

Hospital Report 2005: Complex Continuing Care
Clinical Utilization and Outcomes Technical Report

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Purpose of this Document

This Technical Report aims to expand on specifics of methodology that would have been too detailed for inclusion in *Hospital Report 2005: Complex Continuing Care* (referred to as “the Report”). Where sufficient detail exists in the Report it is not repeated here.

Indicator Selection

Clinical performance indicators for this 2005 Report were originally presented in Hospital Report 2003: Complex Continuing Care. For details about the development of many of these indicators and ongoing research in this area, please consult the web site of the “MegaQI project” (Final Report at http://www.cms.hhs.gov/quality/nhqi/PAC_QM_FinalReport.pdf), sponsored by the Centers for Medicare and Medicaid Services, of the federal government of the USA (<http://cms.hhs.gov/quality/nhqi>). Details of the methods and findings of that research can be found in several documents at that web site and much of it now also can be found in the scientific literature.

An important component of the MegaQI project was an extensive project undertaken to evaluate the validity of the clinical performance indicators based on the RAI-Minimum Data Set (MDS) data. In that study, hypotheses were developed concerning the correlation of the indicators to various validation elements. The validation elements included structures, processes or actions that, according to the hypotheses, facilities would use to prevent or respond to the clinical issues addressed in an indicator. For example, to validate a pressure ulcer indicator, hypotheses predicted correlations to such validation elements as use of skin breakdown risk screening, use of skin treatment protocols, programs to implement and monitor individualized prevention interventions. The validation elements were measured by means of direct observation, management surveys, and medical record reviews. The study also involved an extensive examination of the inter-rater reliability of items used in calculation of the indicators, comparing assessments by a research nurse to those routinely conducted by staff nurses. The study involved over 200 long-term care facilities in six States in the USA.

In addition, for the first time, a Women’s Health section is integrated into the Complex Continuing report. This section includes all indicators in the Clinical Utilization and Outcomes quadrant stratified by sex¹. Sex-stratified data and analyses are provided at a provincial level in the Executive Report, and at a hospital and aggregate levels (i.e. peer group, regional and provincial) in the E-Scorecard.

¹ Sex is biological maleness and femaleness. Gender is made up of multiple dimensions, and reflects the interaction of sex with other economic, cultural, environmental, social characteristics (e.g., age, income, ethnicity, social support), as well as roles ascribed to the sexes, and relations between the sexes. Because of the limited availability of other gender-related variables in routinely collected hospital data, the analysis is limited to sex. Pursuing gender-based analysis is an important long-term goal.

Indicator Calculation

Data Cleaning and Preparation

The following table describes the data cleaning applied to the Continuing Care Reporting System (CCRS) data cut received from the Canadian Institute for Health Information for this project and the associated record counts. The section on Risk Adjustment later in this document gives more detail concerning how the records were arranged for calculation of the indicators and risk-adjustment.

The CCRS consists of several related data files. All patient stays are captured with Admission and Discharge Tracking Forms – the data of which is kept in the Admissions File of the CCRS. Hospital clinical staff performs clinical assessments and collect data using the RAI-MDS assessment tool. These data are stored in files referred to here as Assessment Files. Patients with very short lengths of stay in complex continuing care (less than 14 days) often do not get assessed using the MDS tool (it is only mandatory for patients who stay 14 days or more). These patient stays will have a record in the Admissions File, but will not have any assessment data in the Assessment Files corresponding to that stay. For calculation of the performance indicators only the MDS Assessment File records were used. However, for the system-level descriptive analyses comparing demographics and admission source/discharge destination between short-stay and chronic patients, the Admission File and Assessment File data were combined into a combined data set.

Table 1: Data Cleaning and Record Counts: CCRS data cut containing data from July 1996 to end of fiscal year 2003/04

Data Cleaning Step	Records Remaining in Data Set
Total Number of records in the CCRS data cut (includes full information for patients with RAI/MDS assessment records and admission/discharge information records for patients without assessments):	295,246
Exclusion 1: <ul style="list-style-type: none"> • invalid health card number • assessment before July 1, 1996 • assessment after March 31, 2004 • assessment before admission • discharge before admission • assessment before date of birth 	284,923
Exclusion 2: Remove the following Facilities: <ul style="list-style-type: none"> • Bloorview-MacMillan, • Queensway Carleton (Nepean) • Deep River Hospital • Grace Hospital (Windsor) • Scarborough General Hospital • St. Joseph's Hospital (Toronto) • Hogarth-Westmount • Pembroke Civic Hospital 	281,443

