institutions, and obstetric admissions. |
| PDI 15 | Admissions with diabetes with short-term complications[a] per 100,000 population, ages 6-17 | [a] Consistent with the AHRQ PDI software, diabetes must be the principal diagnosis and short-term complications include ketoacidosis, hyperosmolarity, or coma. Transfers from other institutions and obstetric admissions are excluded. |
| PDI 16 | Admissions for pediatric gastroenteritis[a] per 100,000 population, ages 3 months to 17 years | [a] Consistent with the AHRQ PDI software, gastroenteritis must be the principal diagnosis or a secondary diagnosis with a principal diagnosis of dehydration. Exclusions include admissions with gastrointestinal abnormalities or bacterial gastroenteritis, transfers from other institutions, neonates if age in days is missing, and obstetric admissions. |
| PDI 17 | Admissions with perforations or abscesses of appendix per 1,000 admissions with appendicitis,[a] ages 1-17 | [a] Consistent with the AHRQ PDI software, exclusions include transfers from other institutions and obstetric admissions. |
| PDI 18 | Admissions for urinary tract infection (UTI)[a] per 100,000 population, ages 3 months to 17 years | [a] Consistent with the AHRQ PDI software, UTI must be the principal diagnosis and the following cases are excluded: kidney or urinary tract disorders, admissions in a immunocompromised state, admissions with hepatic failure consisting of any diagnosis or cirrhosis and hepatic come or hepatorenal syndrome, neonates is age in days is missing, obstetric admissions, and transfers from other institutions. |
| PDI 90 | AHRQ overall Pediatric Quality Indicator (PDI) composite[a] per 100,000 population, ages 6-17 | [a] Consistent with the AHRQ PDI software, the overall composite is based on the four PDIs for asthma, diabetes, gastroenteritis, and urinary tract infection. |

| QI No. | Description | Footnote |
|---|---|---|
| PDI 91 | AHRQ acute Pediatric Quality Indicator (PDI) composite[a] per 100,000 population, ages 6-17 | [a] Consistent with the AHRQ PDI software, the acute composite is based on the two PDIs for gastroenteritis and urinary tract infection. |
| PDI 92 | AHRQ chronic Pediatric Quality Indicator (PQI) composite[a] per 100,000 population, ages 6-17 | [a] Consistent with the AHRQ PDI software, the chronic composite is based on the two PDIs for asthma and diabetes. |
| NQI 01 | Admissions with iatrogenic pneumothorax per 1,000 medical and surgical admissions,[a] neonates weighing 500 to 2500 grams | [a] The AHRQ PDI software requires that the iatrogenic pneumothorax be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PDI software, the following cases are excluded: neonates with a birth weight less than 500 grams, admissions with chest trauma, pleural effusion, thoracic surgery, lung/pleural biopsy, diaphragmatic surgery repair, or cardiac surgery, and obstetric admissions. |
| NQI 02 | Deaths per 1,000 newborn admissions[a] | [a] Consistent with the AHRQ PDI software, newborn admissions include babies born outside the hospital and then admitted. Exclusions include newborns weighing less than 500 grams or with any diagnosis of anencephaly, polycystic kidney, trisomy 13, or trisomy 18. |
| NQI 03 | Admissions with blood stream infection per 1,000 medical and surgical discharges of length 2 or more days, newborns[a] | [a] The AHRQ PDI software requires that the blood stream infection be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PDI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PDI software, newborn admissions include babies born outside the hospital and then admitted; infants with a birth weight of 500 to 1499 grams or with gestational age between 24 and 30 weeks; and newborns with a birth weight greater than or equal to 1500 grams, only if the infant experienced death in-hospital, major surgery, mechanical ventilation, or transferred to an acute care facility. Exclusions include newborns weighing less than 500 grams, cases with a principal diagnosis of sepsis or infection or with a length of stay less than 2 days. |
| **Inpatient Quality Indicators[9]** | | |
| IQI 8 | Deaths per 1,000 hospital admissions with esophageal resection for cancer,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions and transfers to another hospital. |
| IQI 9 | Deaths per 1,000 hospital admissions with pancreatic resection for cancer,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions and transfers to another hospital. |
| IQI 11 | Deaths per 1,000 hospital admissions with abdominal aortic aneurysm repair,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, excluding obstetric admissions and transfers to another hospital. |
| IQI 12 | Deaths per 1,000 hospital admissions with coronary artery bypass graft,[a] age 40 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions and transfers to another hospital. |
| IQI 13 | Deaths per 1,000 hospital admissions with craniotomy,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include admissions with a principal diagnosis of head trauma and transfers to another hospital. |
| IQI 14 | Deaths per 1,000 hospital admissions with a hip replacement procedure,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include hip fractures, obstetric admissions, and transfers to another hospital. |

[9] Indicator IQI 10 is not assigned by the IQI software, version 4. Volume measures IQI 1 to 7 are not calculated.

| QI No. | Description | Footnote |
|---|---|---|
| IQI 15 | Deaths per 1,000 hospital admissions with acute myocardial infarction (AMI),[a] age 18 and over | [a] Consistent with the AHRQ IQI software, AMI must be the principal diagnosis and the following cases are excluded: obstetric admissions and transfers to another hospital. |
| IQI 16 | Deaths per 1,000 hospital admissions with congestive heart failure (CHF),[a] age 18 and over | [a] Consistent with the AHRQ IQI software, CHF must be the principal diagnosis and the following cases are excluded: obstetric admissions and transfers to another hospital. |
| IQI 17 | Deaths per 1,000 hospital admissions with acute stroke,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, stroke must be the principal diagnosis and the following cases are excluded: obstetric admissions and transfers to another hospital. |
| IQI 18 | Deaths per 1,000 hospital admissions with gastrointestinal hemorrhage,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, gastrointestinal hemorrhage must be the principal diagnosis and the following cases are excluded: obstetric admissions and transfers to another hospital. |
| IQI 19 | Deaths per 1,000 hospital admissions with hip fracture,[a] age 65 and over | [a] Consistent with the AHRQ IQI software, hip fracture must be the principal diagnosis and the following cases are excluded: periprosthetic fractures, obstetric admissions, and transfers to another hospital. |
| IQI 20 | Deaths per 1,000 hospital admissions with pneumonia,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, pneumonia must be the principal diagnosis and the following cases are excluded: obstetric admissions and transfers to another hospital. |
| IQI 21 | Cesarean deliveries per 1,000 deliveries[a] | [a] Consistent with the AHRQ IQI software, exclusions include deliveries for preterm or multiple infants, deliveries with abnormal presentations or breech procedures, and deliveries resulting in fetal death. |
| IQI 22 | Vaginal birth after cesarean (VBAC) per 1,000 women with previous cesarean deliveries[a] | [a] Consistent with the AHRQ IQI software, exclusions include deliveries for preterm or multiple infants, deliveries with abnormal presentations or breech procedures, and deliveries resulting in fetal death. |
| IQI 23 | Laparoscopic cholecystectomies per 1,000 cholecystectomy procedures,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions. |
| IQI 24 | Incidental appendectomies per 1,000 hospital admissions with abdominal or pelvic surgery,[a] age 65 and over | [a] Consistent with the AHRQ IQI software, exclusions include admissions for cancer involving or adjacent to the appendix, admissions with a colectomy or pelvic evisceration, and obstetric admissions. |
| IQI 25 | Bilateral cardiac catheterizations per 1,000 heart catheterizations for coronary artery disease,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include valid indications for right-side catheterization and obstetric admissions. |
| IQI 26 | Coronary artery bypass grafts (CABG)[a] per 100,000 population, age 40 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions. |
| IQI 27 | Percutaneous coronary intervention[a] per 100,000 population, age 40 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions. |
| IQI 28 | Hysterectomies[a] per 100,000 female population, age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include admissions with genital cancer, pelvic or lower-abdominal trauma, and obstetric admissions. |
| IQI 29 | Laminectomies or spinal fusions[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions. |
| IQI 30 | Deaths per 1,000 hospital admissions with percutaneous coronary intervention,[a] age 40 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions and transfers to another hospital. |
| IQI 31 | Deaths per 1,000 hospital admissions with carotid endarterectomy,[a] age 18 and over | [a] Consistent with the AHRQ IQI software, exclusions include obstetric admissions and transfers to another hospital. |

