Hospital Report 2003: 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 2003: Complex Continuing Care.* Where sufficient detail exists in the Report it is not repeated here[1].

Indicator Selection

Candidate indicators were identified from among the indicators reported in *Hospital Report 2001: Complex Continuing Care* and new indicators that had been developed in a recent (2000-2002) large research project (the "MegaQI project") sponsored by the Centers for Medicare and Medicaid Services, of the federal government of the USA. The MegaQI project served as the basis for the current public reporting of nursing home quality indicators in 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 are beginning to appear 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.

Hospital Report uses Advisory Panels to assist the research team in selecting indicators that are most important, relevant, valid and feasible. Members of the 30-member Clinical Utilization and Outcomes Advisory Panel included clinical professionals and managers from complex continuing care programs at 23 Ontario hospitals. Twenty-six indicators were considered by the Panel. This list included the 25 chronic care indicators that were validated (level I or II) in the MegaQI study and one indicator from *Hospital Report 2001* (New Stage 2+ Skin Ulcers. Consensus on the selection of the final 12 chronic patient indicators was achieved by having the Panel members first independently score the indicators for their importance and relevance by means of a survey. A copy of the survey can be found in the document "CCCClinicalPanelSurvey 2003 May 29.pdf" that accompanies this Technical Report at www.hospitalreport.ca**.** At a subsequent face-to-face meeting of the Panel, the results of the

[1] *Hospital Report 2003: Complex Continuing Care* is often simply referred to in this document as "the Report".

survey were presented to and discussed by Panel members. The members used the following two questions to guide their indicator selection process at the meeting:

1. If we saw a change in this indicator, what would we do about it? What action would we take?
2. Have we assessed the reliability and validity to the best of our ability, and do they meet and acceptable standard?

The indicator for short-stay patients had not been included on the pre-meeting survey, but was discussed at the meeting. The Panel decided that the indicator on pain in short-stay patients should be developed based on the MegaQI indicator concerning presence of pain in "post-acute care" patients, and included in the Report

Indicator Calculation

Data cleaning and preparation

The following table describes the data cleaning applied to the Ontario Chronic Care Patient System (OCCPS) 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 OCCPS 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 OCCPS. Hospital clinical staff perform 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 of their stay 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.

Data Cleaning and Record Counts: OCCPS data cut containing data from July 1996 to end of 2001/02

Line	**Assessment File Records (Full and Quarterly MDS)**	Number of Records
1	Starting number of Full MDS assessment records	105,043
2	Starting number of Quarterly MDS assessment records	92,613
3	Total assessment records	197,656
4	After remove records with invalid Health Care Number	196,451

5	After remove records with • Assessment date < July 1, 1996 (start of OCCPS) • Assessment date < Admission date • Assessment date < Date of birth • Admission date > Discharge date	196,249
6	After remove • Records for patients that never have a Full assessment • Out of place Quarterly assessments (first ever record for patient; same date as Full; quarterly dated > 300 days after most recent Full)	193,722
7	After keep only the LAST record in each fiscal quarter	189,305
8	After delete records from hospitals • That closed soon after the OCCPS began (Queensway Carleton; Deep River; Grace Windsor; Scarborough Hospital – General site; St. Joseph's Toronto; Pembroke Civic; St. Joseph's Thunderbay – Hogarth-Westmount site) • That are inappropriate to include (Bloorview-MacMillan – pediatric; Toronto East General – opened CCC later in 2001/02)	186,151
	Admission File Records	
9	Starting number of Admission file records	110,144
10	After remove records for same hospitals as were deleted from Assessment file records	108,867
11	After remove records with • Admission date < Date of birth • Discharge date < Admission date • Invalid Health Care Number	108,140
12	After remove records associated with visits represented in the Assessment File (remainder are records of stays for which no assessment was completed)	26,995
	Combined File (Assessments + Stays without Assessment) lines 8 + 12	213,146
13	• Remove records with no discharge date, no assessment, and admitted more than 3 fiscal quarters before the end of fiscal 2001/02 (end of data) Other evidently erroneous records that appear to be incomplete duplicates of other records or have assessment date > discharge date and no subsequent stay of the same patient to which the record could belong	213,073
14	**Final tally of Assessment Records (Fulls and Quarterlies) available for Hospital Report indicator calculations** After link back records from Combined file (line 13) to Assessment file records (line8) by patient, stay, and assessment type identifiers and dropping non-matching records (i.e., records deleted due to cleanup of Combined file)	**185,202**

The 80-day rule for prevalence-type indicators

When calculating the prevalence-type indicators (#5, 8, 9, 11, and 12) 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 change-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 2003: 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 January 10, 2004).