Data Cleaning Step	Records Remaining in Data Set
Exclusion 3: <ul style="list-style-type: none"> Data Cleaning No Full Assessment found If quarterly assessment first or in the same day as full assessment If quarterly assessment done more than 300 days from full assessment If admission date is before July 1, 2002 and since then, no assessment done and no discharge date reported 	278,541
Number of Assessment Records remaining after above steps	244,452
Keep only the last assessment completed for each patient in each fiscal quarter. <ul style="list-style-type: none"> These records were used to calculate indicators 	238,539

Table 2: Number of CCRS Records after Exclusions and Data Cleaning, by Year

Year	All Cleaned CCRS Records	Cleaned Records that have RAI/MDS Assessment	Cleaned Records with no associated RAI/MDS Assessment	Assessment Records Available for Indicator Calculation (last assessment per quarter)
Jul 1996 – Apr 1997	29,865	25,472	4,383	24,999
Fiscal 1997/98	35,115	30,985	4,130	30,306
Fiscal 1998/99	36,225	31,474	4,751	30,830
Fiscal 1999/00	35,593	31,486	4,107	30,855
Fiscal 2000/01	35,433	31,270	4,173	30,489
Fiscal 2001/02	36,017	31,993	4,024	31,094
Fiscal 2002/03	34,906	30,927	3,979	30,180
Fiscal 2003/04	35,387	30,845	4,542	29,786
Total	278,541	244,452	34,089	238,539

The 80-day rule for prevalence-type indicators

When calculating the prevalence-type indicators, a MDS assessment was only included if the assessment reference date (A3) was at least 80 days after the admission date for the patient stay during which the assessment was completed. This rule was used in order to ensure that the indicator reflects the status of patients only after they have been continuously in the care of the complex continuing care provider for a considerable period of time and thus can be more clearly attributed to care provided in the complex continuing care setting.

The rule regarding the 45 to 165 day interval between MDS assessments for calculation of change-type indicators

The “incidence”-type indicators are meant to reflect change in status from one fiscal quarter to the next (over an approximately 90 day period). Assessments of chronic patients will typically be completed approximately 90-92 days apart. However, due to transfers out of the facility,

sudden changes in patient status (leading to a “significant change” assessment), assessor error, or other events that disrupt the assessment schedule, the interval between assessments in contiguous fiscal quarters is not always at that optimal spacing. The 45 to 165 day rule was developed during the MegaQI study to include a maximal number of patients while ensuring that the indicator reflects change over a reasonably consistent risk period between measurements. In order to preserve comparability, we adopted the same rule to maintain consistency with the indicator calculation methodology being applied in the USA.

Patient Categories

Two categories of patients were defined for Hospital Report - Complex Continuing Care: chronic patients and short-stay patients. Twelve of the 13 clinical indicators applied to the chronic patient population, which comprised just under one-third of patients during a year. The inclusion criteria for “chronic” patients were

- the patient must have at least two MDS assessments, one in each of two contiguous fiscal quarters, OR
- the patient must have at least two MDS assessments within 5 fiscal quarters of each other and have qualified for inclusion in at least one of the chronic patient indicators (namely, the patient had at least one MDS assessment greater than 80 days after a date of entry to the complex continuing care program at a hospital)

The inclusion criteria for “short-stay” patients were

- the patient must have at most one MDS assessment associated with any given stay and that assessment must be an admission Full assessment;
- a stay must be separated by more than 90 days on either side (prior to the admission and after the discharge) from any other complex continuing care stay of the same patient in the same hospital;
 - a stay is the period during which the patient is continuously in the complex continuing care program from the date of entry to a date of separation;
 - two stays that arise due to a temporary transfer out and a single re-entry can be counted as a single “stay” for purposes of the short-stay patient definition as long as the combined “stay” adheres to the first two criteria.

Risk-Adjustment

A technical description is given here of the mechanics of calculating the risk-adjusted indicator values with only a limited and simplified discussion of the theory behind the process. For further details on the theory the reader is referred to Section 7 of the document “Identification and Evaluation of Existing Quality Indicators that are Appropriate for Use in Long-Term Care Settings” available at http://cms.hhs.gov/quality/nhqi/task2_final.pdf. (This file confirmed available on September 29, 2005).

The risk-adjusted indicators as calculated for the Report are “indirectly standardized” values. In essence, a ratio of the raw (observed) indicator value to the expected indicator value (from a predictive model based on the risk-adjustment covariates) is calculated for each hospital. This ratio can be called the “performance ratio”.