| QI No. | Description | Footnote |
|---|---|---|
| IQI 32 | Deaths per 1,000 hospital admissions with acute myocardial infarction (AMI),[a] age 18 and over | [a] Consistent with the AHRQ IQI software, AMI must be the principal diagnosis and the following cases are excluded: obstetric admissions and transfers to and from another hospital. |
| IQI 33 | First-time cesarean deliveries (identified by no previous cesarean delivery diagnosis on the record) per 1,000 deliveries[a] | [a] Consistent with the AHRQ IQI software, exclusions include previous cesarean delivery, deliveries for preterm or multiple infants, deliveries with abnormal presentations or breech procedures, and deliveries resulting in fetal death. |
| IQI 34 | Vaginal birth after cesarean per 1,000 women with previous cesarean deliveries[a] | [a] Consistent with the AHRQ IQI software, there are no exclusions. |
| IQI 90 | AHRQ Inpatient Quality Indicator (IQI) mortality composite for selected procedures,[a] age 18 and over | [a] Based on seven mortality AHRQ IQIs for esophageal resection for cancer, pancreatic resection for cancer, abdominal aortic aneurysm repair, coronary artery bypass graft (age 40 and over), craniotomy, percutaneous coronary intervention (age 40 and over), and carotid endarterectomy. |
| IQI 91 | AHRQ Inpatient Quality Indicator (IQI) mortality composite for selected conditions,[a] age 18 and over | [a] Based on the six mortality AHRQ IQIs for acute myocardial infarction, congestive heart failure, acute stroke, gastrointestinal hemorrhage, hip fracture (age 65 and over), and pneumonia. |
| **Patient Safety Indicators[10]** | | |
| PSI 2 | Deaths per 1,000 hospital admissions with expected low-mortality,[a] age 18 and over or obstetric admissions | [a] Consistent with the AHRQ PSI software, admissions with expected low-mortality are identified by Medicare Severity Diagnosis Related Group (MS-DRG) or Diagnosis Related Group (DRG), depending on the date of discharge. Exclusions include admissions with cancer, admissions in an immunocompromised state, admissions involving a traumatic injury, and transfers to an acute care facility. |
| PSI 4 | Deaths per 1,000 elective-surgery admissions having developed specified complications of care during hospitalization,[a] ages 18-89 or obstetric admissions | [a] Consistent with the AHRQ PSI software, complications of care include acute renal failure, pneumonia, pulmonary embolism, deep vein thrombosis, sepsis, shock, cardiac arrest, gastroentestinal hemorrhage, and acute ulcer with transfers to another hospital excluded. The AHRQ PSI software requires that the complication be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. In addition, the surgery is not verifiable as occurring in the first two days of the inpatient stay. |
| PSI 6 | Admissions with iatrogenic pneumothorax per 1,000 medical and surgical admissions,[a] age 18 and over | [a] The AHRQ PSI software requires that the iatrogenic pneumothorax be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric admissions and admissions with chest trauma, pleural effusion, thoracic surgery, lung/pleural biopsy, diaphragmatic surgery repair, and cardiac surgery. |

[10] Indicators PSI 1 and 20 are not assigned by the PSI software, version 4. Incidence measures PSI 3 (pressure ulcer), PSI 5 (foreign body), and PSI 16 (transfusion reaction) are not calculated.

| QI No. | Description | Footnote |
|---|---|---|
| PSI 7 | Admissions with central venous catheter-related bloodstream infection per 1,000 medical and surgical discharges of length 2 or more days,[a] age 18 and over or obstetric admissions | [a] The AHRQ PSI software requires that the central venous catheter-related bloodstream infection be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PSI software, the following cases are excluded: admissions with a diagnosis of cancer or in an immunocompromised state. |
| PSI 8 | Postoperative hip fracture per 1,000 surgical admissions who were not susceptible to falling,[a] age 18 and over | [a] The AHRQ PSI software requires that the hip fracture be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. In addition, the hip fracture repair is not verifiable as following surgery. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric cases; admissions for seizure, syncope, stroke, coma, cardiac arrest, poisoning, trauma, delirium and other psychoses, anoxic brain injury, metastatic cancer, lymphoid/bone malignancy malignancy, or self-inflicted injury; admissions for diseases and disorders of the musculoskeletal system and connective tissue; and admissions in which hip fracture repair is the only operating room procedure. |
| PSI 9 | Postoperative hemorrhage or hematoma with surgical drainage or evacuation per 1,000 surgical admissions,[a] age 18 and over | [a] The AHRQ PSI software requires that the hemorrhage or hematoma complicating procedure be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. In addition, the control of the hemorrhage or hematoma is not verifiable as following surgery. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric conditions and admissions in which the control of the hemorrhage or hematoma is the only operating room procedure. |
| PSI 10 | Postoperative physiologic and metabolic derangements per 1,000 elective-surgery admissions,[a] age 18 and over | [a] The AHRQ PSI software requires that the physiologic and metabolic derangements be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. In addition, the derangement is not verifiable as following surgery. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric admissions and admissions for ketoacidosis, hyperosmolarity, and diabetic coma; admissions with acute renal failure, acute myocardial infarction, cardiac arrhythmia, cardiac arrest, shock, hemorrhage, gastrointestinal hemorrhage, or chronic renal failure. |
| PSI 11 | Postoperative respiratory failure per 1,000 elective-surgery admissions,[a] age 18 and over | [a] The AHRQ PSI software requires that the respiratory failure be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. In addition, the tracheostomy is not verifiable as following surgery. Consistent with the AHRQ PSI software, the following cases are excluded: admissions with respiratory disease, circulatory disease, craniofacial anomalies, neuromuscular disorders, or degenerative neurological disorder; obstetric admissions; admissions in which the tracheostomy is the only operating room procedure; and admissions with a procedure for esophageal resection, lung cancer, or the nose, mouth, and pharynx. |

| QI No. | Description | Footnote |
|---|---|---|
| PSI 12 | Postoperative pulmonary embolism (PE) or deep vein thrombosis (DVT) per 1,000 surgical admissions,[a] age 18 and over | [a] The AHRQ PSI software requires that the PE or DVT be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. The detection of the PE or DVT did not count procedures to unspecified sites. In addition, the interruption of vena cava is not verifiable as following surgery. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric conditions and admissions in which the interruption of vena cava is the only operating room procedure. |
| PSI 13 | Postoperative sepsis per 1,000 elective-surgery admissions of length 4 or more days,[a] age 18 and over | [a] The AHRQ PSI software requires that the sepsis be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. In addition, the sepsis is not verifiable as following surgery. Consistent with the AHRQ PSI software, the following cases are excluded: admissions with a principal diagnosis of sepsis or infection, admissions with cancer or in an immunocompromised state; and obstetric admissions. |
| PSI 14 | Reclosure of postoperative abdominal wound dehiscence per 1,000 abdominopelvic-surgery admissions of length 2 or more days,[a] age 18 and over | [a] Reclosure of abdominal wound dehiscence is not verifiable as following surgery and may have occurred on or before the abdominopelvic procedure. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric admissions and admissions in an immunocompromised state. |
| PSI 15 | Accidental puncture or laceration during procedure per 1,000 medical and surgical admissions,[a] age 18 and over | [a] The AHRQ PSI software requires that the accidental puncture or laceration be reported as a secondary diagnosis (rather than the principal diagnosis), but unlike the AHRQ PSI software, the secondary diagnosis could be present on admission. Consistent with the AHRQ PSI software, the following cases are excluded: obstetric admissions and admissions involving spinal surgery. |
| PSI 17 | Birth trauma - injury to neonate per 1,000 live births[a] | [a] Consistent with the AHRQ PSI software, exclusions include newborns weighing less than 2000 grams and newborns with injury to brachial plexus or with osteogenesis imperfecta. |
| PSI 18 | Obstetric trauma[a] per 1,000 instrument-assisted vaginal deliveries | [a] Consistent with the AHRQ PSI software, obstetric trauma must involve 3rd or 4th degree lacerations. |
| PSI 19 | Obstetric trauma[a] per 1,000 vaginal deliveries without instrument assistance | [a] Consistent with the AHRQ PSI software, obstetric trauma must involve 3rd or 4th degree lacerations. |
| PSI 21 | Admissions for foreign body accidentally left in during procedure[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PSI software, admissions are identified using all diagnosis, including those present on admission. |
| PSI 22 | Admissions for iatrogenic pneumothorax[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PSI software, admissions are identified using all diagnosis, including those present on admission. Exclusions include obstetric admissions and admissions with chest trauma, pleural effusion, thoracic surgery, lung/pleural biopsy, diaphragmatic surgery repair, or cardiac surgery. |
| PSI 23 | Admissions for central venous catheter-related bloodstream infections[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PSI software, admissions are identified using all diagnosis, including those present on admission. Exclusions include admissions with a diagnosis of cancer or in an immunocompromised state. |

| QI No. | Description | Footnote |
|---|---|---|
| PSI 24 | Admissions for reclosure of abdominal wound dehiscence[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PSI software, admissions are identified using all procedures. Exclusions include obstetric admissions and admissions in an immunocompromised state. |
| PSI 25 | Admissions for accidental puncture or laceration during procedure[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PSI software, admissions are identified using all diagnosis, including those present on admission. Exclusions include obstetric admissions and admissions involving spinal surgery. |
| PSI 26 | Admissions for transfusion reactions[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PSI software, admissions are identified using all procedures. |
| PSI 27 | Admissions for postoperative hemorrhage or hematoma[a] per 100,000 population, age 18 and over | [a] Consistent with the AHRQ PSI software, admissions are identified using all procedures. Exclusions include obstetric admissions. |
| PSI 90 | AHRQ Patient Safety Indicator (PSI) composite,[a] age 18 and over | [a] The AHRQ PSI composite has been modified to include the seven PSIs for iatrogenic pneumothorax, central venous catheter-related bloodstream infection, postoperative hip fracture, postoperative pulmonary embolism/deep vein thrombosis, postoperative sepsis, reclosure of postoperative abdominal wound dehiscence, and accidental puncture or laceration. The AHRQ PSI for pressure ulcers is excluded. |

