

PROVIDER PEER GROUPING METHODOLOGY

2011 HOSPITAL TOTAL CARE

CALCULATION OF HOSPITAL TOTAL CARE QUALITY

QUALITY MEASURES

Appendix Table 1 presents information on the 42 measures included in the total care quality composite. The measures are grouped into four categories, also referred to as “subdomains”: Process of Care (26 measures); Inpatient Complications (6 measures); Mortality (7 measures); and Readmissions (3 measures). Ten Patient Experience measures are also presented in the hospital reports for informational purposes, but these measures are not included in the total care composite score.

DATA SOURCES

The data for all quality measures in the total care composite come from publicly reported sources. Most measures are included in the Minnesota Statewide Quality Reporting and Measurement System and are publicly reported by the Minnesota Department of Health.

- The process of care measures for AMI, heart failure, pneumonia, and surgical care infection prevention (SCIP) measures are from the CMS hospital inpatient quality reporting program, reported on Hospital Compare (<http://www.hospitalcompare.hhs.gov/staticpages/help/hospital-resources.aspx>). The 30-day readmission and mortality measures for AMI, heart failure, and pneumonia are also from CMS Hospital Compare. Hospitals directly report process of care measures to CMS as part of the Hospital Inpatient Quality Reporting program, based on medical records of care provided to all patients. CMS calculates 30-day mortality and readmission measures using claims/billing data for Medicare fee-for-service patients only.
- Two process measures for infection control measures for intensive care unit (ICU) patients and one inpatient complication measure for surgical site infection following vaginal hysterectomy were obtained from the Minnesota Hospital Association. (See <http://www.mnhospitalquality.org/measures.aspx> for more information).
- The inpatient complication measures are AHRQ patient safety indicators (PSIs) (http://www.qualityindicators.ahrq.gov/Modules/psi_overview.aspx). Four of the mortality measures are AHRQ inpatient quality indicators (IQIs) (http://www.qualityindicators.ahrq.gov/Modules/iqi_overview.aspx). Data for these measures were calculated by the Minnesota Department of Health, using AHRQ software version 4.1, and are reported on <http://www.mnhealthscores.org>.

ASSIGNMENT OF QUALITY POINTS

Hospitals can earn up to 10 points on each quality measure for which they have data. Points are assigned by comparing a hospital’s rate to cutoffs in the distribution of measure rates among all hospitals in their peer group (PPS hospitals or CAHs).¹ Before calculating these cutoffs and assigning

¹ This approach is similar to the Centers for Medicare & Medicaid Services’ (CMS’s) hospital value-based purchasing approach for assigning achievement points. However, this approach uses different cutoffs that are calculated only among the Minnesota peer groups (PPS or CAH).

points, rates for negative outcomes (mortality, readmission and inpatient complications) are first subtracted from 100, so that higher scores represent better performance.

For each measure for which a hospital has data for, points are then assigned as follows:

- **0 points** if the hospital’s rate is less than the “achievement threshold” determined by the 30th percentile of rates among hospitals in the peer group. That is, at least 70 percent of hospitals have better rates.
- **10 points** if the hospital’s rate is equal to or greater than the “benchmark” determined by the 75th percentile of rates among hospitals in the peer group.
- **1 to 9 points** if the hospital’s rate is at or above the achievement threshold but below the benchmark, with points assigned depending on where the hospital’s rate falls in 9 evenly-spaced intervals between the achievement threshold and the benchmark.

Hospitals must meet the relevant minimum case size (denominator) threshold (see Table 1) to have points assigned to a measure and used in the calculation of the subdomain score, as described below—with one exception for CAHs only. If a CAH has results for at least one measure in a subdomain but does not meet the minimum case size for any of those measures—that is, does not have any other measures in the subdomain that do meet the minimum case size—then the rate on the measure(s) is adjusted to reflect a weighted average between the hospital’s rate and the mean among other CAHs with that measure. Further, to calculate this weighted average, there must be at least 30 total cases among the other CAHs with the measure. The weight assigned to the hospital’s rate is proportional to the case size. For example, for a measure with a case size minimum of 10, if a hospital has 4 cases, its rate would receive a weight of 0.4 in the average while the peer group mean would receive a weight of 0.6. Points are then assigned (as described above) to this adjusted weight for calculation of the subdomain and total quality scores.

CALCULATION OF SUBDOMAIN (CATEGORY) SCORES

To receive a subdomain score, hospitals must have points assigned for at least one measure in the subdomain category, based on the rules above. No imputation is done for measures for which hospitals have no data.

The subdomain score, ranging from 0 to 100, is calculated as follows:

$$\text{Score} = (\text{Total points } \underline{\text{earned}}) / (\text{Total points } \underline{\text{possible}}) * 100$$

For example, if a hospital had 4 measures in a given subdomain, it would have 40 total points possible (10 per measure) for that subdomain. If that hospital earned 30 points on those four measure combined, then its subdomain score would be $(30/40)*100 = 75$. Under this approach, the subdomain score may be based on different subsets of measures for different hospitals, depending on which measures within the full set of measures are applicable to each hospital’s patient population and services provided.