- If the performance ratio (observed/expected indicator values) has a value greater than one (> 1) this indicates that the hospital had poorer performance on the indicator than would be predicted on the basis of the patient characteristics described by the risk-adjustment covariates.
- If the performance ratio has a value less than one (< 1) it indicates that the hospital had better performance on the indicator than would be predicted based on the patient characteristics.

To calculate the risk-adjusted indicator value for a hospital, the performance ratio is multiplied by a “standard” indicator value in common to the population of hospitals for which the risk-adjusted indicator is being calculated. The “standard” used in calculating the risk-adjusted indicators for *Hospital Report 2005: Complex Continuing Care* was the overall provincial expected value, calculated as the average of all hospitals’ observed indicator values, weighted by the number of records contributed by each (the “provincial average”).

Thus, if a hospital had performed worse than expected based on the risk profile of its patients, the risk-adjusted indicator value would be higher than the “standard” (provincial average), because a performance ratio value of greater than one (> 1) would be multiplied by the standard value. If a hospital had better performance than expected, based on the risk profile of its patients, the ratio would be less than one (< 1) and the risk-adjusted indicator value would be less than the provincial average. If a hospital had a raw indicator value equal to the value predicted by the risk-adjustment model, the hospital’s adjusted indicator value would be equal to the all hospitals’ average. In this way, the indicator value reported in the Report is adjusted to reflect hospitals’ performance relative to the different risk profiles of their patient populations.

The description above describes the essence of the process of how the risk-adjusted indicators were calculated. Unfortunately the actual process is not quite as direct as that because extreme values of the performance ratio, when multiplied by the all hospitals’ average indicator value, may result in adjusted indicator values greater than one (or greater than 100%, if expressed as a percentage). For this reason, the calculation described above is done on a transformed scale that will not permit values of the risk-adjusted indicator score to exceed one (or 100%). For Hospital Report, we used the Probit transformation and calculated the risk-adjusted indicator in terms of values of the Normal distribution (Z-scores), then back transformed the result to obtain the final risk-adjusted indicator value.

In *Hospital Report 2005: Complex Continuing Care* indicators in all of the balanced scorecard quadrants were calculated and reported at the level of hospital corporations. This was a level of analysis and reporting that could be achieved across all quadrants, given that many multi-site hospitals report financial data to the Ontario Ministry of Health and Long-Term Care at a corporate level, not all multi-site hospitals have site-specific reporting numbers for their clinical (MDS) data, and the data for the other two quadrants were generally collected at the corporation level. Therefore, when different sites of multi-site hospital corporations had separate facility numbers in the OCCPS (MDS) data base, we combined the data from all sites under a single

corporation identifier in order to calculate the clinical indicators at the corporation-level. References to a “hospital”, in the description of risk-adjusted indicator calculation below, refers to a hospital corporation.

The following details the steps required to calculate risk-adjusted Clinical Utilization and Outcomes (CUO) quadrant indicator values for a given fiscal year. In order to simplify the description, the calculation of risk-adjusted indicator values for 2003/2004 is given as an example.

- Steps 1 to 8 relate to the development and analyses of a MDS record-level data base.
 - Steps 9 and 10 involve analyses of data in the record-level data base to create a hospital-level data base.
 - Steps 11 to 13 involve analyses within the hospital-level data base.
1. Create an analysis data base containing all MDS records from fiscal years 2002/03 through 2003/2004 after all data cleaning rules are applied.
 2. Each record should contain:
 - a. all the relevant MDS items needed for indicator calculation and risk-adjustment covariates;
 - b. the carried forward values for MDS items that are needed for the risk-adjustment covariates or for indicator calculation from the MDS assessment immediately prior to each MDS assessment in fiscal years 2002/2003 and 2003/2004. (If the prior MDS is a Quarterly assessment and the needed item is not found in Quarterly assessments, it is carried forward from the most recent prior Full assessment). These carried forward MDS items are held in a record as new variables (named with the prefix “pre” before the item name).
 3. Keep for further analysis only one record (the last) per patient in each fiscal quarter in the data set. (In relatively rare instances individual patients have more than one assessment in a fiscal quarter. This step ensures that only one record per patient per fiscal quarter is included in the indicator calculations)
 4. Use indicator definition algorithms to determine for each MDS assessment record in the analysis data set whether the record will be counted in the numerator, denominator or both for the CUO indicator. The indicator definition algorithms can be found in Appendix F of Hospital Report 2003: Complex Continuing Care (available at www.hospitalreport.ca). At this point all records will have the following:
 - a. the raw MDS data specified in 2a and 2b above, plus
 - b. two (2) binary variables for each clinical indicator; one indicating whether or not the record is counted in the numerator, the other indicating whether or not the record is counted in the denominator. These will be called the numerator and denominator “counter” variables. They have values of zero (0) or one (1).
 5. Calculate the risk-adjustment covariates for each record, using the MDS items carried forward from the previous (or prior Full) assessments. Algorithms defining the covariates used for each indicator are given in Appendix F of Hospital Report 2003: Complex Continuing Care (available at www.hospitalreport.ca).