**Table 2. Sources of 2012 HCUP Inpatient Data for the QDR**

Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP is a family of databases, software tools, and products developed through the collaboration of State data organizations, hospital associations, private data organizations, and the Federal government.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

| Data Sources for the HCUP State Inpatient Databases | Also included in the disparities analysis files |
|---|---|
| **Alaska** State Hospital and Nursing Home Association | Yes |
| **Arizona** Department of Health Services | Yes |
| **Arkansas** Department of Health | Yes |
| **California** Office of Statewide Health Planning and Development | Yes |
| **Colorado** Hospital Association | Yes |
| **Connecticut** Hospital Association | Yes |
| **Florida** Agency for Health Care Administration | Yes |
| **Georgia** Hospital Association | Yes |
| **Hawaii** Health Information Corporation | Yes |
| **Illinois** Department of Public Health | Yes |
| **Indiana** Hospital Association | Yes |
| **Iowa** Hospital Association | Yes |
| **Kansas** Hospital Association | Yes |
| **Kentucky** Cabinet for Health and Family Services | Yes |
| **Louisiana** Department of Health and Hospitals | --- |
| **Maine** Health Data Organization | * |
| **Maryland** Health Services Cost Review Commission | Yes |
| **Massachusetts** Center for Health Information and Analysis | Yes |
| **Michigan** Health & Hospital Association | Yes |
| **Minnesota** Hospital Association | --- |
| **Mississippi** Department of Health | ** |
| **Missouri** Hospital Industry Data Institute | Yes |
| **Montana MHA** – An Association of Montana Health Care Providers | --- |
| **Nebraska** Hospital Association | --- |
| **Nevada** Department of Health and Human Services | Yes |
| **New Hampshire** Department of Health & Human Services | ** |
| **New Jersey** Department of Health | Yes |
| **New Mexico** Department of Health | Yes |
| **New York** State Department of Health | Yes |
| **North Carolina** Department of Health and Human Services | Yes |

| Data Sources for the HCUP State Inpatient Databases | Also included in the disparities analysis files |
|---|---|
| **North Dakota** (data provided by the Minnesota Hospital Association) | --- |
| **Ohio** Hospital Association | Yes |
| **Oklahoma** State Department of Health | Yes |
| **Oregon** Association of Hospitals and Health Systems | Yes |
| **Pennsylvania** Health Care Cost Containment Council | Yes |
| **Rhode Island** Department of Health | Yes |
| **South Carolina** Revenue and Fiscal Affairs Office | Yes |
| **South Dakota** Association of Healthcare Organizations | Yes |
| **Tennessee** Hospital Association | Yes |
| **Texas** Department of State Health Services | Yes |
| **Utah** Department of Health | Yes |
| **Vermont** Association of Hospitals and Health Systems | Yes |
| **Virginia** Health Information | Yes |
| **Washington** State Department of Health | Yes |
| **West Virginia** Health Care Authority | --- |
| **Wisconsin** Department of Health Services | Yes |
| **Wyoming** Hospital Association | Yes |

* Maine was included in the 2012 State-level disparities analysis files. Maine data was not available in time to be included in the 2012 national disparities analysis file.
** Mississippi and New Hampshire data were not available in time to be included in the 2014 QDR.

**Table 3. Age Groupings for Risk Adjustment**

This table 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 are constructed from the 18 age categories split into 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 |

**Table 4. Use of Secondary Procedure Days in AHRQ Quality Indicators, Version 4.4**

Seven PSIs and three PDIs used information on the timing of procedures (PRDAY) to exclude patients:

- PSI 8 – Post-operative hip fractures
- PSI 9 – Post-operative hemorrhage or hematoma
- PSI 10 – Post-operative physiologic/metabolic derangements
- PSI 11 – Post-operative respiratory failure
- PSI 12 – Post-operative pulmonary embolism or deep vein thrombosis
- PSI 14 – Post-operative abdominal wound dehiscence
- PSI 27 – Post-operative hemorrhage or hematoma (area based)

- PDI 8 – Pediatric: Post-operative hemorrhage or hematoma
- PDI 9 – Pediatric: Post-operative respiratory failure
- PDI 11 – Pediatric: Post-operative wound dehiscence

**Table 5. Use of Present on Admission in AHRQ Quality Indicators, Version 4.4**

Among the AHRQ QIs generated for the QDR, 10 PSIs and 9 PDIs used information on whether a condition was present on admission (POA) to exclude patients:

- PSI 6 Iatrogenix Pneumothorax
- PSI 7 Central Venous Catheter-Related Bloodstream Infection
- PSI 8 Postoperative Hip Fracture
- PSI 9 Postoperative Hemorrhage or Hematoma
- PSI 10 Postoperative Physiologic and Metabolic Derangements
- PSI 11 Postoperative Respiratory Failure
- PSI 12 Postoperative Pulmonary Embolism or Deep Vein Thrombosis
- PSI 13 Postoperative Sepsis
- PSI 14 Postoperative Abdominal Wound Dehiscence (Provider-based)
- PSI 15 Accidental Puncture or Laceration (Provider-based)

- PDI 1 Pediatric: Accidental Puncture or Laceration
- PDI 5 Pediatric: Iatrogenic Pneumothorax
- PDI 8 Pediatric: Postoperative Hemorrhage or Hematoma
- PDI 9 Pediatric: Postoperative Respiratory Failure
- PDI 10 Pediatric: Postoperative Sepsis
- PDI 11 Pediatric: Postoperative Abdominal Wound Dehiscence
- PDI 12 Pediatric: Central Venous Catheter-Related Bloodstream Infection
- NQI 01 Neonatal Iatrogenic Pneumothorax
- NQI 03 Neonatal Central Venous Catheter-Related Bloodstream Infection

**Table 6. Number of Diagnosis and Procedure Fields by State, 2012**

| State | Maximum Number of Diagnoses | Maximum Number of Procedures |
|---|---|---|
| Alaska | 30 | 20 |
| Arkansas | 18 | 8 |
| Arizona | 25 | 12 |
| California | 25 | 21 |
| Colorado | 30 | 30 |
| Connecticut | 30 | 30 |
| Florida | 31 | 31 |
| Georgia | 30 | 30 |
| Hawaii | 20 | 20 |
| Illinois | 25 | 25 |
| Indiana | 60 | 25 |
| Iowa | 60 | 26 |
| Kansas | 30 | 25 |
| Kentucky | 25 | 25 |
| Louisiana | 10 | 8 |
| Maine | 11 | 6 |
| Maryland | 30 | 15 |
| Massachusetts | 15 | 15 |
| Michigan | 30 | 30 |
| Minnesota | 40 | 40 |
| Missouri | 30 | 25 |
| Montana | 25 | 25 |
| Nebraska | 9 | 6 |
| Nevada | 33 | 12 |
| New Jersey | 24 | 25 |
| New Mexico | 18 | 6 |
| New York | 25 | 15 |
| North Carolina | 25 | 20 |
| North Dakota | 40 | 25 |
| Ohio | 15 | 9 |
| Oklahoma | 16 | 16 |
| Oregon | 25 | 25 |
| Pennsylvania | 18 | 6 |
| Rhode Island | 25 | 25 |
| South Carolina | 15 | 13 |
| South Dakota | 88 | 63 |
| Tennessee | 18 | 6 |
| Texas | 25 | 15 |
| Utah | 9 | 6 |
| Vermont | 20 | 20 |
| Virginia | 18 | 6 |
| Washington | 25 | 25 |
| West Virginia | 18 | 6 |
| Wisconsin | 30 | 30 |
| Wyoming | 30 | 25 |

**Table 7. Use of E codes in the AHRQ Quality Indicators, Version 4.4**

| PSI or PDI * | 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 |
| PSI 21 | E8710 – E8719 | 9984, 9987 | None | None |
| PSI 8 | None | None | Self-inflicted injury (E95nn);<br>Poisoning (E85nn, E86nn, E951n, E952n, E962nn, E980n-E982n) | 9600-9799 |
| PSI 15<br>PSI 25<br>PDI 1 | E870n | 9982 | None | None |
| PSI 26 | E8760 | 9996-9997 | None | None |

* All other PSIs and PDIs do not use E codes.

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# APPENDICES

## APPENDIX A: DEVELOPMENT OF THE DISPARITIES ANALYSIS FILE FOR NATIONAL QI ESTIMATES BY RACE/ETHNICITY

Race and ethnicity measures can be problematic in hospital discharge databases because many hospitals do not code race and ethnicity completely. Because race/ethnicity is a pivotal measure for the QDR, we explored the reporting practices in States that participate in the HCUP SID. A description of race/ethnicity reporting for both the 2011 and 2012 SID are presented in this appendix.

### HCUP Race Data

HCUP coding includes race and ethnicity in one data element (RACE). Because of variability in the collection of race and ethnicity information in the State data provided to HCUP, HCUP maintains a uniform set of categories based on race definitions used in the 1977 Office of Management and Budget (OMB) Directive 15 using the combined race-ethnicity format (separate categories for Hispanic and five Non-Hispanic racial groups – White, Black, Asian or Pacific Islander, American Indian or Alaska Native, and Other).

When a State and its hospitals collect Hispanic ethnicity *separately* from race, HCUP assigns the data to the combined race/ethnicity categorization and uses Hispanic ethnicity to override any other race category to create uniform coding across States.

There is also limited reporting of Native American (*American Indian/Alaska Native - AIAN*) in the HCUP data. Research literature suggests that AIAN is seriously underreported in hospital discharge data. In addition, in some areas of the country care for the AIAN population is provided in Indian Health Service (IHS) hospitals, which are not included in HCUP. For these reasons, American Indian/Alaska Native discharges were combined with “Other” races for the QDR analyses.