CALCULATION OF TOTAL CARE QUALITY SCORE

To receive a total care quality score, hospitals must have a subdomain score for all four subdomains. CAHs that might have received a subdomain score through the adjustment process described above

will only receive a total care quality score if they have results for all four subdomains. The total quality score, ranging from 0 to 100, is calculated as a weighted average of each of the four subdomain score with the following weights:

<u>Subdomain</u>	<u>Weight in Composite</u>
Process of Care	30%
Inpatient Complications	20%
Mortality	30%
Readmissions	20%

For example, if a hospital has a score of 60 on the Process of Care subdomain, 75 on Inpatient Complications, 30 on Mortality, and 50 on Readmissions, its total quality score would be calculated as follows:

$$(60*0.3) + (75*0.2) + (30*0.3) + (50*0.2) = (18 + 15 + 9 + 10) = \mathbf{52}$$

Risk Adjustment

The quality measure data for outcomes of care (mortality, inpatient complications, and readmissions) used in peer grouping have already been adjusted to reflect differences in patient risk factors that affect outcomes across hospitals. The process of care measures are not risk adjusted because patients for whom the recommended treatment would not be appropriate are excluded from the denominator; that is, for everyone included in the measure, the recommended service should have been provided, regardless of the patient’s risk factors.

The outcome measures are adjusted using methodologies specific to each measure set: 30-day mortality and 30-day readmissions are adjusted based on CMS methodology; the inpatient mortality and inpatient complications are adjusted using methodology developed by the AHRQ, as well as MHA methods for the surgical site infection rate for the vaginal hysterectomy measure.

The approach to risk adjustment in the CMS 30-day and AHRQ outcomes measures vary and are described elsewhere.² However, both use an “indirect standardization” approach to risk adjustment. This approach, in general, uses complex statistical models that measure the effect of patient risk factors (such as age, gender, and pre-existing health conditions) on an outcome, and use the results from this model to estimate what a hospital’s expected outcomes would be if they were to treat an “average” patient caseload.³ Under the AHRQ approach, the ratio of observed-to-expected outcomes is computed and multiplied by a population rate to create a risk-adjusted rate for the hospital. The CMS approach to

² See <http://www.qualitynet.org/> → Hospitals-Inpatient → Claims-based measures for detailed information on the 30-day mortality and readmission measures; see <http://www.qualityindicators.ahrq.gov/Default.aspx> for basic information on the AHRQ QIs, and <http://www.qualityindicators.ahrq.gov/Resources/default.aspx> for links to more detailed information on risk adjustment. MDH used AHRQ software version 4.1 to compute the measures.

³ In the AHRQ measures approach, the effect of each risk factor has been estimated on a national reference population and are applied to the Minnesota hospital discharge data; in the CMS measure approach, the effect of each risk factor is estimated on the national fee-for-service Medicare data for July 2006-June 2009.

risk adjustment is more complex, and also accounts for a “hospital specific effect” on quality; in this approach, a *predicted* rate which reflects the estimated rate with the hospital’s own quality effect and the hospital’s patients is compared to an expected rate which reflects the estimated outcome with the average quality effect for all hospitals and the hospital’s patients.

The surgical site infection rate for vaginal hysterectomy is adjusted using a form of direct standardization.⁴ The rate is a combination of two rates produced for each hospital: one for patients with any of three risk factors and one for patients with none of the three risk factors. The risk factors are: (1) the duration of the surgery was greater than the recommended amount of time; (2) the wound class was III or IV; and (3) the ASA score (an anesthesiology risk assessment) was greater than or equal to 3. The combined rate is then the weighted average of these two rates, weighted by the number of patients in each cohort.

CALCULATION OF HOSPITAL TOTAL CARE COSTS

ATTRIBUTION OF PATIENT ADMISSIONS TO HOSPITALS

Costs are calculated based on patients’ admitting diagnoses and the care they received during an inpatient hospital stay. In most cases, this reflects a single hospitalization for a specific diagnosis or procedure. However, patients may be readmitted to the same or another hospital soon after discharge for problems that could have been addressed during the first hospitalization. For this reason (except when patients are transferred to another hospital), if patients are readmitted to any hospital for any reason within 30 days of their discharge for one of four conditions—heart attack or acute myocardial infarction (AMI), congestive heart failure (CHF), pneumonia, or total knee replacement (TKR)—the costs associated with the later admission are attributed to the first hospital. That is, 30-day all-cause hospital readmissions for these four conditions are not counted as separate hospitalizations and are attributed to the same hospital as the first admission. Thus, the total number of “attributed” patient admissions across hospitals is smaller than the actual number of patient admissions.

Attribution of hospital admissions consists of three key steps: (1) identifying index admissions for AMI, CHF, pneumonia, and TKR, (2) identifying the first all-cause readmission within 30 days of discharge from an index admission for these conditions and procedure, and (3) combining the costs of the readmission with costs of the index admission to create a single admission episode.

