

*Hospital Report e-Scorecard 2006: Complex Continuing Care*

**Clinical Utilization and Outcomes Technical Report**

This technical document has been modified by Surabhi Pandey and Rita Susanto for the 2006 analysis. Acknowledgement is given to Gary Teare, Natalie Rashkovan, and Geta Cernat, the original authors of the 2005 version of this technical document.

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## Purpose of this Document

This Technical Report aims to provide specifics of methodology that was used to calculate clinical indicators for *Hospital Report e-Scorecard 2006: Complex Continuing Care* Clinical Utilization and Outcomes quadrant (referred to as “e-Scorecard” in this document).

## Indicator Selection

Clinical performance indicators for this 2006 e-Scorecard 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.interrai.org/applications/qireport2.pdf>), sponsored by the Centers for Medicare and Medicaid Services, of the federal government of the USA (<http://cms.hhs.gov/quality/nhqj>). 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, the e-Scorecard included calculation for all indicators in the Clinical Utilization and Outcomes quadrant stratified by sex<sup>1</sup>. Sex-stratified data and analyses are provided at hospital and aggregate levels (i.e. at LHIN and provincial levels) in the e-Scorecard.

## Indicator Calculation

### *Data Cleaning and Preparation*

The following table describes the data cleaning applied to the Continuing Care Reporting System (CCRS) data cut used for this project and the associated record counts. The section on Risk

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<sup>1</sup> 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.

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 2004/2005

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):	324,779
Exclusion 1: <ul style="list-style-type: none"> <li>• invalid health card number</li> <li>• assessment before July 1, 1996</li> <li>• assessment before admission</li> <li>• discharge before admission</li> <li>• assessment before date of birth</li> </ul>	320,596
Exclusion 2: Remove the following Facilities: <ul style="list-style-type: none"> <li>• Bloorview-MacMillan,</li> <li>• Queensway Carleton (Nepean)</li> <li>• Deep River Hospital</li> <li>• Grace Hospital (Windsor)</li> <li>• Scarborough General Hospital</li> <li>• St. Joseph's Hospital (Toronto)</li> <li>• Hogarth-Westmount</li> <li>• Pembroke Civic Hospital</li> </ul>	317,015
Exclusion 3: <ul style="list-style-type: none"> <li>• Data Cleaning</li> <li>• No Full Assessment found</li> <li>• If quarterly assessment first or in the same day as full assessment</li> <li>• If quarterly assessment done more than 300 days from full assessment</li> <li>• If admission date is before July 1, 2002 and since then, no assessment done and no discharge date reported</li> </ul>	313,930

Data Cleaning Step	Records Remaining in Data Set
Number of Assessment Records remaining after above steps	276,353
Keep only the last assessment completed for each patient in each fiscal quarter. <ul style="list-style-type: none"> <li>• These records were used to calculate indicators</li> </ul>	269,247

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	29,222	26,059	3,163	25,576
Fiscal 1997/1998	35,115	30,985	4,130	30,306
Fiscal 1998/1999	36,225	31,474	4,751	30,830
Fiscal 1999/2000	35,593	31,486	4,107	30,855
Fiscal 2000/2001	35,433	31,260	4,173	30,489
Fiscal 2001/2002	36,016	31,991	4,025	31,092
Fiscal 2002/2003	34,907	30,926	3,981	30,179
Fiscal 2003/2004	35,449	30,922	4,527	29,856
Fiscal 2004/2005	35,970	31,250	4,720	30,064
<b>Total</b>	<b>313,930</b>	<b>276,353</b>	<b>37,577</b>	<b>269,247</b>

***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 e-Scorecard 2006: 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 continuous 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://interrai.org/applications/qireport1.pdf> (This file confirmed available on June 23, 2006).

The risk-adjusted indicators as calculated for the e-Scorecard 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 e-Scorecard 2006: 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 the e-Scorecard, 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 e-Scorecard 2006: 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) database, 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 2004/2005 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 database.
1. Create an analysis database containing all MDS records from fiscal years 2003/2004 through 2004/2005 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 2003/2004 and 2004/2005. (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 <http://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 <http://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 2004/2005 data, so risk-adjustment models were based on records selected from the 2003/2004 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 2003/2004, 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 2004/2005 (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 2004/2005 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 2004/2005:
    - 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 2004/2005:
    - 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 predicted (expected) 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:
    - a.  $\text{Probit (adjusted)} = \text{Probit (observed)} - \text{Probit (expected)} + \text{Probit (standard)}$
    - b. 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).
    - c. 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 were used in risk-adjustment for each risk-adjusted indicator.

## **Performance Allocation**

In *Hospital Report e-Scorecard 2006: 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 that volunteered to participate in the e-Scorecard were included in the hospital-specific reporting. However, data from all hospitals with MDS data available in the CCRS, except for hospitals with data quality issues, were used to calculate the provincial average used in the calculation of the risk-adjusted indicators and to which hospitals' performance was compared. There was one hospital excluded from provincial average and LHIN average calculations for all indicators, and an additional hospital excluded for the same calculations for pain related (chronic and short-stay) indicators due to data quality issues.

### ***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 e-Scorecard 2006: Complex Continuing Care* reports and in other 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	36	30	436	19.6
Decline Wheel/Walk	assessments	38	30	584	28.6
More Depress/Anxious	assessments	68	30	1207	29.3
Decline Communication	assessments	61	31	1074	25.1
Indwelling Catheter	patients	41	30	391	22.9
Decline Bladder Continence	assessments	50	30	701	28.5
New Fallers	assessments	63	32	1171	11.7
Pain (chronic patients)	patients	42	31	431	46.2
Pressure Ulcer	patients	42	31	431	38.0
New Skin Ulcer	assessments	63	30	1009	15.8
Physical Restraints	patients	42	31	431	25.8
Antipsychotics	patients	38	31	374	26.4
Pain (short-stay patients)	patients	70	30	454	59.4

## Reporting Results by sex

Provincial-level means for the hospital-specific indicators (stratified by sex) described in this summary were included in the e-Scorecard. In addition, the e-Scorecard 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". This calculation was done for each indicator and it gave an indication of the direction (i.e.  $F > M$  or  $M > F$ ) and the statistical significance of these values at a hospital level.

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.