6. For developing the risk-adjustment models, select one record per patient from the fiscal year prior to the year for which you are calculating risk-adjusted indicators (In this case, we were calculating indicators based on the fiscal year 2003/04 data, so risk-adjustment models were based on records selected from the 2002/03 data). If an individual patient has more than one MDS record in the year, use random selection to select only one record.
7. Run an ordinary logistic regression model with the selected records from 2002/2003, regressing the binomial outcome variable (which indicates whether or not that record is counted or is not counted in the indicator numerator) on the risk-adjustment covariates.
8. Calculate a predicted numerator counter variable for each record in 2003/04 (the target year) by “plugging in” the values of the risk-adjustment covariates from the target year MDS records into the logistic regression model equation derived from the previous year’s data (step 6). The predicted numerator counter variable can be any value between zero (0) and one (1).
 - a. That is, the regression parameters from step 6 are multiplied by their respective covariate values in the 2003/04 records and are summed to obtain the logit of the predicted status of the record with respect to the numerator of the clinical indicator. The logit is then transformed to a proportion (value between zero and one).
9. Calculate the observed indicator value for each hospital in 2003/04:
 - a. Calculate the numerator = sum of the numerator counter variable across all records for that hospital in the year.
 - b. Calculate the denominator = sum of the denominator counter variable across all records for that hospital in the year.
 - c. Divide numerator by denominator.
 - d. Save the observed indicator value in a hospital-level data file
10. Calculate the predicted (expected) indicator value for each hospital in 2003/04:
 - a. Numerator = average of the predicted numerator counter variable values (from step 8) across all records for that hospital in the year
 - b. Denominator = sum of the denominator counter variable (which has value of one for all records having a valid value in the predicted numerator counter) across all records for that hospital in the year.
 - c. Divide numerator by denominator.
 - d. Save the observed indicator value in the hospital-level data file
11. Calculate the “standard” indicator value as the weighted average of all hospitals’ observed indicator values. Technically, this is done by summing the numerator counter variable (from Step 4) across all MDS assessment records in the data set and then dividing by the total number of assessments. Assign this value to all records of the hospital-level data file.
12. Apply the Probit transformation to the observed (9d), expected (10d) and standard (11) indicator values.

13. Calculate the adjusted indicator for each hospital as follows:
- Probit (adjusted) = Probit (observed) – Probit (expected) + Probit (standard)
 - Calculate the risk-adjusted indicator value by back-transforming the Probit (adjusted) to get a proportion value again. The Probit (adjusted) is a value of the Z distribution (standard Normal). The back-transformation involves identifying the total proportion of the Normal distribution under the curve at a Z-value equal to Probit (adjusted).
 - Where the observed indicator value = zero, the risk-adjusted indicator value is set to = zero (0). Where the observed indicator value = one, the adjusted value is set to = one (1).

Risk-Adjustment Covariates

The definitions for the covariates used in risk-adjustment models are given in Appendix F of Hospital Report 2003: Complex Continuing Care. The following erratum for that table is noted here:

The following covariate was listed in that Appendix but not defined:

Indicator: Percent of Chronic Patients with New Stage 2 or Greater Skin Ulcers

Covariate: Dependence in transfers

Definition: Covariate = 1 if MDS item G1bA = 3, 4, or 8
Covariate = 0 if G1bA = 0, 1, or 2

Goodness of Fit of Risk-Adjustment Regression Models

Statistics on the goodness of fit and predictive accuracy of the logistic regression models used in risk-adjustment for each risk-adjusted indicator are given in Appendix 1 of this Technical Report.

Performance Allocation

In *Hospital Report 2005: Complex Continuing Care*, three levels of shading designated whether a hospital's performance on each indicator was above average, average or below average. Hospitals had to have an effective sample size of at least 30 to be included in the performance allocation process. Only hospitals who volunteered to participate in Hospital Report were included in the hospital-specific reporting. However, data from all hospitals with MDS data available in the CCRS were used to calculate the provincial average used in the calculation of the risk-adjusted indicators and to which hospitals' performance was compared.