Attribution of admissions not associated with these three conditions and one procedure is more straightforward: all admissions that occur at the hospital over the payer-specific period of measurement (calendar year 2008 for Medicare and from July 2008 through June 2009 for Medicaid⁵ and commercial payers) are attributed to the hospital, with no attempt to identify and combine readmissions.

Admissions for AMI, CHF, or pneumonia are identified based on the principal admitting diagnosis;

⁴ See <http://www.mnhospitals.org/index/InfectionI> for more information.

⁵ Throughout this document, the term “Medicaid” refers both to Medicaid and to other state-funded insurance programs.

those for TKR are identified based on any one of six relevant procedure codes (see Appendix Table 2). Admissions for these diagnoses are eligible for inclusion only if (1) the patient does not die, (2) the patient is not transferred out of the hospital to another acute care hospital, and (3) the admission is not preceded within 30 days by an index admission.⁶ These exclusions do not apply to other conditions. The first admission in the measurement period for any one of the three conditions or one procedure was considered to be an index admission for that admission type. The period for identifying AMI, CHF, pneumonia, and TKR index admissions was restricted to the first 11 months of the measurement period; index admissions in the 12th month were excluded from the total care cost measure.

For each index admission for AMI, CHF, pneumonia, and TKR, the first all-cause readmission following within 30 days of discharge was next identified. All admissions except index admissions were eligible to be counted as readmissions, no matter what condition the patient was admitted for. If the first readmission within 30 days of discharge from an index admission resulted in a transfer to another hospital, its costs were bundled with the succeeding admission to form a *single* readmission.

In the final step of the attribution process, the costs of each readmission were combined with those of the index admission, and the readmission was no longer counted as a separate admission.

ACTUAL AND STANDARDIZED COSTS

We examine and report both actual risk-adjusted costs and price-standardized costs in the hospital total care cost analysis. Actual costs measure total expenditures on health care (reflecting both volume and intensity of resource use and prices) by the patient, government, and private insurer(s), whereas standardized costs measure use of total health care resources by controlling for differences in hospitals' payments due to contractual agreements with third-party payers and other factors. We calculate actual costs by adding patient deductibles, copayments, prepayments, and third-party insurer payments. We calculate standardized costs using All Patient Refined-Diagnosis Related Groups (APR-DRGs) and length of stay. APR-DRGs are an expanded set of the basic DRG classification system that is more representative of non-Medicare populations and incorporates severity-of-illness subclasses into DRGs.⁷ The standardized cost of an admission is simply the average cost per day of admissions within a particular APR-DRG at a particular hospital type paid by a particular payer type multiplied by the length of stay of that admission.

Prior to standardization, data were cleaned to exclude discharges that (1) were out-of-state discharges (because the hospital total care analysis includes only inpatient costs for Minnesota hospitals), (2) resulted in less than \$300 per day in payment, (3) were not assigned any ADG codes, and (4) had inaccurate lengths of stay (less than 0 or more than 730 days). The majority of excluded discharges (60 percent) and costs (90 percent) were out-of-state discharges. In addition, models used for risk adjustment included discharges only from hospitals eligible to receive reports.

⁶ Additionally, for AMI (but not for pneumonia, CHF or TKR), admissions for which patients were discharged on the same day they were admitted are not eligible to be treated as index admissions, because these same-day discharges are unlikely to be true AMIs.

⁷ Basic DRGs are used by the Centers for Medicare & Medicaid Services (CMS) to categorize and pay for hospital admissions for Medicare beneficiaries. The All Patient DRGs (AP-DRGs) are an expansion of the basic DRGs and are more representative of non-Medicare populations, such as pediatric patients. The APR-DRGs incorporate severity of illness subclasses into the AP-DRGs.

To calculate standardized costs, we used a data file that contained information on inpatient admissions at all PPS hospitals and CAHs in Minnesota, from July 1, 2008 through June 30, 2009. (For Medicare-covered discharges, the time period is the whole of calendar year 2008, since information on inpatient admissions covered by Medicare was only available for 2008). Each record identified the payer type (Medicare, Medicaid, or commercial payer) and hospital type (PPS or CAH), and each stay was classified into an APR-DRG, that is, an AP-DRG along with one of the four DRG-severity levels. To increase cell sizes, we collapsed the lowest two severity levels into a single severity category and the highest two severity levels into another severity category, resulting in two broad severity levels. To calculate costs per day within a DRG, we first combined DRGs with small numbers of observations with other DRGs with similar clinical characteristics and resource intensity in order to produce stable estimates. Standardized cost per day for each stay was calculated as the sum of costs divided by the sum of lengths of stay across all stays within a DRG-severity cell for a hospital type and payer type. Ungroupable cases were treated as a single cell for the purpose of this step and cost per day of ungroupable cases was calculated for each hospital type and payer type. As mentioned above, the standardized cost for an admission is simply the standardized cost per day within the DRG-severity cell to which that admission belongs multiplied by the length of stay for that admission, and is calculated separately by hospital type and payer type.