The resulting QDR reporting categories for the HCUP data include: White Non-Hispanic; African American Non-Hispanic; Asian/Pacific Islander Non-Hispanic; Other Non-Hispanic; and Hispanic (of any race).

### Availability of Race Data for the 2012 National Disparities Analysis File

In the 2012 HCUP data, 44 States participated in the HCUP SID. Three States did not provide information on patient race to HCUP. One State did not report Hispanic ethnicity. Two States report race and ethnicity, but are missing information on more than half the discharges. The remaining 38 States were used for the creation of the disparities analysis files (See Table 2 in the main body of the report for the list of States). Table A-1 demonstrates the representation by U.S. Census region of these 38 States.

**Table A-1. Geographic Representation of Disparities Analysis File, 2012**

| Census Region | Number of States used for the Disparities Analysis File | Number of States in the region | Percent of States in the region included in the Disparities Analysis File |
|---|---|---|---|
| Northeast | 7 | 9 | 78% |
| Midwest | 9 | 12 | 75% |
| South | 11 | 16 | 69% |
| West | 11 | 13 | 85% |
| Total | 38 | 50 | 76% |

Table A-2 compares aggregated totals of various measures for the 38 States as a percent of the national measure. In 2012, the 38 States accounted for 91 percent of U.S. hospital discharges (based on the American Hospital Association's Annual Survey). They accounted for about 89 percent of White and African Americans in the nation and 97 percent of Asian/Pacific Islanders and Hispanics (based on 2012 Nielsen data).

**Table A-2. Population Representation of Disparities Analysis File, 2012**

| Measure | Total of 38 HCUP States with race/ethnicity as a percent of national total |
|---|---|
| Hospital discharges | 91% |
| Total resident population | 91% |
| *Population by race/ethnicity:* | |
| White | 89%* |
| African American | 88%* |
| Asian/Pacific Islander | 96%* |
| Hispanic | 97%* |
| *Population by age:* | |
| Population under age 18 | 91%* |
| Population age 18-64 | 91%* |
| Population over age 64 | 90%* |
| *Population by income:* | |
| Population with income under the poverty level | 91.1** |

**Calculated using 2012 Nielsen Demographic Update data and 1977 OMB Directive 15 race definitions (e.g. no option for selecting "two or more races").*

***Calculated using Kaiser Family Foundation, statehealthfacts.org. Data Source: Urban Institute and Kaiser Commission on Medicaid and the Uninsured estimates based on the Census Bureau's March 2012 and 2013 Current Population Survey (CPS: Annual Social and Economic Supplements), accessed September 10, 2014.*

### Availability of Race Data for the 2011 National Disparities Analysis File

In the 2011 HCUP SID, 45 States participated in the HCUP SID. Six States did not provide information on patient race to HCUP. One State did not report Hispanic ethnicity. One State was omitted because the data did not arrive in time. The remaining 39 States were used for the creation of the disparities analysis files. Table A-3 demonstrates the representation by U.S. Census region of these 39 States.

**Table A-3. Geographic Representation of Disparities Analysis File, 2011**

| Census Region | Number of States used for the disparities analysis file | Number of States in the region | Percent of States in the region included in the disparities analysis file |
|---|---|---|---|
| Northeast | 8 | 9 | 89% |
| Midwest | 8 | 12 | 67% |
| South | 12 | 16 | 75% |
| West | 11 | 13 | 85% |
| Total | 39 | 50 | 78% |

Table A-4 compares aggregated totals of various measures for the 39 States as a percent of the national measure. In 2011, the 39 States accounted for 83 percent of U.S. hospital discharges (based on the American Hospital Association's Annual Survey). They accounted for about 84 percent of White and African Americans in the nation and 93 percent of Asian/Pacific Islanders and Hispanics (based on 2011 Nielsen data).

**Table A-4. Population Representation of Disparities Analysis File, 2011**

| Measure | Total of 39 HCUP States with race/ethnicity as a percent of national total |
|---|---|
| Hospital discharges | 83% |
| Total resident population | 86% |
| *Population by race/ethnicity:* | |
| White | 84%* |
| African American | 84%* |
| Asian/Pacific Islander | 91%* |
| Hispanic | 94%* |
| *Population by age:* | |
| Population under age 18 | 86%* |
| Population age 18-64 | 86%* |
| Population over age 64 | 85%* |
| *Population by income:* | |
| Population with income under the poverty level | 89.3%** |

**Calculated using 2011 Nielsen Demographic Update data and 1977 OMB Directive 15 race definitions (e.g. no option for selecting "two or more races").*

***Calculated using Kaiser Family Foundation, statehealthfacts.org. Data Source: Urban Institute and Kaiser Commission on Medicaid and the Uninsured estimates based on the Census Bureau's March 2011 and 2012 Current Population Survey (CPS: Annual Social and Economic Supplements), accessed on September 24, 2013.*

## Preparing the National Disparities Analysis Files

The sampling and weighting strategy used for the disparities analysis files for national estimates by race/ethnicity is similar to the method used to create the HCUP 2000-2011 NIS under the original design, except that the disparities analysis file draws its sample from the States that provide race/ethnicity data and is a 40-percent sample of community hospitals rather than a 20-percent sample as in the pre-2012 NIS.

For the 2012 disparities analysis file, the sample was drawn from 38 of the 44 States included in the 2012 SID. For the 2011 disparities analysis file, the sample was drawn from 39 of the 45 States included in the 2011 SID.

- First, community hospitals from the selected States with race/ethnicity data were sampled to approximate a 40-percent stratified sample of U.S. community hospitals. The sampling strata were defined based on five hospital characteristics: geographic region, hospital control (i.e., public, private not-for-profit, and proprietary), urbanized location, teaching status, and bed size.
- Hospitals were excluded from the sampling frame if the coding of patient race was suspect (i.e., more than 30% of the discharges in the hospital had the race reported as "other"; more than 50% of the discharges had no information on the race of the patient;

all of the discharges in the hospital had race coded as white, other, or missing; or 100% of the discharges had race coded as white and the hospital had more than 50 beds).

- For discharges missing race, a "hot deck" imputation method (which draws donors from strata of similar patients within the same hospital) is used to assign values while preserving the variance within the data.
- Once the 40-percent sample was drawn, discharge-level weights were developed to produce national-level estimates when applied to the disparities analysis file.

*The final 2012 disparities analysis file included about 14.4 million hospital discharges from nearly 2,000 hospitals.*

*The final 2011 disparities analysis file included about 15.4 million hospital discharges from more than 2,000 hospitals.*

The QDR also reports information derived from the 2001-2010 disparities analysis files for comparison. These additional data files were developed using the year-specific SID and the same approach described above. QI statistics for the back years were re-run using the version 4.4 software so that the same version of the QI software is used for all years in a given QDR release.

### Evaluating the Disparities Analysis Files

After creating the disparities analysis file using the above steps, we evaluated the reliability of national estimates produced with these data by comparing its composition to the NIS.[11] The 2012 disparities analysis file was compared with the 2012 NIS (which was redesigned using a new sampling strategy). The 2011 disparities analysis file was compared with the 2011 NIS. The tables below contain the distribution of discharges in both files by key demographic and clinical data elements. Based on these analyses, the disparities analysis files appear to provide reliable national estimates when compared with the NIS.

**Weighted Frequencies for the 2012 Comparison**

| Stratum used to sample hospitals | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| Region | Frequency | Percent | Frequency | Percent |
| 1: Northeast | 7,313,256 | 20.2 | 6,981,645 | 19.1 |
| 2: Midwest | 6,828,616 | 18.9 | 8,238,220 | 22.6 |
| 3: South | 14,676,885 | 40.5 | 14,113,101 | 38.7 |
| 4: West | 7,391,517 | 20.4 | 7,151,880 | 19.6 |

[11] The disparities analysis files were compared to the HCUP NIS to assure that the databases are comparable.

