Cost-to-Charge Ratio Files:

User Guide for Kids' Inpatient Database (KID) CCRs

1. Purpose

   The purpose of this data file is to provide Healthcare Cost and Utilization Project (HCUP) users of the Kids' Inpatient Database (KID) with ratios that will allow the conversion of charge data to cost estimates. The annual Cost-to-Charge Ratio (CCR) files are constructed using information from the Healthcare Cost Report Information System (HCRIS) files submitted by hospitals to the Centers for Medicare & Medicaid Services (CMS). Separate CCR for KID files are released for each data year and should be used with the corresponding year of the KID.

   Beginning with the 2012 data, the CCR for KID files were revised to reflect the redesign of the 2012 Kids' Inpatient Database (KID). These versions of the file include HOSP_KID, which is a unique hospital number exclusive to the KID. The CCR variables were renamed to indicate they are designed to be used exclusively with the 2012 and later KID.

   The HCUP CCR files provide an estimate of all-payer inpatient cost-to-charge ratios for hospitals in the 2003-2016 KID. Records are included for all community hospitals from the HCUP KID that have "clean" matches with both the AHA Annual Survey Database and the CMS hospital cost file for the corresponding fiscal year.[1]

   The CCR for KID files can be linked to records in the KID using the data element HOSPID, through 2011, and the data element HOSP_KID, for 2012 and later years. HOSP_KID is reassigned each year and does not link to other HCUP databases or to external databases, or track hospitals over years.

   The cost of inpatient care for a discharge is estimated by multiplying TOTCHG (from the discharge record) by either the hospital-specific all-payer inpatient cost/charge ratio or the group average all-payer inpatient cost/charge ratio. The hospital-specific cost/charge data element is named APICC, through 2011, and is named CCR_KID, for 2012 and later years. CCR_KID is based on the hospital-specific all-payer inpatient cost/charge ratio (APICC) when available, or the group average all-payer inpatient cost/charge ratio (GAPICC) otherwise.

[1] HCUP uses the CMS fiscal year files like "hosp10_2016_NMRC.csv," also referred to as PPS records, for hospital data submitted through March 31st, approximately 18 months after the close of a fiscal year.

2. File Format

Beginning with the 2012 data, the cost-to-charge ratio has been modified to enhance confidentiality of the KID. Statistical reliability of the estimates is not affected.

For 2012 and 2016, the datasets contain a record for each hospital (unduplicated HOSP_KID) in the KID:

- 4,200 hospitals in the 2016 CCR-KID
- 4,179 hospitals in the 2012 CCR-KID.

For 2003, 2006, and 2009, the datasets contain a record for each hospital (unduplicated HOSPIDs) in the KID for states that permitted release of their cost-to-charge ratios:[2]

- 3,956 of 4,121 hospitals in the 2009 CCR-KID
- 3,739 of 3,739 hospitals in the 2006 CCR-KID
- 2,965 of 3,438 hospitals in the 2003 CCR-KID.

All HCUP hospitals in the CCR for KID files are in the American Hospital Association (AHA) Annual Survey.

Note: The HOSP_KID variable on the CCR CSV (comma-separated value) text file is enclosed in quotations in order to preserve leading zeros in Excel. As a result, some software applications may interpret HOSP_KID as a character variable, which in turn would not match the numeric version of HOSP_KID on the KID. This data element should be loaded as numeric or converted to numeric prior to merging with the KID.

3. Linkage to the KID

Where permitted by HCUP Partner organizations, the files provide a hospital-specific all-payer inpatient cost-to-charge ratio, APICC (renamed as CCR_KID). For all hospitals, there is also a weighted group average, GAPICC. Analysts can use APICC, when available, and otherwise use the weighted group average, GAPICC. For 2012 and later files, the cost-to-charge ratio element CCR_KID can be used for all hospitals.

Year	Records with APICC	Percent	Records with GAPICC only
2009	3,816	93%	305
2006	2,935	78%	804
2003	2,243	76%	722

[2] For 2003 and 2009, one or more states did not provide permission to participate in the KID CCR.

4. KID-Specific Cost-to-Charge Ratio—CCR_KID

   The cost-to-charge ratio element CCR_KID, provided for linkage to the 2012 and later KID, is populated with the all-payer inpatient cost-to-charge ratio (APICC), when available. The hospital group average CCR (GAPICC) is used to populate CCR_KID when the APICC is not available. The construction of the all-payer inpatient and group average CCR are described in the next sections.