COST OUTLIERS

We performed hospital cost outlier adjustment by top-coding or truncating costs. We began by testing several truncation thresholds and evaluating them for their effects on explanatory power, reliability, and proportion of costs profiled. We performed these tests separately for raw costs and standardized costs, for each of the three payer types—Medicare, Medicaid, and commercial—and for each of the two hospital peer groups—PPS hospitals and CAHs. We evaluated nine different thresholds along with untransformed costs, as follows:

- *Arbitrary dollar-value cutoff*: Truncate at \$100,000.
- *Global percentile cutoff*: Truncate at 95th, 98th, 99th, and 99.5th percentile based on all discharges for a given cost type, hospital type, and payer type.
- *Major diagnostic category (MDC)-specific percentile cutoff*: Truncate by MDC at 95th, 98th, 99th, and 99.5th percentile based on all discharges for a given cost type, hospital type, payer type, and MDC.

As a measure of explanatory power, we used the R-squared from a discharge-level ordinary least squares model predicting cost as a function of patient characteristics such as age, gender, and Aggregated Diagnosis Groups (ADGs). As a measure of reliability, we used the intraclass correlation (ICC) from a hierarchical linear model predicting cost as a function of age, gender, and ADGs, with a random intercept for each hospital. Both models were run separately for the two cost types, three payer types, and two hospital peer groups. To calculate the proportion of costs profiled, we divided the sum of truncated costs by the sum of untransformed costs for each truncation threshold, cost type, payer type, and hospital type.

We selected the global 99th percentile to truncate costs (with two exceptions), because it achieved a reasonable balance between high explanatory power and reliability and a small reduction in the proportion of costs profiled. In two cases—raw costs in PPS hospitals paid by Medicaid and

commercial payers, respectively—the global 99th percentile ended up excluding much more than five percent of the costs. Because we did not want to exclude more than 5 percent of costs due to truncation, we made an exception in these two instances and truncated at the global 99.5th percentile.

RISK ADJUSTMENT

Truncated raw and standardized costs were risk adjusted using indirect standardization, based on linear regression models of cost. Clinical risk factors were assigned based on Aggregated Diagnosis Groups (ADGs) from the ACG (Adjusted Clinical Groups) System that were assigned using diagnostic information contained on index admission records. When a stay was assigned the costs of the first all-cause readmission following it within 30 days of discharge, the clinical risk factors for the stay were limited to the diagnoses observed for the index stay and did not include the diagnoses observed for the readmission. We estimated 12 separate regression models for the two types of costs (raw and standardized costs), two types of hospital peer groups (PPS hospitals and CAHs), and discharges covered by three types of payers (Medicaid, Medicare, and commercial payers). Expected cost was calculated for each discharge using the regression that applied to its hospital and payer type.

Models were evaluated based on goodness of fit and reliability. In addition to clinical risk factors, models included patient age and sex, and dual eligibility (for Medicare and Medicaid) in the Medicare and Medicaid models. We compared models based on ACGs and ADGs and selected the ADG models based on their small but consistent improvement in fit. We tested median income in the patient’s zip code as a proxy for socioeconomic status, but we found it had little explanatory power and therefore did not include it in the final model. To improve fit for models of PPS hospital costs, additional risk factors identifying mental health diagnoses and rehabilitative stays were added. We also tested the impact of hospital characteristics such as teaching status, presence of a burn unit, or transplant capabilities, though only patient characteristics were included in the risk adjustment.

Risk-adjusted costs were calculated as the mean cost times the sum of observed over expected costs, where the expected cost is the cost projected from the regression model. That is because the risk-adjusted value is intended to represent the cost of treating the average patient, controlling for risk. These values were calculated separately for discharges in each MDC category—medical, surgical, and newborn—as well as for individual MDCs. Payer-mix adjustment was performed similarly, as the ratio of observed to expected costs, summed across payer types, multiplied by the overall mean. Because the mean costs across these groups differ, summing risk-adjusted values across payer types and diagnosis groups does not produce exactly the same value as the risk adjusted total.

RELIABILITY

Reliability is the consistency with which cost comparisons of hospitals can be measured. Reliability depends on the number of discharges attributed to a hospital and the intraclass correlation (ICC) for hospital costs. The larger the number of discharges at each hospital and the higher the ICC, the more reliably profiling can distinguish actual differences in performance between hospitals. For this reason, we selected truncation rules that maximized the ICC while also improving explanatory power and the proportion of costs profiled. Based on the ICCs from the selected rules for the different cost, payer, and hospital type combinations, we calculated the minimum number of discharges needed to achieve reliability levels of 0.4, 0.6, and 0.8, respectively. We applied the minimum number of discharges for the three levels of reliability to the distribution of discharges across CAHs and PPS hospitals to identify the number of hospitals of each type that would fail to meet these minimum thresholds for a given payer type and would therefore be excluded from reporting on those payer-specific costs.

Because a higher reliability level would result in exclusion of more hospitals from reporting, we sought to balance the desire for high reliability with considerations about the number of hospitals that would be included in peer grouping and reporting. Based on this analysis and subsequent input from the Reliability Workgroup, we decided (1) to include a hospital in provider peer grouping only if it met the minimum number of discharges to satisfy a reliability standard of 0.8 for at least one payer type; and (2) among hospitals that were included in provider peer grouping, to report a hospital's costs by service category (or Major Diagnostic Category (MDC)) or rolled-up MDCs to hospitals only if it met the minimum number of discharges to satisfy a reliability standard of 0.4 for each final MDC category, by hospital type and payer type. MDH will only publicly report data at a 0.8 reliability threshold.