Effective Sample Size

In order to maximize sample size and precision of the indicator estimates the indicator denominator was based on all available MDS assessment records for each patient during a given fiscal year, up to a maximum of four per patient (one per fiscal quarter). This produces an annualized indicator value that is the same as a weighted average of indicator values calculated separately for each fiscal quarter. (Recall that the MDS assessment is generally done once per quarter on all patients.) Indicators based on MDS data have been calculated this way in all Hospital Report: Complex Continuing Care reports and in reports published by the Canadian Institute for Health Information.

The effective sample size (ESS) was the sample size used in calculating the confidence interval for an indicator. It was not always the same as the denominator used to calculate the indicator; for some indicators it was a smaller value. Statistical theory and formulae for the calculation of confidence intervals assume that each observation in the sample is independent of the others. However, since multiple observations from individual patients are included in the calculation of an indicator, the assumption of independence may not hold because an individual's status on the indicator may be similar across their multiple observations. Therefore, determination of the ESS for a given indicator was based on consideration of the degree of independence among the multiple observations on individuals. Independence of observations was measured by the correlation of the indicator status (that is, correlation of the numerator counter variable) between observations of individual patients.

For the "prevalence-type" indicators for chronic patients (numbers 5, 8, 9, 11, 12) the correlation of the indicator status variable between observations (MDS assessments) within individuals was generally strong (rho in the range of 0.6 to 0.8). For the "incidence-type" indicators (numbers 1, 2, 3, 4, 6, 7, 10) the correlation between separate observations of a patients' status on the indicator was weak or non-existent (rho less than 0.15). On the basis of this analysis, the multiple observations for individuals could not be considered independent of each other for the prevalence-type indicators, but could be considered independent for the change-type indicators. Therefore, the number of observations to use in the formula to calculate confidence intervals (the ESS) was as follows:

- For prevalence-type indicators: the count of patients included in the indicator calculation;
- For incidence-type indicators: the actual indicator denominator (number of MDS assessment records)

Assigning Performance Classifications

Two criteria were used to assess each hospital's performance relative to the other hospitals on each indicator. First, a determination was made of whether or not the hospital's indicator value was statistically different from the provincial average. If a hospital's indicator value was statistically different than the provincial average in the direction that is considered better performance (i.e., lower values than average value, except for the ADL Improvement indicator) this was sufficient to assign the hospital to the above average performance category. However, the criterion of statistical difference alone was considered insufficient when designating hospitals as having below average performance.

The calculation of the width of the confidence interval depends heavily on sample size; the greater the sample (denominator) size, the narrower the confidence interval. Given equal-sized differences from the average indicator value, a hospital with a larger sample size (narrower confidence interval) is more likely to be found significantly different from the average. Given the wide range of complex continuing care programs at hospitals in the province, there were dramatically different sample sizes for the indicators. Therefore, in order not to "penalize" hospitals from which larger samples of data were available, a second criterion, described below, was used for assigning hospitals to the below average performance category.

Procedure for Determination of a Hospital's Performance Category

1. Calculate the provincial average indicator value as the average of hospital scores, weighted by the number of assessments from each hospital.
2. For prevalence-type indicators, calculate the 95% confidence interval around the indicator value using the number of patients included in the indicator calculation as the ESS.
3. For change-type indicators, calculate the 95% confidence interval around the indicator value using the number of MDS records included in the indicator calculation (the denominator) as the ESS.
4. At this point, proceed in the performance allocation process only with hospitals that have an ESS of 30 or more. Hospitals with smaller sample sizes will have confidence intervals that are much too wide.
5. If the hospital risk-adjusted indicator value was on the "better performance" side of the provincial average and the 95% confidence interval did not include the provincial average, the hospital was said to have a significantly above average performance.
6. If the hospital risk-adjusted indicator value was on the "worse performance" side of the provincial average and the 95% confidence interval did not include the provincial average, the hospital was considered to have potentially below average performance. Steps 8 and 9 were done to determine whether the hospital was allocated to the below average performance category.
7. If neither condition #5 nor #6 are true, the hospital was designated as having average performance
8. Define the low performance cut-point as the highest indicator score (lowest, in the case of the ADL Improvement indicator) among the hospitals identified in step 7 (those with indicator value not statistically discernible from the all hospitals' average). Recall, higher scores are reflective of poorer performance, except for indicator #1.
9. Hospitals that met the condition of step #6 were assigned the below average designation if the hospital's indicator value was further from the provincial average than the low performance cut-point.