| Age in years at admission | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| AGE | Frequency | Percent | Frequency | Percent |
| .: Missing | 20,900 | 0.1 | 10,190 | 0.0 |
| .A: Invalid | 30 | 0.0 | 35 | 0.0 |
| .C: Inconsistent | 5,444 | 0.0 | 6,480 | 0.0 |
| 0-17 | 5,804,820 | 16.0 | 5,755,617 | 15.8 |
| 18-44 | 8,876,094 | 24.5 | 8,996,393 | 24.7 |
| 45-64 | 8,860,892 | 24.5 | 9,011,427 | 24.7 |
| 65+ | 12,642,094 | 34.9 | 12,704,704 | 34.8 |

| Indicator of sex | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| FEMALE | Frequency | Percent | Frequency | Percent |
| .: Missing | 3,060 | 0.0 | 2,340 | 0.0 |
| .A: Invalid | 11 | 0.0 | 15 | 0.0 |
| .C: Inconsistent | 2,276 | 0.0 | 2,485 | 0.0 |
| 0: Male | 15,296,817 | 42.2 | 15,436,338 | 42.3 |
| 1: Female | 20,908,110 | 57.7 | 21,043,668 | 57.7 |

| Primary expected payer | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| PAY1 | Frequency | Percent | Frequency | Percent |
| .: Missing | 45,555 | 0.1 | 60,100 | 0.2 |
| .A: Invalid | 2,590 | 0.0 | 30,560 | 0.1 |
| 1: Medicare | 14,140,638 | 39.1 | 14,276,970 | 39.1 |
| 2: Medicaid | 7,623,532 | 21.1 | 7,620,265 | 20.9 |
| 3: Private Insurance | 11,039,731 | 30.5 | 11,171,409 | 30.6 |
| 4: Self-pay | 1,954,153 | 5.4 | 1,899,716 | 5.2 |
| 5: No Charge | 138,909 | 0.4 | 145,360 | 0.4 |
| 6: Other | 1,265,166 | 3.5 | 1,280,466 | 3.5 |

| Patient race/ethnicity[12] | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| RACE | Frequency | Percent | Frequency | Percent |
| .: Missing | 526,508 | 1.5 | 2,090,888 | 5.7 |
| .A: Invalid | 429 | 0.0 | 1,470 | 0.0 |
| 1: White | 23,646,458 | 65.3 | 22,759,225 | 62.4 |
| 2: Black | 5,262,637 | 14.5 | 5,073,490 | 13.9 |
| 3: Hispanic | 4,512,097 | 12.5 | 4,076,682 | 11.2 |
| 4: Asian/Pacific Islander | 918,447 | 2.5 | 933,061 | 2.6 |
| 5: Native American | 310,877 | 0.9 | 251,130 | 0.7 |
| 6: Other | 1,032,821 | 2.9 | 1,298,900 | 3.6 |

| Location of patient residence | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| PL_NCHS | Frequency | Percent | Frequency | Percent |
| .: Missing | 0 | 0.0 | 148,450 | 0.4 |
| 1: Large central metro | 10,660,925 | 29.4 | 10,633,794 | 29.1 |
| 2: Large fringe metro | 9,016,171 | 24.9 | 8,638,919 | 23.7 |
| 3: Medium metro | 6,789,946 | 18.8 | 7,062,671 | 19.4 |
| 4: Small metro | 3,442,518 | 9.5 | 3,417,024 | 9.4 |
| 5: Micropolitan (nonmetro) | 3,785,039 | 10.5 | 3,934,398 | 10.8 |
| 6: Noncore (nonmetro) | 2,515,675 | 6.9 | 2,649,590 | 7.3 |

[12] Differences in race distribution are attributable to higher rates of missing race on the 2012 NIS (6%). The 2012 Disparities Analysis File uses a modified race variable with missing or invalid values imputed and Native American and Other combined into one racial group.

| Top 25 MS-DRGs (Combination of Top 25 MS-DRGs for Disparities and NIS file) | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| MS-DRG, Version 30 | Frequency | Percent | Frequency | Percent |
| 795: NORMAL NEWBORN | 2,710,451 | 7.5 | 2,681,316 | 7.3 |
| 775: VAGINAL DELIVERY W/O COMPLICATING DIAGNOSES | 2,097,204 | 5.8 | 2,095,400 | 5.7 |
| 885: PSYCHOSES | 1,044,097 | 2.9 | 1,120,870 | 3.1 |
| 470: MAJOR JOINT REPLACEMENT OR REATTACHMENT OF LOWER EXTREMITY W/O MCC | 936,911 | 2.6 | 970,744 | 2.7 |
| 766: CESAREAN SECTION W/O CC/MCC | 809,154 | 2.2 | 787,350 | 2.2 |
| 392: ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS W/O MCC | 799,260 | 2.2 | 791,880 | 2.2 |
| 871: SEPTICEMIA W/O MV 96+ HOURS W MCC | 649,266 | 1.8 | 641,840 | 1.8 |
| 794: NEONATE W OTHER SIGNIFICANT PROBLEMS | 646,351 | 1.8 | 658,205 | 1.8 |
| 603: CELLULITIS W/O MCC | 497,857 | 1.4 | 502,960 | 1.4 |
| 765: CESAREAN SECTION W CC/MCC | 459,618 | 1.3 | 467,155 | 1.3 |
| 690: KIDNEY & URINARY TRACT INFECTIONS W/O MCC | 427,772 | 1.2 | 429,865 | 1.2 |
| 194: SIMPLE PNEUMONIA & PLEURISY W CC | 419,081 | 1.2 | 421,150 | 1.2 |
| 313: CHEST PAIN | 383,889 | 1.1 | 371,280 | 1.0 |
| 292: HEART FAILURE & SHOCK W CC | 364,533 | 1.0 | 370,720 | 1.0 |
| 641: NUTRITIONAL & MISC METABOLIC DISORDERS W/O MCC | 346,746 | 1.0 | 349,060 | 1.0 |
| 774: VAGINAL DELIVERY W COMPLICATING DIAGNOSES | 331,071 | 0.9 | 337,700 | 0.9 |
| 945: REHABILITATION W CC/MCC | 312,670 | 0.9 | 311,620 | 0.9 |
| 291: HEART FAILURE & SHOCK W MCC | 301,433 | 0.8 | 298,270 | 0.8 |
| 683: RENAL FAILURE W CC | 296,495 | 0.8 | 296,685 | 0.8 |
| 897: ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O REHABILITATION THERAPY W/O MCC | 291,511 | 0.8 | 310,675 | 0.9 |
| 872: SEPTICEMIA OR SEVERE SEPSIS W/O MV 96+ HOURS W/O MCC | 282,774 | 0.8 | 284,240 | 0.8 |
| 247: PERC CARDIOVASC PROC W DRUG-ELUTING STENT W/O MCC | 280,256 | 0.8 | 295,220 | 0.8 |
| 203: BRONCHITIS & ASTHMA WITHOUT CC/MCC | 279,083 | 0.8 | 265,755 | 0.7 |
| 287: CIRCULATORY DISORDERS EXCEPT AMI, W CARD CATH W/O MCC | 275,026 | 0.8 | 280,495 | 0.8 |
| 378: GI HEMORRHAGE WITH CC | 266,010 | 0.7 | 273,520 | 0.7 |

| Median income of Patient's ZIP Code | | | | |
|---|---|---|---|---|
| | 2012 Disparities Analysis File | | 2012 NIS | |
| ZIPINC_QRTL | Frequency | Percent | Frequency | Percent |
| .: Missing | 876,705 | 2.4 | 809,621 | 2.2 |
| A: Invalid | 1,481 | 0.0 | 2,950 | 0.0 |
| 1: First Quartile (lowest income) | 10,768,811 | 29.7 | 10,946,024 | 30.0 |
| 2: Second Quartile | 8,750,472 | 24.2 | 8,879,566 | 24.3 |
| 3: Third Quartile | 8,161,850 | 22.5 | 8,426,639 | 23.1 |
| 4: Fourth Quartile (highest income) | 7,650,953 | 21.1 | 7,420,046 | 20.3 |

## Weighted Means for the 2012 Comparison

| | 2012 Disparities Analysis File | | | 2012 NIS | | |
|---|---|---|---|---|---|---|
| Variable / Label | Minimum | Maximum | Mean | Minimum | Maximum | Mean |
| LOS: Length of stay (cleaned) | 0 | 365 | 4.6 | 0 | 365 | 4.5 |
| NDX: Number of diagnoses on this record | 0 | 75 | 8.9 | 0 | 74 | 9.0 |
| NPR: Number of procedures on this record | 0 | 50 | 1.6 | 0 | 50 | 1.6 |
| TOTCHG: Total charges (cleaned) | $ 101 | $4,984,151 | $37,584 | $100 | $4,956,982 | $36,704 |

## Weighted Frequencies for the 2011 Comparison

| Stratum used to sample hospitals | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| Region | Frequency | Percent | Frequency | Percent |
| 1: Northeast | 7,528,258 | 19.5% | 7,528,258 | 19.5% |
| 2: Midwest | 8,768,800 | 22.7% | 8,768,800 | 22.7% |
| 3: South | 14,802,929 | 38.4% | 14,802,929 | 38.4% |
| 4: West | 7,490,746 | 19.4% | 7,490,746 | 19.4% |

| Age in years at admission | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| AGE | Frequency | Percent | Frequency | Percent |
| .: Missing | 305 | 0.0% | 25,435 | 0.1% |
| .A: Invalid | 36 | 0.0% | 36 | 0.0% |
| .C: Inconsistent | 5,995 | 0.0% | 4,511 | 0.0% |
| 0-17 | 6,071,971 | 15.7% | 5,664,404 | 14.7% |
| 18-44 | 9,408,109 | 24.4% | 9,385,257 | 24.3% |
| 45-64 | 9,559,746 | 24.8% | 9,694,504 | 25.1% |
| 65+ | 13,544,572 | 35.1% | 13,816,586 | 35.8% |

| Indicator of sex | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| FEMALE | Frequency | Percent | Frequency | Percent |
| .: Missing | 2,090 | 0.0% | 70,252 | 0.2% |
| .A: Invalid | 12 | 0.0% | 17 | 0.0% |
| .C: Inconsistent | 1,290 | 0.0% | 4,322 | 0.0% |
| 0: Male | 16,282,014 | 42.2% | 16,182,138 | 41.9% |
| 1: Female | 22,305,327 | 57.8% | 22,334,004 | 57.9% |