CATEGORIES OF HEALTH CARE SERVICES (AND ROLL-UPS)

Cost-of-service categories are represented by major diagnostic categories (MDCs) or rolled-up MDCs, classified into the clinical areas of Medical, Surgical, and Newborn. We use individual MDCs or rolled-up MDCs to report cost breakdowns, because MDCs are the only summary-level clinical service categories consistently available in claims data for all three payer types (Medicare, Medicaid, and commercial). MDCs are formed by classifying all possible principal diagnoses (from ICD-9-CM) into 25 mutually exclusive diagnosis areas. The diagnoses in each MDC correspond to a single organ system or etiology, and, in general, are associated with a particular medical specialty. MDCs can be viewed as a roll-up of diagnosis-related groups (DRGs), which are available on most, but not all, hospital claims.

MDCs and DRGs were calculated by MDH's data aggregator (Onpoint Health Data) and incorporated into the all payer database using 3MTM APR-DRG Software, developed by 3M Health Information Systems. In the inpatient claims for this analysis, there were some ungroupable cases that had no assigned MDCs and DRGs because the principal diagnosis was invalid or missing for these claims. These ungroupable cases are included in the total discharges and contribute to the aggregate cost statistics, by payer type and across payers. However, these discharges are not included in cost breakdowns by MDCs or rolled-up MDCs (Medical, Surgical, Newborn). Therefore, in some of the tables (specifically Exhibits II.1 – II.3), the number of discharges by MDCs or rolled-up MDCs may not add up to the total discharges for a particular payer type or across payers.

For the hospital cost reports, we report a hospital's total care costs only if it meets the minimum number of discharges required to achieve reliability of 0.8 for at least one payer type, and we report detailed cost breakdowns by service categories only if such a hospital meets the minimum number of discharges required to satisfy a moderate reliability standard of 0.4 for each cost-of-service category, by payer type. Additionally, to meet CMS's guidelines for Medicare-covered discharges, detailed cost breakdowns by service categories are reported only if there were at least 11 discharges for a particular service category.

To determine whether reporting of hospital total care costs would be feasible for individual MDCs, by payer type and across all payers, we performed an analysis whereby we applied the minimum discharge thresholds described above and examined the number of hospitals meeting these discharge thresholds by hospital type and payer type. Based on these findings and recommendations, we applied the following rules for collapsing MDCs in the final reporting of hospital total care costs by cost-of-service categories:

- Hospital total care costs, *by payer type*, are reported at the aggregate MDC level of

Medical/Surgical/Newborn and not by individual MDCs for both PPS hospitals and CAHs.

- Hospital total care costs, *across all payers in the aggregate*, are reported at the individual MDC level if 10 or more hospitals meet the minimum discharge threshold associated with the reliability standard of 0.4 for that MDC. MDCs for which fewer than 10 hospitals meet the threshold are rolled up to an “other” category. This rule is applied separately to medical MDCs and surgical MDCs, and to CAHs and PPS hospitals. Newborn cases representing a single MDC are also separately reported for both PPS hospitals and CAHs.

BENCHMARKING

To facilitate peer group comparisons, we report a number of cost statistics. The benchmark statistics are weighted means calculated across a hospital’s peer group, which is comprised of *all* hospitals of the same type (PPS or CAH). PPS hospitals are compared to each other as part of one peer group, while CAHs are compared to each other as part of a separate peer group.

In the summary cost tables, the following benchmark statistics are included:

- Risk-adjusted total costs per discharge, calculated as the mean of adjusted total costs per discharge across all hospitals in the peer group weighted by the number of discharges at each hospital. Means are calculated by payer and across payers for all discharges and for categories of discharges.
- Risk-adjusted price-standardized costs per discharge, calculated similarly to total costs, as a weighted average across all hospitals in the peer group, but using standardized costs per discharge instead of actual costs. Standardizing risk-adjusted payments for each payer type (based on the length of stay and statewide average daily payment for clinically similar hospital stays) accounts for differences in hospitals’ payments, due to contractual agreements with third-party payers and other factors, and permits comparisons of resource use among hospitals with different rates of reimbursement.
- Ratio of risk-adjusted total costs to risk-adjusted standardized costs per discharge, calculated as the ratio of the benchmark total costs per discharge to the benchmark standardized costs per discharge. This ratio gives a baseline for the average price in terms of payments per resource unit, for a particular category of discharges, when resources are measured using standardized prices. It indicates, across all hospitals in the peer group, whether the price per resource unit, measured for that category of discharges is greater (if greater than 1.0), the same (if equal to 1.0) or less (if less than 1.0) than the average price across all discharges

Additionally, for each hospital, we report the 95% confidence interval for total costs per discharge. The confidence interval is compared with the benchmark value in order to determine whether the hospital’s costs are significantly different; that is, whether the benchmark falls outside the hospital’s confidence interval. The confidence interval is calculated assuming a T-distribution, for which the standard error is estimated as the standard deviation of residuals from the risk adjustment regression for all observations in the benchmark mean, divided by the square root of the number of discharges at a hospital.