The following table below shows for which indicators the effective sample size (ESS) was based on the indicator denominator (number of MDS assessments included in the indicator calculation) and for which it was based on the number of patients represented in the indicator denominator. The table also shows the number of hospitals that had at least the minimum ESS for inclusion in the performance allocation process, the range of the ESS and the low performance cut-point, for each indicator.

Table 3: Performance Allocation: Effective Sample Size (ESS) and the Low Performance Cut-Point

Indicator	Basis of Effective Sample Size	Number of Hospitals with ESS of 30 or more	Smallest ESS	Largest ESS	Low Performance Indicator Value Cut-Point
Improve ADL	assessments	33	30	521	14.8
Decline Wheel/Walk	assessments	36	30	644	24.9
More Depress/Anxious	assessments	64	30	1215	34.2
Decline Communication	assessments	56	30	1092	22.9
Indwelling Catheter	patients	39	31	384	27.9
Decline Bladder Continence	assessments	47	31	636	32.2
New Fallers	assessments	56	31	1173	9.7
Pain (chronic patients)	patients	42	30	425	44.0
Pressure Ulcer	patients	42	30	425	32.7
New Skin Ulcer	assessments	58	30	1030	14.4
Physical Restraints	patients	42	30	425	27.9
Antipsychotics	patients	38	30	376	35.2
Pain (short-stay patients)	patients	49	30	619	55.5

Reporting Results (by sex) for Women's Health

Provincial-level means for the hospital-specific indicators (stratified by sex) described in this summary were included in the women's health section of the Executive Report. In addition, the Report included an analysis of the rates for women and men, the values of the differences between women and men on mean rates and the statistical significance of these differences at a provincial level. The indicator quantifying the difference between rates for women and men [i.e. $(F-M)/F$] is the value of the difference between women and men attributable to sex - or a value for "equity". At initial release, the E-scorecard included hospital-level risk-adjusted means and components by sex for each indicator. As the E-scorecard is updated, it will include the sex difference values $[(F-M)/F]$ for each indicator and an indication of the direction (i.e. $F>M$ or $M>F$) and the statistical significance of these values at a hospital level. In the interim, participating hospitals will be able to access their own and other hospitals' difference values and the direction (i.e. $F>M$ or $M>F$) and statistical significance of these differences for each indicator on a password-protected database at <http://www.hospitalreport.ca/participants.html> (see Women's Health - Complex Continuing Care 2005).

The interpretation of these data and notes about suppression will accompany this database. In terms of interpretation, if this value [i.e. $(F-M)/F$] is negative (i.e. it may be the full range of negative values to infinity), males have higher rates than females; if this value is positive (i.e. it may be positive up to a value of 1), females have higher rates than males. A value of "0" is used as the benchmark as it represents true equity between women and men. Furthermore, if a hospital's 95% confidence interval around their specific value of the difference between women and men for a given indicator includes zero, then the hospital is said to have no statistically significant sex difference for that indicator (which is preferred). If a hospital's 95% confidence interval around their specific value of the difference between women and men for a given

indicator does not include zero and is negative, then the hospital is said to have unequal (i.e. $M > F$) performance or a statistically significant sex difference, in which males have a higher rates than females. If a hospital's 95% confidence interval around their specific value of the difference between women and men for a given indicator does not include zero and is positive, then the hospital is said to have unequal ($F > M$) performance or a statistically significant sex difference, in which females have a significantly higher rate than males.

The Executive Report also indicated whether high performing hospitals have statistically significant sex differences across indicators, including those in the Clinical Utilization and Outcomes quadrant.

Appendix 1: Model Fit Statistics for Risk-Adjustment Logistic Regression Models

Percent of Chronic Patients with Rehabilitation Potential Who Improved in Activities of Daily Living

adli_03 model 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	2352.056	2316.473
SC	2357.584	2344.112
-2 Log L	2350.056	2306.473

Association of Predicted Probabilities and Observed Responses

Percent Concordant	58.1	Somers' D	0.197
Percent Discordant	38.4	Gamma	0.204
Percent Tied	3.5	Tau-a	0.087
Pairs	760608	c	0.599

adli_03 model 2003 data, 2002 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	5608.780	5545.515
SC	5615.223	5577.731
-2 Log L	5606.780	5535.515

Association of Predicted Probabilities and Observed Responses

Percent Concordant	56.5	Somers' D	0.163
Percent Discordant	40.3	Gamma	0.168
Percent Tied	3.2	Tau-a	0.067
Pairs	4455240	c	0.581