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 2003: Complex Continuing Care* was the overall expected value of the indicator across all hospitals, that is, the average of all hospitals' observed (raw) indicator values.

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" (all hospitals' 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 all hospitals' 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 2003: 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 2001/2002 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 2001/2002, 2000/2001, and 1999/2000, 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 2000/2001 and 2001/2002. (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 the Report. At this point all records will have the following:

   a. the raw MDS data specified in 2a and2b 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 according to the algorithms given in Appendix F of the Report. for each record, using the MDS items carried forward from the previous (or prior Full) assessments.

6. Select one record per patient from the 2000/2001 fiscal year data (i.e., the year prior to the year for which you are calculating risk-adjusted indicators). 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 2000/2001, regressing the binary 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 2001/2002 (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 2001/2002 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 2001/2002:
   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 2001/2002:
   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 average of all hospitals' observed indicator values (in the hospital-level file) and 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. Probit(adjusted) = Probit(observed) – Probit(expected) + 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 the Report. The following covariate was listed in that Appendix but not defined. The definition is given here:

Indicator: Percent of Chronic Patients with New Stage 2 or Greater Skin Ulcers
Covariate: Dependence in transfers
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 2003:Complex Continuing Care,* a symbol 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 103 hospitals with MDS data available in the OCCPS were used to calculate the all hospitals' average 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 were calculated this way in *Hospital Report 2001: Complex Continuing Care* and have been reported in this way in reports published by the Canadian Institute for Health Information since 2000.

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 "change-type" indicators (numbers 1, 2, 3, 4, 6, 7, 10) the correlation of 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 used 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 change-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 average of the indicator values across all hospitals in the province (the "all hospitals' average") for which the indicator could be calculated. The finding that a hospital's indicator value was statistically higher than the all hospitals' average 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 average of all hospitals' indicator scores (the "all hospitals' average"), including all hospitals for which an indicator value was calculated.
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 lower end of the 95% confidence interval was **above the average** of all hospitals, the hospital was said to have a significantly above-average performance.
6. If the upper end of the 95% confidence interval was **below the average** of all hospitals, the hospital was considered to have *potentially* lower than average performance. The subsequent steps (8 to?) determine whether the hospital is indeed allocated to the below average performance category.
7. If neither condition #5 nor #6 are true, the hospital is designated as having **average** performance
8. Define the **low performance cut-point** as the highest indicator score (lowest, in the case of indicator #1 ADL Improvement) 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. To be assigned the below average designation, the upper end of a hospital's confidence interval had to be below the average of all hospitals (step 6), ***and*** the hospital's indicator value had to be further from the all hospitals average (in the same direction) than the low performance cut-point.

The 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 included in the indicator calculation. The table also shows the number of hospitals that had the minimum ESS for inclusion in the performance allocation process, the range of the ESS and the low performance cut-point, for each indicator.

Performance Allocation: Effective Denominator Size (EDS) and the Low Performance Cut-Point

Indicator	Basis of Effective Sample Size	Number of Hospitals with EDS of 30 or more	Smallest EDS	Largest EDS	Low Performance Indicator Value Cut-Point
Improve ADL	Assessments	31	31	434	20.38
Decline Wheel/Walk	Assessments	34	33	732	37.63
Decline Communication	Assessments	62	30	1390	26.81
More Depress/Anxious	Assessments	66	30	1466	33.93
Indwelling Catheter	Patients	38	34	433	32.75
Decline Bladder Continence	Assessments	42	30	608	31.25
New Fallers	Assessments	62	31	1409	9.84
Pain (chronic patients)	Patients	41	35	435	40.32
Pressure Ulcer	Patients	41	37	458	34.03
New Skin Ulcer	Assessments	60	31	1287	15.99
Physical Restraints	Patients	41	35	458	41.80
Antipsychotics	Patients	39	32	415	30.83
Pain (short-stay patients)	Patients	53	31	470	55.30

System-level Analysis

Indicator values over several fiscal years

The same indicator definitions and risk-adjustment approaches were applied to the MDS data from fiscal years prior to 2001/2002. In the Report system-level findings were reported for the years 1999/2000 through 2001/2002. The results are presented in tabular form in **Appendix 2.**

Comparison Groups

In the system-level analysis for *Hospital Report 2003: Complex Continuing Care* hospitals were grouped into two categories based on the total number of patient days of complex continuing care service they provided during the 2001/2002 fiscal year. The number of patient days for each hospital was obtained from data held by the Joint Policy and Planning Committee (JPPC), based on the Management Information System (MIS) and Minimum Data Set (MDS) data submitted to the Ministry of Health each year by hospitals.