In the detailed cost tables, we also present a set of benchmark statistics for each hospital, calculated separately for each MDC or aggregated MDC, by payer type, and across *all* hospitals in that hospital’s peer group. The following benchmark statistics are included in the detailed cost tables:

- Average length of stay in days, calculated by payer type, as the weighted mean length of stay across hospitals in the peer group and for a specific MDC/rolled-up MDC, weighted by the number of discharges at each hospital.
- Risk-adjusted total costs per discharge, calculated as the weighted average of risk-adjusted total costs for that MDC or group of MDCs across hospitals in the peer group, weighted by the number of observations per hospital.
- Risk-adjusted price-standardized costs per discharge for that MDC or group of MDCs, calculated as the weighted average across all hospitals in the peer group, but using standardized costs per discharge instead of total costs.
- Ratio of risk-adjusted total costs to risk-adjusted standardized costs per discharge, calculated as the ratio of the benchmark total costs per discharge to the benchmark standardized costs per discharge.
- Percentage of hospital total costs, calculated as the share of total payments to hospitals from a particular payer type that was accounted for by discharges under a given MDC or aggregated MDC, across all hospitals in the peer group.

Unlike the summary cost tables, the detailed tables do not include 95 percent confidence intervals for the hospital-specific total costs per discharge, although any statistically significant difference between a hospital's per discharge costs and the benchmark estimate is shown by an asterisk.

FINAL COST ANALYSIS (AND PAYER MIX ADJUSTMENT)

The final cost analysis for production of the Hospital Total Care cost reports incorporates the various analyses, adjustments, and decisions described above. Total care costs for inpatient admissions reflect facility payments to hospitals for inpatient acute hospital services from July 1, 2008 to June 30, 2009 (for Medicare claims, the time period is calendar year 2008). Costs include payments from third-party payers (Medicare, Medicaid and other state-funded programs, and commercial insurers or health plans), as well as payments for which covered individuals are responsible (prepayments, deductibles, co-insurance, or co-payments). Further, as described above, the analysis is based on costs attributed to each hospital, including costs of readmissions for specific conditions or procedures, and apply various adjustments—price standardization, outlier adjustment, application of reliability standards, as well as risk adjustment. Also, hospital cost calculations across the three payer types incorporate adjustments for payer mix. Specifically, the expected cost of discharges covered by a specific payer type at a hospital, as predicted by the risk adjustment model, is weighted by the share of discharges accounted for by that payer type at that hospital in order to derive the total expected cost, from which the adjusted cost across all discharges and across all payer types at that hospital can be calculated.

The final hospital total care cost analysis was performed for 49 PPS hospitals and 63 CAHs that met the criteria to receive hospital cost and quality reports. These hospitals, in effect, represent the peer groups for each hospital of a specific type (PPS or CAH). Starting with 53 PPS hospitals, we first dropped three children's hospitals from the PPS peer group. We next excluded a fourth hospital that did not meet the global minimum discharge threshold required to achieve reliability of 0.8 for at least one payer type and also did not meet requirements for a quality composite, leading to a final PPS peer group of 49 hospitals. Also, starting out with 78 CAHs, we dropped 15 hospitals that either did not meet the global minimum discharge threshold required to achieve reliability of 0.8 for at least one

payer type or did not have a quality composite (or failed both criteria), leading to a final CAH peer group of 63 hospitals.

MDH excluded certain hospitals up front from the peer grouping process, including VA hospitals and other government-owned hospitals, community health centers, and specialty hospitals (see Appendix Table 3 for a list of excluded hospitals). Also, one PPS hospital (Maple Grove Hospital) was excluded from the initial set of PPS hospitals, because it opened in December 2009 and did not yet have any medical claims in the data warehouse used for the analysis.

Appendix

Appendix Table 1. Information About Quality Measures Included in the Hospital Total Quality Score for MN Provider Peer Grouping (2011)