| Primary expected payer | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| PAY1 | Frequency | Percent | Frequency | Percent |
| .: Missing | 81,553 | 0.2% | 88,930 | 0.2% |
| .A: Invalid | 13,308 | 0.0% | 20,812 | 0.1% |
| 1: Medicare | 15,044,141 | 39.0% | 15,336,984 | 39.7% |
| 2: Medicaid | 7,978,919 | 20.7% | 7,577,744 | 19.6% |
| 3: Private Insurance | 12,090,111 | 31.3% | 12,231,289 | 31.7% |
| 4: Self-pay | 1,957,004 | 5.1% | 1,883,285 | 4.9% |
| 5: No Charge | 180,487 | 0.5% | 184,992 | 0.5% |
| 6: Other | 1,245,210 | 3.2% | 1,266,698 | 3.3% |

| Patient race/ethnicity[13] | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| RACE | Frequency | Percent | Frequency | Percent |
| .: Missing | 528,519 | 1.4% | 3,827,017 | 9.9% |
| .A: Invalid | 470 | 0.0% | 925 | 0.0% |
| 1: White | 25,448,732 | 65.9% | 22,959,229 | 59.5% |
| 2: Black | 5,607,152 | 14.5% | 5,295,653 | 13.7% |
| 3: Hispanic | 4,647,651 | 12.0% | 4,282,784 | 11.1% |
| 4: Asian/Pacific Islander | 956,047 | 2.5% | 827,799 | 2.1% |
| 5: Native American | 283,612 | 0.7% | 213,525 | 0.6% |
| 6: Other | 1,118,550 | 2.9% | 1,183,800 | 3.1% |

| Location of patient residence | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| PL_NCHS | Frequency | Percent | Frequency | Percent |
| .: Missing | 0 | 0.0% | 1,046,757 | 2.7% |
| 1: Large central metro | 11,515,462 | 29.8% | 12,077,467 | 31.3% |
| 2: Large fringe metro | 9,054,598 | 23.5% | 9,509,192 | 24.6% |
| 3: Medium metro | 7,239,474 | 18.8% | 6,424,475 | 16.6% |
| 4: Small metro | 3,727,770 | 9.7% | 3,610,764 | 9.4% |
| 5: Micropolitan (nonmetro) | 4,167,329 | 10.8% | 4,065,222 | 10.5% |
| 6: Noncore (nonmetro) | 2,886,100 | 7.5% | 2,903,613 | 7.5% |

[13] Differences in race distribution are attributable to high rates of missing race on the 2011 NIS (10%). The 2011 disparities analysis file uses a modified race variable with missing or invalid values imputed and Native American and Other combined into one racial group.

| Top 25 MS-DRGs (Combination of Top 25 MS-DRGs for Disparities and NIS file) | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| MS-DRG, Version 29 | Frequency | Percent | Frequency | Percent |
| 795: NORMAL NEWBORN | 2,820,962 | 7.3% | 2,712,017 | 7.0% |
| 775: VAGINAL DELIVERY W/O COMPLICATING DIAGNOSES | 2,178,650 | 5.6 | 2,121,790 | 5.5 |
| 885: PSYCHOSES | 1,097,603 | 2.8 | 1,173,518 | 3.0 |
| 470: MAJOR JOINT REPLACEMENT OR REATTACHMENT OF LOWER EXTREMITY W/O MCC | 982,191 | 2.5 | 975,333 | 2.5 |
| 392: ESOPHAGITIS, GASTROENT & MISC DIGEST DISORDERS W/O MCC | 871,846 | 2.3 | 876,576 | 2.3 |
| 766: CESAREAN SECTION W/O CC/MCC | 839,135 | 2.2 | 805,396 | 2.1 |
| 794: NEONATE W OTHER SIGNIFICANT PROBLEMS | 653,604 | 1.7 | 653,651 | 1.7 |
| 871: SEPTICEMIA W/O MV 96+ HOURS W MCC | 615,755 | 1.6 | 617,190 | 1.6 |
| 603: CELLULITIS W/O MCC | 534,398 | 1.4 | 527,546 | 1.4 |
| 765: CESAREAN SECTION W CC/MCC | 472,755 | 1.2 | 465,649 | 1.2 |
| 690: KIDNEY & URINARY TRACT INFECTIONS W/O MCC | 471,310 | 1.2 | 469,745 | 1.2 |
| 194: SIMPLE PNEUMONIA & PLEURISY W CC | 468,021 | 1.2 | 462,817 | 1.2 |
| 313: CHEST PAIN | 440,126 | 1.1 | 449,069 | 1.2 |
| 292: HEART FAILURE & SHOCK W CC | 403,078 | 1.0 | 407,035 | 1.1 |
| 641: NUTRITIONAL & MISC METABOLIC DISORDERS W/O MCC | 399,251 | 1.0 | 392,626 | 1.0 |
| 897: ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O REHABILITATION THERAPY W/O MCC | 336,772 | 0.9 | 332,715 | 0.9 |
| 774: VAGINAL DELIVERY W COMPLICATING DIAGNOSES | 336,429 | 0.9 | 334,438 | 0.9 |
| 247: PERC CARDIOVASC PROC W DRUG-ELUTING STENT W/O MCC | 313,852 | 0.8 | 298,253 | 0.8 |
| 945: REHABILITATION W CC/MCC | 313,724 | 0.8 | 316,304 | 0.8 |
| 291: HEART FAILURE & SHOCK W MCC | 313,636 | 0.8 | 316,229 | 0.8 |
| 287: CIRCULATORY DISORDERS EXCEPT AMI, W CARD CATH W/O MCC | 309,991 | 0.8 | 298,292 | 0.8 |
| 743: UTERINE & ADNEXA PROC FOR NON-MALIGNANCY W/O CC/MCC | 307,833 | 0.8 | 308,479 | 0.8 |
| 312: SYNCOPE & COLLAPSE | 305,495 | 0.8 | 310,199 | 0.8 |
| 683: RENAL FAILURE W CC | 304,144 | 0.8 | 304,909 | 0.8 |
| 203: BRONCHITIS & ASTHMA W/O CC/MCC | 298,746 | 0.8 | 264,088 | 0.7 |

| Median income of Patient's ZIP Code | | | | |
|---|---|---|---|---|
| | 2011 Disparities Analysis File | | 2011 NIS | |
| ZIPINC_QRTL | Frequency | Percent | Frequency | Percent |
| .: Missing | 802,860 | 2.1% | 775,339 | 2.0% |
| 1: First Quartile (lowest income) | 11,495,433 | 29.8% | 11,050,006 | 28.6% |
| 2: Second Quartile | 9,362,529 | 24.3% | 9,358,627 | 24.3% |
| 3: Third Quartile | 9,243,973 | 24.0% | 9,591,091 | 24.9% |
| 4: Fourth Quartile (highest income) | 7,684,402 | 19.9% | 7,809,761 | 20.2% |
| A: Invalid | 1,535 | 0.0% | 5,909 | 0.0% |

## Weighted Means for the 2011 Comparison

| | 2011 Disparities Analysis File | | | 2011 NIS | | |
|---|---|---|---|---|---|---|
| Variable / Label | Minimum | Maximum | Mean | Minimum | Maximum | Mean |
| LOS: Length of stay (cleaned) | 0 | 365 | 4.6 | 0 | 365 | 4.6 |
| NDX: Number of diagnoses on this record | 0 | 88 | 8.7 | 0 | 72 | 8.8 |
| NPR: Number of procedures on this record | 0 | 63 | 1.6 | 0 | 31 | 1.6 |
| TOTCHG: Total charges (cleaned) | $100 | $4,994,014 | $35,645.82 | $100 | $4,994,014 | $35,414.80 |

**APPENDIX B:**
**DEVELOPMENT OF THE DISPARITIES ANALYSIS FILES**
**FOR STATE-LEVEL QI ESTIMATES BY RACE/ETHNICITY**

Data from each year's SID were used to create individual State disparities analysis files that were designed to provide State-level QI estimates by race/ethnicity. The starting point for State-level disparities analysis files were the SID prepared for the other reporting in the QDR, as described in the HCUP Databases section of this report. These files were limited to community, non-rehabilitation hospitals.

State-level disparities analysis files for 2012 were created for 39 of the 45 HCUP States that report race/ethnicity of discharges in their 2012 HCUP SID[14] (see Table 2 in the main body of the report for the list of States). State-level disparities analysis files for 2011 were created for the 39 of the 46 HCUP States that report race/ethnicity of discharges in their 2011 HCUP SID.

### Preparation of the State Disparities Analysis Files

The following steps were taken to further prepare the State-level files for reporting by race/ethnicity:

1. *Selection of Hospitals.* We first selected hospitals whose original coding of patient race-ethnicity was not "suspect." Hospitals were removed from the State-level disparities analysis files if the quality of the race-ethnicity reporting was suspect, using the same four criteria for exclusion of hospitals with suspect race coding that were applied when creating the national disparities analysis file (see Appendix A for details).

   The tables below indicate the reason for excluding hospitals and their associated discharges from the State-level disparities analysis files. Except in a few cases, hospitals in a State were most often excluded because substantial shares of discharges were coded as "other" or "missing" race.