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

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

adli_03 model 2000/2001 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	1653.383	1587.923
SC	1658.628	1614.147
-2 Log L	1651.383	1577.923

Association of Predicted Probabilities and Observed Responses

Percent Concordant	60.4	Somers' D	0.257
Percent Discordant	34.7	Gamma	0.270
Percent Tied	4.9	Tau-a	0.103
Pairs	392418	c	0.628

adli_03 model 2001/02 data, 2000/2001 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	6115.052	5924.648
SC	6121.586	5957.318
-2 Log L	6113.052	5914.648

Association of Predicted Probabilities and Observed Responses

Percent Concordant	59.7	Somers' D	0.230
Percent Discordant	36.7	Gamma	0.239
Percent Tied	3.6	Tau-a	0.095
Pairs	5310435	c	0.615

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

locw_03 model 2000/01 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	1934.151	1822.416
SC	1939.707	1861.311
-2 Log L	1932.151	1808.416

Association of Predicted Probabilities and Observed Responses

Percent Concordant	63.9	Somers' D	0.351
Percent Discordant	28.7	Gamma	0.379
Percent Tied	7.4	Tau-a	0.114
Pairs	592836	c	0.676

locw_03 model 2001/02 data, 2000/01 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	6461.693	6020.489
SC	6468.479	6067.992
-2 Log L	6459.693	6006.489

Association of Predicted Probabilities and Observed Responses

Percent Concordant	64.4	Somers' D	0.360
Percent Discordant	28.4	Gamma	0.388
Percent Tied	7.2	Tau-a	0.113
Pairs	6724682	c	0.680

Percent of Chronic Patients Who Declined in Their Ability to Communicate

commw_03 model 2000/01 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates

```
AIC             3709.302       3444.109
SC              3715.632       3501.080
-2 Log L        3707.302       3426.109


commw_03 model 2001/02 data, 2000/01 betas


         Model Fit Statistics

                               Intercept
               Intercept          and
Criterion        Only        Covariates

AIC            12898.578      11874.477
SC             12906.178      11942.879
-2 Log L       12896.578      11856.477

Association of Predicted Probabilities and Observed Responses

Percent Concordant        63.6    Somers' D    0.381
Percent Discordant        25.5    Gamma        0.428
Percent Tied              10.9    Tau-a        0.102
Pairs                 29041152    c            0.691
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Percent of Chronic Patients with Indwelling (Urinary) Catheters

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cath_03 model 2000/01 data

         Model Fit Statistics

                               Intercept
               Intercept          and
Criterion        Only        Covariates

AIC             3794.233       3327.499
SC              3800.740       3373.047
-2 Log L        3792.233       3313.499

Association of Predicted Probabilities and Observed Responses

Percent Concordant       72.1    Somers' D    0.468
Percent Discordant       25.3    Gamma        0.480
Percent Tied              2.6    Tau-a        0.105
Pairs                 2738755    c            0.734

cath_03 model 2001/02 data, 2000/01 betas

         Model Fit Statistics

                               Intercept
               Intercept          and
Criterion        Only        Covariates
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AIC            10336.607       9081.277
SC             10344.101       9133.738
-2 Log L       10334.607       9067.277

Association of Predicted Probabilities and Observed Responses

Percent Concordant        72.1    Somers' D    0.470
Percent Discordant        25.0    Gamma        0.484
Percent Tied               2.9    Tau-a        0.107
Pairs                 20139045    c            0.735
```

Percent of Chronic Patients Whose Bladder Continence Worsened

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wblc_03 model 2000/01 data

         Model Fit Statistics

                               Intercept
                Intercept         and
Criterion         Only        Covariates

AIC              2202.648       1979.139
SC               2208.313       2069.784
-2 Log L         2200.648       1947.139

Association of Predicted Probabilities and Observed Responses

Percent Concordant      73.1    Somers' D    0.467
Percent Discordant      26.4    Gamma        0.469
Percent Tied             0.6    Tau-a        0.156
Pairs                 758582    c            0.733

wblc_03 model 2001/02 data, 2000/01 betas

         Model Fit Statistics

                               Intercept
                Intercept         and
Criterion         Only        Covariates

AIC              7825.405       7014.566
SC               7832.353       7125.735
-2 Log L         7823.405       6982.566