	Measure	Source	Data Collection Period	Risk Adjusted?	Minimum Cases
Process of Care					
AMI-1	Heart attack patients given aspirin at arrival	CMS	10/08-9/09	No	10
AMI-2	Heart attack patients given aspirin at discharge	CMS	10/08-9/09	No	10
AMI-3	Heart attack patients given ACEI or ARB for left ventricular systolic dysfunction	CMS	10/08-9/09	No	10
AMI-4	Heart attack patients given smoking cessation advice/counseling	CMS	10/08-9/09	No	10
AMI-5	Heart attack patients given beta blocker at discharge	CMS	10/08-9/09	No	10
AMI-8a	Heart attack patients given PCI w/in 90 min of arrival	CMS	10/08-9/09	No	10
HF-1	Heart failure patients given discharge instructions	CMS	10/08-9/09	No	10
HF-2	Heart failure patients given an evaluation of left ventricular systolic function	CMS	10/08-9/09	No	10
HF-3	Heart Failure Patients Given ACEI or ARB for left ventricular systolic dysfunction	CMS	10/08-9/09	No	10
HF-4	Heart Failure Patients Given Smoking Cessation Advice/Counseling	CMS	10/08-9/09	No	10
PN-2	PN Patients Assessed and Given Pneumococcal Vaccination	CMS	10/08-9/09	No	10
PN-3b	Pneumonia Patients Whose Initial ER Blood Culture Was Performed Prior to the Administration of the First Hospital Dose of Antibiotics	CMS	10/08-9/09	No	10
PN-4	Pneumonia Patients Given Smoking Cessation Advice/Counseling	CMS	10/08-9/09	No	10
PN-5c	Pneumonia Given Initial Antibiotic(s) w/in 6 hrs of Arrival	CMS	10/08-9/09	No	10
PN-6	PN Given the Most Appropriate Initial Antibiotic(s)	CMS	10/08-9/09	No	10
PN-7	PN Patients Assessed and Given Influenza Vaccination	CMS	10/08-9/09	No	10
SCIP-VTE-1	Surgery patients with recommended venous thromboembolism prophylaxis ordered	CMS	10/08-9/09	No	10
SCIP-VTE-2	Surgery patients who received appropriate VTE prophylaxis within 24 hours prior and 24 hours after surgery	CMS	10/08-9/09	No	10
SCIP-INF-1a	Surgery patients who received prophylactic antibiotic 1 hour prior to incision	CMS	10/08-9/09	No	10
SCIP-INF-2a	Surgery patients with appropriate prophylactic antibiotic selected	CMS	10/08-9/09	No	10
SCIP-INF-3a	Surgery patients with prophylactic antibiotics discontinued within 24 hours after surgery	CMS	10/08-9/09	No	10
SCIP-INF-4	Cardiac surgery patients with controlled postoperative blood glucose	CMS	10/08-9/09	No	10
SCIP-INF-6	Surgery patients with appropriate hair removal	CMS	10/08-9/09	No	10
SCIP-CARD-2	Surgery patients who were taking beta blockers who were kept on them	CMS	10/08-9/09	No	10
MHA	Ventilator associated pneumonia bundle compliance for ICU patients	MHA	7/09-6/10	No	3
MHA	Central line bundle compliance for ICU patients	MHA	7/09-6/10	No	3

	Measure	Source	Data Collection Period	Risk Adjusted?	Minimum Cases
Inpatient Complications					
PSI 3	Decubitus Ulcer (pressure ulcer)	MDH (AHRQ)	10/08-9/09	Yes	25
PSI 4	Death among surgical inpatients with serious treatable complications	MDH (AHRQ)	10/08-9/09	Yes	25
PSI 12	Postoperative pulmonary embolism or deep vein thrombosis	MDH (AHRQ)	10/08-9/09	Yes	25
PSI 18	Obstetric trauma - vaginal delivery with instrument	MDH (AHRQ)	10/08-9/09	Yes	25
PSI 19	Obstetric trauma - vaginal delivery without instrument	MDH (AHRQ)	10/08-9/09	Yes	25
MHA	HAI: SSI rate for vaginal hysterectomy	MHA	7/09-6/10	Yes	25
Mortality					
MORT-30-AMI	30-day mortality after hospital admission for heart attack	CMS	7/06-6/09	Yes	25
MORT-30-HF	30-day mortality after hospital admission for heart failure	CMS	7/06-6/09	Yes	25
MORT-30-PN	30-day mortality after hospital admission for pneumonia	CMS	7/06-6/09	Yes	25
IQI 11	Abdominal aortic aneurism (AAA) repair inpatient mortality rate	MDH (AHRQ)	10/08-9/09	Yes	25
IQI 12	Coronary Angioplasty bypass graft (CABG) inpatient mortality rate	MDH (AHRQ)	10/08-9/09	Yes	25
IQI 19	Hip fracture inpatient mortality rate	MDH (AHRQ)	10/08-9/09	Yes	25
IQI 30	Percutaneous transluminal coronary angioplasty (PTCA) inpatient mortality rate	MDH (AHRQ)	10/08-9/09	Yes	25
Readmissions					
READM-30-AMI	30-day readmission rate following hospital discharge for heart attack	CMS	7/06-6/09	Yes	25
READM-30-HF	30-day readmission rate following hospital discharge for heart failure	CMS	7/06-6/09	Yes	25
READM-30-PN	30-day readmission rate following hospital discharge for pneumonia	CMS	7/06-6/09	Yes	25

Appendix Table 2. ICD9CM Codes for Acute Myocardial Infarction (AMI), Congestive Heart Failure (CHF), Pneumonia, and Total Knee Replacement