   For the 2012 State-level disparities analysis files, in 27 of the 39 States with race/ethnicity data, at least one hospital was eliminated due to suspect race coding. Eleven States had no hospitals with suspect race coding. Overall, 5.3 percent of hospitals and 2.9 percent of discharges were excluded.

| Exclusions from 2012 State-level Disparities Analysis Files for Race/Ethnicity | | | | | | |
|---|---|---|---|---|---|---|
| **Measure** | **Excluded for any reason** | **Percent of Total** | **>30% discharges are "other" race** | **>50% discharges are "missing" race** | **All discharges are white, other or missing** | **All discharges are white and hospital has >50 beds** |
| **Total number of hospitals excluded** | 213 | 5.3% | 84 | 86 | 42 | 1 |

[14] One additional State, Maine, was included in the 2012 State-level disparities analysis files. Maine data was not available in time to be included in the 2012 national disparities analysis file.

| | | | | | | |
|---|---|---|---|---|---|---|
| **Total number of discharges excluded** | 946,474 | 2.9% | 569,639 | 362,843 | 14,973 | 19 |

For the 2011 State-level disparities analysis files, in 24 of the 39 States with race/ethnicity data, at least one hospital was eliminated due to suspect race coding. Fifteen States had no hospitals with suspect race coding. Overall, 4.5 percent of hospitals and 2.4 percent of discharges were excluded.

| **Exclusions from the 2011State-level Disparities Analysis Files for Race/Ethnicity** | | | | | | |
|---|---|---|---|---|---|---|
| **Measure** | **Excluded for any reason** | **Percent of Total** | **>30% discharges are "other" race** | **>50% discharges are "missing" race** | **All discharges are white, other or missing** | **All discharges are white and hospital has >50 beds** |
| **Total number of hospitals excluded** | 179 | 4.5% | 66 | 75 | 37 | 1 |
| **Total number of discharges excluded** | 767,757 | 2.4% | 339,804 | 415,830 | 11,981 | 141 |

2. *Impute for Missing Race/Ethnicity.* Because the area-level measures selected for this report use total State population in the denominator, minimizing the loss of discharges from the numerator for the QI calculation is critical to producing unbiased QI rates. For missing race, we used a “hot deck” imputation method (which draws donors from strata of similar patients within the same hospital) to assign values while preserving the variance within the data. Typically, most States initially have no more than five percent (5%) of discharges with missing race values before imputation.

3. *Weighting of Selected Hospitals.* We calculated discharge-level weights to account for hospitals excluded because of suspect race coding, community hospitals not reported in the SID, and missing quarters of data. We weighted to the State’s universe of hospitals in the American Hospital Association (AHA) Annual Survey Database based on hospital characteristics.

Some caution should be used in interpreting State comparisons. There may be differences in race and ethnicity coding among States that affect the estimates. For example, some States include Hispanic ethnicity as one of the racial categories, and others record Hispanic ethnicity separately from race. At the hospital-level, policies vary on methods for collecting such data. Some hospitals ask the patient to identify their race and ethnicity, and others determine it from observation. The effect of these and other unmeasured differences in coding of race and ethnicity across the States and hospitals cannot be assessed.

**APPENDIX C:**
**INPATIENT AND EMERGENCY DEPARTMENT RATES**
**FOR SELECTED CONDITIONS**

For the 2014 QDR, the HCUP data were used to examine national and regional differences in inpatient and emergency department (ED) rates for selected AHRQ Prevention Quality Indicators (PQIs), related Pediatric Quality Indicators (PDIs), and selected mental illness and substance use disorders. Table C-1 in this appendix contains a list of PQIs and PDIs examined. Table C-2 contains the list of HCUP Clinical Classifications Software (CCS) categories for mental illness and substance use disorders used in this analysis.

## Analysis of PQIs and PDIs

The PQIs are measures of quality associated with processes and outcomes of care that occurred in an outpatient or an inpatient setting. The PQIs rely solely on hospital administrative data and, for this reason, are screens for examining quality that may indicate the need for more in-depth studies. Experts have suggested that using both inpatient and emergency room data may give a more accurate picture of avoidable visits/admissions for some ambulatory care sensitive conditions which can be identified by certain PQIs and PDIs.

Two HCUP databases were used for the analysis:

- The HCUP Nationwide Emergency Department Sample (NEDS), a nationally stratified sample of hospital-based EDs from HCUP States that contribute ED data (30 States in the 2011 NEDS).[15]
- The HCUP Nationwide Inpatient Sample (NIS), a nationally stratified sample of hospitals from HCUP States that contribute inpatient data (46 States in the 2011 NIS).

The 2011 NEDS contains approximately 30 million ED events from over 950 hospital-based EDs. The NEDS includes information on ED visits that do not result in an admission (i.e., treat-and-release visits and transfers to another hospital) as well as discharge information on patients initially seen in the ED and then admitted to the same hospital. For 2011, the NIS contains roughly 8.0 million unweighted inpatient discharges from more than 1,000 hospitals. Discharge-level weights included with the NEDS and NIS are used to produce national estimates.

Several steps were taken to prepare the HCUP databases: (1) QI software review and modification, (2) acquisition of population-based data, (3) general preparation of HCUP data, and (4) identification of statistical methods.

1. **QI Software Review and Modification.** A modification of PQI Version 4.4 was used. The PQIs were developed for use with hospital inpatient discharge data. No guidelines for applying the AHRQ QIs to emergency department data were available when this analysis began. Some of the events in the NEDS are visits for patients initially seen in the emergency room and then admitted to the same hospital (an "ED admission"), and some NEDS events are ED visits that do not result in an inpatient admission (e.g., treat-and-release visits and transfers to another hospital). About 15 percent of records in the 2011 NEDS represent an ED admission. The PQIs rely on the first-listed diagnosis code (DX1) to identify cases with the outcome of interest. For ED admissions, DX1 is the principal diagnosis code and reflects the condition established to be chiefly responsible for a patients' admission to the hospital. Unfortunately, principal diagnosis is not clearly discernible for ED visits that do not result in admission. Coding instructions for outpatient

[15] The 2011 NEDS was the most recent data year available at the time of the analysis.

data specify that the first-listed diagnosis is supposed to be the "reason for visit," which is different than the principal diagnosis. Even though DX1 in ED data is not necessarily the principal diagnosis, using DX1 preserves the concept from the PQI algorithm that the first code has higher priority than others. Therefore, this analysis used the first-listed diagnosis in both the inpatient and ED data analyses.

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 PQI or PDI, we used the HCUP NEDS to create national estimates of all ED visits, ED visits resulting in admission to the same hospital, and all other types of ED visits. We used the HCUP NIS to create national estimates of inpatient admissions including those admitted through the ED. For the denominator counts, population ZIP-Code-level counts from demographic update data provided by Nielsen (a vendor that compiles and adds value to the U.S. Bureau of Census data) were used for all reporting categories. Nielsen uses intra-census methods to estimate household and demographic statistics for geographic areas (The Nielsen Company, 2012). We also used the Nielsen population data for risk adjustment by age and gender.

3. **Preparation of HCUP Data.** Next, the HCUP NEDS was modified to create an analytic file consistent with the NIS which is already used for other measures in the QDR. The NEDS consists only of hospital-based EDs from community, non-rehabilitation hospitals and includes discharge weights to the universe of hospital-based ED visits to the U.S. as defined by the American Hospital Association Annual Survey Database. For missing age and gender data that occurred on a small proportion of discharge records, a “hot deck” imputation method (which draws donors from strata of similar hospitals and patients) was used to assign values while preserving the variance within the data.

4. **Statistical Methods.** 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.

5. **Masking Rates for Statistical Reliability, Data Quality, and Confidentiality.** PQI and PDI estimates were included in this analysis if they reached a threshold defined by a relative standard error less than 30% and at least 11 unweighted cases in the denominator. Estimates that did not meet this threshold were suppressed and the corresponding table cell was marked with an asterisk.

**Analysis of ED Visits for Mental Illness and Substance Use Disorders**

The HCUP NEDS for 2011 was used to identify ED visits for mental illness and substance use disorders. Specific disorders are listed in Table C-2.

ED visits were identified by the Clinical Classifications Software (CCS) category for the first-listed diagnosis. No distinction was made between ED visits that resulted in a hospital admission and those that did not. Nielsen population data was used to calculate rates per 100,000 residents by age, gender, community income, urban/rural location of patient residence, and region of the United States. Rates were not risk-adjusted.

**Table C-1. PQIs and PDIs Used to Examine QI Rates in Inpatient and ED Settings**

| PQI or PDI | Description |
|---|---|
| PQI 1 | Diabetes with short-term complications |
| PQI 3 | Diabetes with long-term complications |
| PQI 5 | Chronic obstructive pulmonary disease or asthma |
| PQI 7 | Hypertension |
| PQI 8 | Congestive heart failure |
| PQI 10 | Dehydration |
| PQI 11 | Bacterial pneumonia |
| PQI 12 | Urinary tract infections |
| PQI 13 | Angina without cardiac procedure |
| PQI 14 | Uncontrolled diabetes without complications |
| PQI 15 | Adult asthma admissions |
| PQI 16 | Lower extremity amputations among patients with diabetes |
| PQI 18* | Immunization-preventable influenza |
| PQI 90 | Overall Prevention Quality Indicator (PQI) composite |
| PQI 91 | Acute Prevention Quality Indicator (PQI) composite |
| PQI 92 | Chronic Prevention Quality Indicator (PQI) composite |
| PDI 14 | Pediatric asthma admissions |
| PDI 15 | Pediatric diabetes with short-term complications |

* Modified or added version of PQI.