Association of Predicted Probabilities and Observed Responses

Percent Concordant       72.3    Somers' D    0.452
Percent Discordant       27.1    Gamma        0.454
Percent Tied              0.6    Tau-a        0.148
Pairs                 9676656    c            0.726
```

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

falls_03 model 2000/01 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	1367.151	1223.732
SC	1373.573	1275.103
-2 Log L	1365.151	1207.732

Association of Predicted Probabilities and Observed Responses

Percent Concordant	74.9	Somers' D	0.559
Percent Discordant	19.0	Gamma	0.596
Percent Tied	6.1	Tau-a	0.037
Pairs	688602	c	0.780

falls_03 model 2001/02 data, 2000/01 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	4679.296	4150.939
SC	4686.980	4212.403
-2 Log L	4677.296	4134.939

Association of Predicted Probabilities and Observed Responses

Percent Concordant	74.6	Somers' D	0.557
Percent Discordant	19.0	Gamma	0.595
Percent Tied	6.4	Tau-a	0.036
Pairs	8266830	c	0.778

Percent of Chronic Patients with Disruptive or Severe Pain

Pain_03 model 2000/01 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	7520.914	7393.632
SC	7527.631	7447.363

```
-2 Log L        7518.914       7377.632


Association of Predicted Probabilities and Observed Responses

Percent Concordant       52.9    Somers' D    0.185
Percent Discordant       34.4    Gamma        0.212
Percent Tied             12.7    Tau-a        0.079
Pairs                 7911477    c            0.593

Pain_03 model 2001/02 data, 2000/01 betas

         Model Fit Statistics

                             Intercept
               Intercept        and
Criterion        Only       Covariates

AIC            19711.616      19376.250
SC             19719.295      19437.680
-2 Log L       19709.616      19360.250

Association of Predicted Probabilities and Observed Responses

Percent Concordant        51.7    Somers' D    0.178
Percent Discordant        33.9    Gamma        0.208
Percent Tied              14.3    Tau-a        0.076
Pairs                 54321744    c            0.589
```

Percent of Chronic Patients with Pressure Ulcers

```
pulcer_03 model 2000/01 data


         Model Fit Statistics

                             Intercept
               Intercept        and
Criterion        Only       Covariates

AIC             6267.467       5802.713
SC              6274.213       5910.650
-2 Log L        6265.467       5770.713

Association of Predicted Probabilities and Observed Responses

Percent Concordant       69.7    Somers' D    0.401
Percent Discordant       29.5    Gamma        0.405
Percent Tied              0.8    Tau-a        0.128
Pairs                 6287424    c            0.701

pulcer_03 model 2001/02 data, 2000/01 betas


              Model Fit Statistics
```

```
                              Intercept
                 Intercept       and
Criterion          Only       Covariates

AIC              16683.961     13385.950
SC               16691.659     13509.119
-2 Log L         16681.961     13353.950

Association of Predicted Probabilities and Observed Responses

Percent Concordant        66.5    Somers' D    0.340
Percent Discordant        32.5    Gamma        0.343
Percent Tied               1.0    Tau-a        0.112
Pairs                  43793424    c            0.670
```

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

```
newulcer_old model - 2000/01 data

         Model Fit Statistics

                              Intercept
                 Intercept       and
Criterion          Only       Covariates

AIC               1862.808      1823.752
SC                1869.159      1880.912
-2 Log L          1860.808      1805.752

Association of Predicted Probabilities and Observed Responses

Percent Concordant      57.9    Somers' D    0.268
Percent Discordant      31.1    Gamma        0.302
Percent Tied            11.0    Tau-a        0.029
Pairs                 970056    c            0.634

 newulcer_old model - 2001/02 data, 2000/01 betas

         Model Fit Statistics
                              Intercept
                 Intercept       and
Criterion          Only       Covariates

AIC               6907.901      6729.271
SC                6915.494      6797.600
-2 Log L          6905.901      6711.271