ICD-9-CM	Description
AMI Codes	
410.00	AMI (anterolateral wall) – episode of care unspecified
410.01	AMI (anterolateral wall) – initial episode of care
410.10	AMI (other anterior wall) – episode of care unspecified
410.11	AMI (other anterior wall) – initial episode of care
410.20	AMI (inferolateral wall) – episode of care unspecified
410.21	AMI (inferolateral wall) – initial episode of care
410.30	AMI (inferoposterior wall) – episode of care unspecified
410.31	AMI (inferoposterior wall) – initial episode of care
410.40	AMI (other inferior wall) – episode of care unspecified
410.41	AMI (other inferior wall) – initial episode of care
410.50	AMI (other lateral wall) – episode of care unspecified
410.51	AMI (other lateral wall) – initial episode of care
410.60	AMI (true posterior wall) – episode of care unspecified
410.61	AMI (true posterior wall) – initial episode of care
410.70	AMI (subendocardial) – episode of care unspecified
410.71	AMI (subendocardial) – initial episode of care
410.80	AMI (other specified site) – episode of care unspecified
410.81	AMI (other specified site) – initial episode of care
410.90	AMI (unspecified site) – episode of care unspecified
410.91	AMI (unspecified site) – initial episode of care
CHF Codes	
402.01	Malignant hypertensive heart disease with congestive heart failure (CHF)
402.11	Benign hypertensive heart disease with CHF
402.91	Hypertensive heart disease with CHF
404.01	Malignant hypertensive heart and renal disease with CHF
404.03	Malignant hypertensive heart and renal disease with CHF & renal failure (RF)
404.11	Benign hypertensive heart and renal disease with CHF
404.13	Benign hypertensive heart and renal disease with CHF & RF
404.91	Unspecified hypertensive heart and renal disease with CHF
404.93	Hypertension and non-specified heart and renal disease with CHF & RF
428.xx	Heart failure codes
Pneumonia Codes	
480.0	Pneumonia due to adenovirus
480.1	Pneumonia due to respiratory syncytial virus
480.2	Pneumonia due to parainfluenza virus
480.3	Pneumonia due to SARS-associated coronavirus
480.8	Viral pneumonia: pneumonia due to other virus not elsewhere classified
480.9	Viral pneumonia unspecified
481	Pneumococcal pneumonia [streptococcus pneumoniae pneumonia]
482.0	Pneumonia due to klebsiella pneumoniae
482.1	Pneumonia due to pseudomonas
482.2	Pneumonia due to hemophilus influenzae (h. influenzae)
482.30	Pneumonia due to streptococcus unspecified
482.31	Pneumonia due to streptococcus group a
482.32	Pneumonia due to streptococcus group b
482.39	Pneumonia due to other streptococcus
482.40	Pneumonia due to staphylococcus unspecified
Pneumonia Codes (continued)	

ICD-9-CM	Description
482.41	Pneumonia due to staphylococcus aureus
482.49	Other staphylococcus pneumonia
482.81	Pneumonia due to anaerobes
482.82	Pneumonia due to escherichia coli [e.coli]
482.83	Pneumonia due to other gram-negative bacteria
482.84	Pneumonia due to legionnaires' disease
482.89	Pneumonia due to other specified bacteria
482.9	Bacterial pneumonia unspecified
483.0	Pneumonia due to mycoplasma pneumoniae
483.1	Pneumonia due to chlamydia
483.8	Pneumonia due to other specified organism
485	Bronchopneumonia organism unspecified
486	Pneumonia organism unspecified
487.0	Influenza with pneumonia
Total Knee Replacement Codes	
81.54	Total Knee Replacement
81.55	Revision of Knee replacement, NOS
81.59	Revision of joint replacement of lower extremity, not elsewhere classified
00.80	Revision of knee replacement, total (all components) Replacement of femoral, tibial, and patellar components (all components) Code also any removal of (cement) (joint) spacer (84.57) Excludes: revision of only one or two components (tibial, femoral or patellar component) (00.81-00.84)
00.81	Revision of knee replacement, tibial component Replacement of tibial baseplate and tibial insert (liner) Excludes: revision of knee replacement, total (all components) (00.80)
00.82	Revision of knee replacement, femoral component That with replacement of tibial insert (liner) Excludes: revision of knee replacement, total (all components) (00.80)
00.83	Revision of knee replacement, patellar component Excludes: revision of knee replacement, total (all components) (00.80)
00.84	Revision of total knee replacement, tibial insert (liner)

Appendix Table 3. Hospitals Initially Excluded from the Peer Grouping Process

Hospital Names

Bethesda Rehabilitation Hospital
Regency Hospital of Minneapolis
Phillips Eye Institute
Anoka Metro Regional Treatment Center
Brainerd Regional Human Services Center
Mayo Psychiatry and Psychology Treatment
Willmar Regional Treatment Center
Shriners Hospitals for Children
Veterans Affairs Medical Center
Veterans Affairs Medical Center
US Public Health Service - Red Lake
US Public Health Service - Cass Lake
Community Behavioral Health Hospital - Alexandria
Community Behavioral Health Hospital - Annandale
Community Behavioral Health Hospital - Fergus Falls
Community Behavioral Health Hospital - Rochester
Community Behavioral Health Hospital - St. Peter
Community Behavioral Health Hospital - Wadena
Community Behavioral Health Hospital - Baxter
Community Behavioral Health Hospital - Cold Spring
Community Behavioral Health Hospital - Bemidji