Percent of Chronic Patients Who Declined in Their Ability to Walk or Wheel Themselves

locw_03 model 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	2223.776	2206.696
SC	2229.462	2246.499
-2 Log L	2221.776	2192.696

Association of Predicted Probabilities and Observed Responses

Percent Concordant	51.9	Somers' D	0.140
Percent Discordant	37.9	Gamma	0.155
Percent Tied	10.1	Tau-a	0.046
Pairs	778877	c	0.570

locw_03 model 2003 data, 2002 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	5451.628	5395.141
SC	5458.314	5441.943
-2 Log L	5449.628	5381.141

Association of Predicted Probabilities and Observed Responses

Percent Concordant	53.5	Somers' D	0.163
Percent Discordant	37.2	Gamma	0.180
Percent Tied	9.3	Tau-a	0.047
Pairs	5008608	c	0.582

Percent of Chronic Patients Who Declined in Their Ability to Communicate

commw_03 model 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
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AIC	4047.244	4010.197
SC	4053.708	4068.371
-2 Log L	4045.244	3992.197

Association of Predicted Probabilities and Observed Responses

Percent Concordant	52.4	Somers' D	0.167
Percent Discordant	35.7	Gamma	0.190
Percent Tied	12.0	Tau-a	0.043
Pairs	2900996	c	0.584

commw_03 model 2003 data, 2002 betas
Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	10109.164	9984.763
SC	10116.557	10051.306
-2 Log L	10107.164	9966.763

Association of Predicted Probabilities and Observed Responses

Percent Concordant	52.6	Somers' D	0.165
Percent Discordant	36.0	Gamma	0.187
Percent Tied	11.4	Tau-a	0.042
Pairs	18280512	c	0.583

Percent of Chronic Patients with Indwelling (Urinary) Catheters

cath_03 model 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	3256.684	2924.138
SC	3262.972	2968.158
-2 Log L	3254.684	2910.138

Association of Predicted Probabilities and Observed Responses

Percent Concordant	69.4	Somers' D	0.419
Percent Discordant	27.6	Gamma	0.432
Percent Tied	3.0	Tau-a	0.102
Pairs	1931192	c	0.709

Hospital Report 2005: Complex Continuing Care

cath_03 model 2003 data, 2002 betas
Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	8745.889	7549.503
SC	8753.187	7600.586
-2 Log L	8743.889	7535.503

Association of Predicted Probabilities and Observed Responses

Percent Concordant	73.5	Somers' D	0.495
Percent Discordant	24.0	Gamma	0.507
Percent Tied	2.4	Tau-a	0.118
Pairs	14132318	c	0.748

Percent of Chronic Patients Whose Bladder Continence Worsened

wblc_03 model 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	2908.854	2861.739
SC	2914.751	2956.095
-2 Log L	2906.854	2829.739

Association of Predicted Probabilities and Observed Responses

Percent Concordant	60.7	Somers' D	0.223
Percent Discordant	38.4	Gamma	0.225
Percent Tied	0.9	Tau-a	0.079
Pairs	1284849	c	0.611

wblc_03 model 2003 data, 2002 betas
Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	7057.591	6915.774
SC	7064.447	7025.476
-2 Log L	7055.591	6883.774

Association of Predicted Probabilities and Observed Responses

Hospital Report 2005: Complex Continuing Care

Percent Concordant	60.5	Somers' D	0.222
Percent Discordant	38.4	Gamma	0.224
Percent Tied	1.1	Tau-a	0.071
Pairs	7929660	c	0.611

Percent of Chronic Patients Who Fell Within 30 Days Prior to Assessment (without previous recent history of falls)

falls_03 model 2002 data

Model Fit Statistics

Criterion	Intercept and Covariates	
	Intercept Only	Intercept and Covariates
AIC	1920.433	1693.084
SC	1926.959	1745.297
-2 Log L	1918.433	1677.084

Association of Predicted Probabilities and Observed Responses

Percent Concordant	74.4	Somers' D	0.558
Percent Discordant	18.6	Gamma	0.600
Percent Tied	7.1	Tau-a	0.050
Pairs	1144542	c	0.779

falls_03 model 2003 data, 2002 betas
 Model Fit Statistics

Criterion	Intercept and Covariates	
	Intercept Only	Intercept and Covariates
AIC	4372.561	3928.219
SC	4380.087	3988.422
-2 Log L	4370.561	3912.219

Association of Predicted Probabilities and Observed Responses

Percent Concordant	73.3	Somers' D	0.529
Percent Discordant	20.4	Gamma	0.565
Percent Tied	6.4	Tau-a	0.038
Pairs	6753792	c	0.764