Association of Predicted Probabilities and Observed Responses

Percent Concordant        55.7    Somers' D    0.243
Percent Discordant        31.4    Gamma        0.279
Percent Tied              12.8    Tau-a        0.029
Pairs                 12706572    c            0.621
```

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

apsy_03 model 2000/01 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	4921.865	4357.720
SC	4928.466	4450.123
-2 Log L	4919.865	4329.720

Association of Predicted Probabilities and Observed Responses

Percent Concordant	73.0	Somers' D	0.486
Percent Discordant	24.5	Gamma	0.498
Percent Tied	2.5	Tau-a	0.136
Pairs	4126760	c	0.743

apsy_03 model 2001/02 data, 2000/01 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	13720.591	12326.968
SC	13728.168	12433.048
-2 Log L	13718.591	12298.968

Association of Predicted Probabilities and Observed Responses

Percent Concordant	70.8	Somers' D	0.447
Percent Discordant	26.1	Gamma	0.461
Percent Tied	3.0	Tau-a	0.133
Pairs	31085095	c	0.724

Percent of Short-Stay Patients with Disruptive or Severe Pain

Short-Stay Pain_03 model 2000 data

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	477.432	482.504
SC	481.310	513.525
-2 Log L	475.432	466.504

Association of Predicted Probabilities and Observed Responses

Percent Concordant	51.6	Somers' D	0.179
Percent Discordant	33.7	Gamma	0.209
Percent Tied	14.7	Tau-a	0.085
Pairs	30140	c	0.589

Pain_03 model calendar 2001 data, 2000 betas

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	1121.757	1093.953
SC	1126.471	1131.666
-2 Log L	1119.757	1077.953

Association of Predicted Probabilities and Observed Responses

Percent Concordant	53.7	Somers' D	0.240
Percent Discordant	29.7	Gamma	0.287
Percent Tied	16.6	Tau-a	0.117
Pairs	165120	c	0.620

Appendix 2: System-level Results – Descriptive Statistics for Fiscal Years 1999/00 through 2001/02.

Indicator		Year	Mean	SD	25th Percentile	Median	75th Percentile
1	Improvement in Performance of Activities of Daily Living	1999/00	31.7	19.6	20.8	31.4	40.8
		2000/01	29.0	21.7	15.5	26.6	40.7
		2001/02	30.3	23.1	15.5	27.0	40.3
2	Decline in Ability to Walk/Wheel Self	1999/00	23.5	20.3	9.4	18.9	29.3
		2000/01	24.0	19.7	9.8	22.2	33.7
		2001/02	25.0	19.7	14.7	21.5	31.8
3	Decline in Ability to Communicate	1999/00	18.2	10.7	9.2	18.7	25.5
		2000/01	17.5	11.4	8.7	17.2	24.9
		2001/02	16.8	11.5	8.0	15.7	24.1
4	Increase in Depression or Anxiety	1999/00	21.6	13.4	13.2	21.3	26.8
		2000/01	21.0	10.8	14.7	20.1	28.1
		2001/02	23.8	14.2	16.7	21.4	29.2
5	Presence of Indwelling Catheter	1999/00	16.7	14.3	7.0	16.1	23.6
		2000/01	17.0	14.5	6.8	15.3	23.8
		2001/02	19.2	15.1	10.3	18.3	26.8
6	Decrease in Bladder Continence	1999/00	19.8	14.0	10.8	19.1	26.5
		2000/01	22.1	15.0	13.4	19.4	29.7
		2001/02	21.6	16.0	12.2	18.6	29.4

	Indicator	Year	Mean	SD	25th Percentile	Median	75th Percentile
7	New Patient Falls	1999/00	5.1	10.7	0.3	2.6	5.6
		2000/01	5.9	11.1	1.5	3.3	6.5
		2001/02	4.9	10.7	0.0	2.9	4.8
8	Presence of Disruptive or Severe Pain	1999/00	26.4	16.5	16.2	24.4	32.7
		2000/01	27.2	16.6	18.7	26.7	34.6
		2001/02	31.4	17.8	21.2	30.6	40.3
9	Presence of Pressure Sores	1999/00	18.8	13.0	11.5	17.0	24.3
		2000/01	19.0	14.8	11.5	17.0	24.8
		2001/02	21.0	13.0	14.2	19.5	27.9
10	New Stage 2 or Greater Skin Ulcers	1999/00	7.0	10.2	3.5	5.6	8.8
		2000/01	6.4	10.3	2.1	4.8	8.6
		2001/02	6.5	6.3	3.0	5.8	8.5
11	Presence of Daily Physical Restraints	1999/00	30.4	21.2	15.1	26.5	41.2
		2000/01	30.0	20.6	15.4	26.9	42.9
		2001/02	29.1	20.6	16.7	25.0	40.3
12	Use of Anti-Psychotic Medication without a Diagnosis of Psychosis	1999/00	19.2	16.3	10.6	16.3	23.6
		2000/01	17.6	12.0	10.6	16.6	23.5
		2001/02	18.3	15.3	9.1	16.8	24.1
13	Short Stay patients with Disruptive or Severe Pain	1999/00	39.1	19.4	30.4	39.4	48.5
		2000/01	39.4	19.4	28.3	40.1	51.9
		2001/02	44.7	22.1	31.7	43.3	56.0