5. Hospital-Specific CCR — APICC

   The all-payer inpatient cost-to-charge ratio (APICC) is created by dividing the inpatient costs by the inpatient charges. Both of these values are found on the CMS Healthcare Cost Reporting Information System (HCRIS) reports, or PPS data. APICC is kept for HCUP KID hospitals that have a matching record in both the PPS and the AHA data. APICC is missing when there is no cost information in the PPS data or the calculated cost/charge values were considered outliers. Several adjustments are made to costs and charges before they are usable in this generalized formula, the most important being the assignment of a portion of ancillary costs to inpatient routine and acute cost centers.

6. Weighted Group Average—GAPICC

   The group average cost-to-charge ratio (GAPICC) is a weighted average for the hospitals in peer groups (defined by state, urban/rural, investor-owned/other, and bedsize), using the proportion of group beds as the weight for each hospital.

   These averages are based on clean observations, meaning the HCUP hospitals that also have records in both the AHA Annual Survey and CMS cost data as of the March 31st date when the CMS files are acquired. These records have a matching hospital in the CMS cost report, have availability of certain completed data items in the report, and pass certain edit checks.

   Note that group averages can be based on only one hospital in the peer group (defined by state and hospital type). The group average may be associated with a non-HCUP hospital.

7. Hospital Type for Grouping—HTYPE

   The hospital type (HTYPE) is utilized for grouping peer hospitals. Although HTYPE is not provided on the CCR for KID files, it is helpful to know how this variable is defined to create peer groups within each state using all hospitals. Some researchers will find the information below useful with respect to replicability, and reviewers for journal articles might find this more detailed description especially valuable.

The following are values for the HTYPE variable:

1= investor-owned, under 100 beds
2= investor-owned, 100 or more beds
3= not-for-profit, rural, under 100 beds
4= not-for-profit, rural, 100 or more beds
5= not-for-profit, urban, under 100 beds
6= not-for-profit, urban, 100-299 beds
7= not-for-profit, urban, 300 or more beds

State and local hospitals are included in the *not-for-profit categories*. *Urban* is defined as being part of a Metropolitan Statistical Area (MSA); *beds* are the total hospital beds set up (as defined in each year's AHA Annual Survey Database). Teaching status, which is customarily used for grouping HCUP hospitals was not assigned; interns and residents per bed are not available on the AHA survey so a high value of this indicator of teaching status could not be used for grouping.

8. Area Wage Index— WI_X / WAGEINDEX

The Area Wage Index is an index computed by CMS to measure the relative hospital wage level in a geographic area compared to the national average hospital wage level. It is provided on the file to allow researchers to analyze cost differences geographically or to control for price factors beyond the hospital's control. Hospital cost variation has a 0.8 elasticity with the area wage index in some AHRQ published studies, meaning that variation in the hospital cost is roughly proportional to the variation in overall hospital costs. Multivariate studies should not assume strict proportionality.

The index is computed for each urban Core-Based Statistical Area (CBSA) and then linked with the AHA before it is added to the file. If the AHA-reported CBSA does not match the CMS hospital area, then the Area Health Resources Files (AHRF) and other hospitals in the same county are used to find a matching CBSA. All rural areas in each state are combined for a single wage index. This information is available for download from CMS. For the HCUP KID hospitals in each year, all hospitals were matched to an area wage index using CMS files, the AHA survey, and the Area Resource File in cases where the AHA survey was incomplete.

Through 2011, this data element is called WI_X. Beginning in 2012, the wage index in the CCR file has been modified to enhance confidentiality of the KID and renamed as WAGINDEX. Statistical reliability of the estimates is not affected.

9. Geographic Adjustment Factor—GAF

The Capital cost adjustment index for Core Based Statistical Areas is included on the file in earlier years. It is used in calculating the Medicare reimbursement payments for capital costs. This data element may prove useful in regression

calculations. However, analysts should note that for a number of states contributing hospital data in the KID, permission was not provided to release values of GAF.

10. State Code—Z013

The State Code (AHA element Z013), provided in earlier years, is the two-character state postal code (e.g., "AZ" for Arizona) for hospitals included in the CCR for KID file.