Percent of Chronic Patients with Disruptive or Severe Pain

Pain_03 model 2002 data

Model Fit Statistics

Hospital Report 2005: Complex Continuing Care

Criterion	Intercept Only	Intercept and Covariates
AIC	6400.424	6265.785
SC	6406.942	6317.931
-2 Log L	6398.424	6249.785

Association of Predicted Probabilities and Observed Responses

Percent Concordant	53.7	Somers' D	0.206
Percent Discordant	33.0	Gamma	0.238
Percent Tied	13.3	Tau-a	0.092
Pairs	5599096	c	0.603

Pain_03 model 2003 data, 2002 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	16812.891	16256.940
SC	16820.408	16317.080
-2 Log L	16810.891	16240.940

Association of Predicted Probabilities and Observed Responses

Percent Concordant	55.7	Somers' D	0.245
Percent Discordant	31.2	Gamma	0.282
Percent Tied	13.1	Tau-a	0.105
Pairs	39463200	c	0.623

Percent of Chronic Patients with Pressure Ulcers

pulcer_03 model 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	5332.298	5178.860
SC	5338.818	5283.174
-2 Log L	5330.298	5146.860

Association of Predicted Probabilities and Observed Responses

Hospital Report 2005: Complex Continuing Care

Percent Concordant	62.2	Somers' D	0.254
Percent Discordant	36.8	Gamma	0.256
Percent Tied	1.0	Tau-a	0.088
Pairs	4364580	c	0.627

pulcer_03 model 2003 data, 2002 betas
Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	14542.630	13896.228
SC	14550.150	14016.551
-2 Log L	14540.630	13864.228

Association of Predicted Probabilities and Observed Responses

Percent Concordant	64.4	Somers' D	0.297
Percent Discordant	34.7	Gamma	0.300
Percent Tied	0.9	Tau-a	0.104
Pairs	32417847	c	0.648

Percent of Chronic Patients with New Stage 2 or Greater Skin Ulcers

newulcerold model - 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	2451.147	2417.098
SC	2457.593	2475.109
-2 Log L	2449.147	2399.098

Association of Predicted Probabilities and Observed Responses

Percent Concordant	54.5	Somers' D	0.186
Percent Discordant	36.0	Gamma	0.205
Percent Tied	9.5	Tau-a	0.025
Pairs	1479016	c	0.593

newulcerold model - 2003 data, 2002 betas
Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
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Hospital Report 2005: Complex Continuing Care

AIC	5503.620	5305.329
SC	5511.049	5372.193
-2 Log L	5501.620	5287.329

Association of Predicted Probabilities and Observed Responses

Percent Concordant	58.9	Somers' D	0.280
Percent Discordant	30.9	Gamma	0.312
Percent Tied	10.3	Tau-a	0.031
Pairs	8444160	c	0.640

Percent of Chronic Patients on Antipsychotic Medication without a Diagnosis of Psychosis

apsy_03 model 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	805.137	721.492
SC	809.837	787.285
-2 Log L	803.137	693.492

Association of Predicted Probabilities and Observed Responses

Percent Concordant	72.4	Somers' D	0.476
Percent Discordant	24.8	Gamma	0.490
Percent Tied	2.8	Tau-a	0.150
Pairs	103827	c	0.738

apsy_03 model 2003 data, 2002 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	5053.929	4362.031
SC	5060.298	4451.203
-2 Log L	5051.929	4334.031

Association of Predicted Probabilities and Observed Responses

Percent Concordant	73.9	Somers' D	0.505
Percent Discordant	23.4	Gamma	0.519
Percent Tied	2.7	Tau-a	0.200
Pairs	3687150	c	0.752

Percent of Short-Stay Patients with Disruptive or Severe Pain

Pain_03 shortstay model calendar 2002 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	12633.257	12431.679
SC	12640.383	12495.809
-2 Log L	12631.257	12413.679

Association of Predicted Probabilities and Observed Responses

Percent Concordant	51.5	Somers' D	0.148
Percent Discordant	36.7	Gamma	0.168
Percent Tied	11.8	Tau-a	0.073
Pairs	20861787	c	0.574

Pain_03 shortstay model calendar 2002 data
 Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	9937.246	9734.820
SC	9944.128	9796.754
-2 Log L	9935.246	9716.820

Association of Predicted Probabilities and Observed Responses

Percent Concordant	52.9	Somers' D	0.172
Percent Discordant	35.7	Gamma	0.194
Percent Tied	11.4	Tau-a	0.085
Pairs	12874960	c	0.586