**Table C-2. Clinical Classifications Software (CCS) Categories Used to Examine Mental Illness and Substance Use Disorders**

| DXCCS | Description |
|---|---|
| ***Mental Illness Disorders*** | |
| 650 | Adjustment disorders |
| 651 | Anxiety disorders |
| 652 | Attention-deficit, conduct, and disruptive behavior disorders |
| 655 | Disorders usually diagnosed in infancy, childhood, or adolescence |
| 656 | Impulse control disorders, NEC |
| 657 | Mood disorders |
| 658 | Personality disorders |
| 659 | Schizophrenia and other psychotic disorders |
| 662 | Suicide and intentional self-inflicted injury* |
| 670 | Miscellaneous disorders |
| ***Substance Use Disorders*** | |
| 660 | Alcohol-related disorders |
| 661 | Substance-related disorders |

**APPENDIX D:**
**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 quality analysis file, the SID, the disparities analysis file, and demographic update data provided by Nielsen (a vendor that compiles and adds value to Bureau of Census data). For NIS, quality analysis file, and disparities analysis file 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 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 Nielsen data, there is no sampling error.

Even though the quality analysis file and the disparities analysis file contain 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 quality analysis file 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 Nielsen Population Data

### a. Standard error estimates for discharge rates per 100,000 population using the 2012 Nielsen population data.

The observed rate was calculated as follows:

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

$w_i$ and $x_i$, respectively, are the weight and variable of interest for patient i in the quality analysis file 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:

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

**b. Standard error estimates for age/sex adjusted inpatient rates per 100,000 population using the Nielsen 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 Table 3 in this methods report, 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 2010. 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):

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

$g$ = index for the 36 age/sex cells.
$N_{g,std}$ = Standard population for cell g (year 2010 total US population in cell g).
$N_{g,obs}$ = Observed population for cell g (year 2012 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).
$w_{g,i}$ = Quality analysis file 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:

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

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

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

## 2. Provider-based QIs using Weighted Discharge Data (SID and Quality Analysis File)

### 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:

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

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 2010 NIS national 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:

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

*g* = index for the 36 age/sex cells.
$\hat{N}_{g,std}$ = Standard inpatient population for cell g (Estimate of year 2010 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.
$w_{g,i}$ = Quality analysis file 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:

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

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:

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

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

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:

$$t = \frac{R_1 - R_2}{\sqrt{SE_1^2 + SE_2^2}}$$

$$p = 2 * \text{Prob}(Z > |t|) \quad \text{(A.10)}$$

where $Z$ is a standard normal variate.

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

SAS: p = 2 * (1 - PROBNORM(ABS(t)));

EXCEL: = 2*(1- NORMDIST(ABS(t),0,1,TRUE))

**APPENDIX E:**
**QDR SUMMARY MEASURES FOR**
**PATIENT SAFETY AND MORTALITY FOR SELECTED**
**PROCEDURES AND CONDITIONS**

To examine national and State-level trends in inpatient mortality and patient safety events, risk-adjusted rates for select AHRQ Inpatient Quality Indicators (IQIs) and Patient Safety Indicators (PSIs) were summarized. The three QDR summary measures include the following:

1. Mortality for selected conditions based on select IQIs
2. Mortality for selected procedures based on select IQIs
3. Patient safety based on select PSIs

These summary measures were calculated as a weighted sum of risk-adjusted rates for individual IQIs and PSIs. The weights used to calculate the QDR summary measures were relatively consistent with AHRQ IQI and PSI Composites; however, the methodology employed to perform the calculations differed. The IQI and PSI composites were designed for use with hospital-level rates, while the QDR report only national and State-level statistics.

The QDR summary measure for mortality for selected conditions was based on six IQIs also included in the similar IQI Composite.

| IQIs Included in the QDR Summary | | | |
|---|---|---|---|
| **IQI** | **Description** | **IQI Composite Weight** | **QDR Summary Measure Weight** |
| IQI 15 | Acute Myocardial Infarction | 0.1433 | 0.1433 |
| IQI 16 | Congestive Heart Failure | 0.2739 | 0.2739 |
| IQI 17 | Acute Stroke Adult Mortality Rate | 0.1329 | 0.1329 |
| IQI 18 | Gastrointestinal Hemorrhage | 0.1302 | 0.1302 |
| IQI 19 | Hip Fracture | 0.0678 | 0.0678 |
| IQI 20 | Pneumonia | 0.2519 | 0.2519 |

The IQI composite weights were extracted from the SAS software, version 4.4. They are based on pooled SID denominators (i.e., the relative frequency of the denominators of the component indicators). This approach is known as “opportunity weighting,” because it gives equal weight to each opportunity that the health care system has to do “the right thing,” which in this case is to discharge the patient alive from the hospital. The QDR summary measure weights were the same as the weights in the similar IQI Composite.

The QDR summary measure for mortality for selected procedures was based on four IQIs instead of the eight IQIs included in the similar IQI Composite.

Three IQIs were excluded because the procedures were not high-volume at the State level and, therefore, State-level risk-adjusted rates were often unavailable. The IQI for Hip Replacement has a zero-weight in the IQI Composite because it is not endorsed by the National Quality Forum. The IQI composite weights were extracted from the SAS software, version 4.4, and were also based on pooled SID denominators. The IQI Composite weights were proportionally reallocated into the QDR summary measure weights to account for the excluded IQIs.

| IQI | Description | IQI Composite Weight | QDR Summary Measure Weight |
|---|---|---|---|
| **IQIs Included in the QDR Summary** | | | |
| IQI30 | Percutaneous coronary intervention | 0.5659 | 0.6275 |
| IQI12 | CABG | 0.2001 | 0.2219 |
| IQI13 | Craniotomy | 0.1031 | 0.1143 |
| IQI11 | Abdominal Aortic Aneurysm Repair | 0.0328 | 0.0364 |
| **IQIs Excluded in the QDR Summary, but in the IQI Composite** | | | |
| IQI08 | Esophageal Resection | 0.0043 | 0.0000 |
| IQI09 | Pancreatic Resection | 0.0048 | 0.0000 |
| IQI14 | Hip Replacement | 0.0000 | 0.0000 |
| IQI31 | Carotid Endarterectomy | 0.0890 | 0.0000 |

The QDR summary measure for patient safety was based on seven PSIs instead of the eleven PSIs included in the similar PSI Composite.

| PSI | Description | PSI Composite Weight | QDR Summary Measure Weight |
|---|---|---|---|
| **PSIs Included in the QDR Summary** | | | |
| PSI15 | Accidental Puncture or Laceration | 0.2982 | 0.3925 |
| PSI12 | Postoperative Pulmonary Embolism or Deep Vein Thrombosis | 0.2360 | 0.3106 |
| PSI07 | Central Venous Catheter-Related Bloodstream Infections (2008 only) | 0.1280 | 0.1685 |
| PSI06 | Iatrogenic Pneumothorax | 0.0457 | 0.0602 |
| PSI13 | Postoperative Sepsis (2008 only) | 0.0383 | 0.0504 |
| PSI14 | Postoperative Wound Dehiscence | 0.0124 | 0.0163 |
| PSI08 | Postoperative Hip Fracture | 0.0011 | 0.0014 |
| **PSIs Excluded in the QDR Summary, but in the PSI Composite** | | | |
| PSI03 | Pressure Ulcer | 0.2403 | 0.0000 |
| PSI09 | Postoperative Hemorrhage or Hematoma | 0.0000 | 0.0000 |
| PSI10 | Postoperative Physiologic and Metabolic Derangement | 0.0000 | 0.0000 |
| PSI11 | Postoperative Respiratory Failure | 0.0000 | 0.0000 |

One PSI Pressure Ulcer was excluded due to its dependence upon reporting whether the diagnosis is present on admission (POA) to the hospital. (This information is not uniformly available across HCUP States). Three PSIs have zero weights in the PSI Composite because they are not endorsed by the National Quality Forum. The PSI composite weights were extracted from the SAS software, version 4.4, and are based on pooled SID numerators (i.e., the relative frequency of the numerators of the component indicators). This approach is known as “event weighting,” because it gives equal weight to each event, regardless of how many patients were evaluated for the occurrence of that event. The PSI Composite weights were proportionally reallocated into the QDR summary measure weights to account for the excluded PSIs.

Calculation of Summary Measures

Each summary measure was calculated as follows:

$$S = \sum_i \quad ai \quad X_i$$

Where $a_i$ corresponds to the weight to the $i^{th}$ QI and $X_i$ corresponds to the risk-adjusted rate for the $i^{th}$ QI.

The standard error (SE) of the summary measure is the square-root of the variance:

$$\mathbf{Var}\left(\sum_i a_i X_i\right) = \sum_i a_i^2 \mathbf{Var}(X_i) + \sum_i \sum_{j \neq i} a_i a_j \mathbf{Cov}(X_i, X_j)$$

Where $a_i$ corresponds to the weight to the $i^{th}$ QI and $X_i$ corresponds to the risk-adjusted rate for the $i^{th}$ QI. The correlations actually had very little effect on the estimated SE for the summary measures. For example, in examining mortality for select conditions, the SE was 0.293 if we assume the correlations are zero (i.e., the individual measures are uncorrelated) and the SE was 0.303 if we assume the correlations are those estimated by the covariance matrix of the State-level rates, which were in the range of 70 to 85 percent. Therefore, the SEs were calculated on the assumption that the individual measures were independent of one another, which eliminates the second term on the right-hand side of the formula above.