11. Internal Validation Studies

A regression analysis of the all-payer inpatient CCR was performed in earlier years. This analysis used all clean HCUP and non-HCUP records with both AHA and CMS data. This was a weighted OLS regression using acute medical-surgical beds as the weighting variable, with separate state constant terms. Factors leading to significant differences in the CCR were: investor-ownership, rural location, large size (more than 300 beds), and a high ratio of interns and residents per bed (top 5%). Several of the state constant terms were also significant. The results tended to validate the "peer-grouping" method used here to create weighted group averages for each HCUP record.

In 2001 a study was performed for two states where different methods of calculating cost by DRG were compared. Hospital-wide CCRs as provided here, although not as accurate as department-based CCRs, are more accurate than gross charges in estimating relative cost by DRG. In more recent years, studies involving a dozen states that report their detailed charges have been done. These studies produced more accurate CCRs because they use departmental CCRs as opposed to hospital-wide CCRs. Users interested in quantifying potential biases due to use of the hospital-wide CCRs should contact HCUP user support (hcup@ahrq.gov).

12. Tools for More Accurate Cost Estimates

HCUP periodically evaluates the differences in cost estimates by hospital and by cost centers (departments) and individual services.[3] There are two sets of cost adjustment factors available, for data years 2006 and 2009. The adjustment factors are contained in the appendices of the following methods reports available at https://www.hcup-us.ahrq.gov/reports/methods/methods.jsp.

An initial report, conducted with 2006 data, provides adjustment factors by Clinical Classifications Software (CCS) categories and All-Patient Refined Diagnosis Related Groups (APR-DRG). The adjustment factors allow an analyst to correct cost estimates based on hospital-wide CCRs. Such adjustments will

[3] In general, department-specific CCRs are more accurate for deriving the cost of a hospital stay than hospital-wide CCRs. However, not all of the HCUP Partner organizations ask hospitals to report detailed charges for every discharge, and not all hospitals have usable CMS accounting reports.

increase the estimated costs for patients in some APR-DRG and CCS categories and reduce the estimated costs for patients in other APR-DRG and CCS categories. For more information about the approach, please see HCUP Methods Series Report # 2008-04. Song, X, Friedman, B. *Calculate Cost Adjustment Factors by APR-DRG and CCS Using Selected States with Detailed Charges*. Online October 8, 2008. U.S. Agency for Healthcare Research and Quality.

An updated report, conducted in 2012, used a more extensive methodology to develop correction factors for 2009 data for each Medicare-Diagnosis Related Group (MS-DRG) and each CCS category. This addresses an issue with the hospital-wide CCR in that it does not account for variations among service departments in the hospital. This year's report created 13 cost-center clusters that take into account the higher markup (the inverse of CCR) for ancillary services as a whole than for routine bed-unit services. The cost-center specific and hospital-wide CCRs were applied to SID discharges for each MS-DRG or CCS category. These adjustment factors allow an analyst to correct cost estimates based on hospital-wide CCRs for the patient's MS-DRG or CCS category to get a more accurate CCR and, hence, a more accurate cost estimate. For more information about the approach, please see HCUP Methods Series Report # 2011-04. Sun Y, Friedman B. *Tools for More Accurate Inpatient Cost Estimates with HCUP Databases, 2009.* Errata added October 25, 2012. 2012. ONLINE October 29, 2012. U.S. Agency for Healthcare Research and Quality.

13. Variable Lists

The following tables summarize the variables (and their respective labels) included in the Cost-to-Charge files for the KID.

CCR for KID: 2012, 2016

HOSP_KID	HCUP hospital identification number
YEAR	Year for linking to HCUP records
CCR_KID	All-payer inpatient or Group Average CCR
WAGEINDEX	Wage Index, source CMS, edited

CCR for KID: 2009

Data Element	Description
HOSPID	HCUP hospital identification number
APICC	All-payer inpatient CCR, hosp-specific
GAF	Capital cost adjustment index for Core Based Statistical Areas
GAPICC	Group avg. all-payer inpatient CCR
WI_X	Wage Index, source CMS, edited
YEAR	Year for linking to HCUP records
Z013	State postal code

CCR for KID: 2003, 2006

Data Element	Description
HOSPID	HCUP hospital identification number
APICC	All-payer inpatient CCR, hosp-specific
GAPICC	Group avg. all-payer inpatient CCR
WI_X	Wage Index, source CMS, edited
YEAR	Year for linking to HCUP records
Z013	State postal code