Strategies for Assessing Health Plan Performance on Chronic Diseases: Selecting Performance Indicators and Applying Health-Based Risk Adjustment

Appendix I

Performance Results

Overview

In this section, we apply the decision rules and statistical techniques described earlier to evaluate the performance of six health plans in Maryland's Medicaid program in CY02 on their ability to provide appropriate care to enrollees with four diseases: asthma, diabetes, HIV/AIDS, and schizophrenia. We select a group of disease-specific measures for each disease, the intent of which is to evaluate each health plan's ability to meet standards of care. We also select three generic measures to evaluate the care provided across diseases, allowing us to look for patterns in service utilization. Our analysis includes both outcome and performance measures.

Following the decision rules presented in Section II, we apply risk adjustment to the performance results, where appropriate. Our analysis suggests that health-based risk adjustment is important when assessing performance on the two generic outcome measures: the percentage of enrollees who had at least one inpatient admission and the percentage who had at least one ER visit.

For each disease, we also apply regression techniques to identify process measures that, when controlling for other factors, appear to be associated with a decrease in the likelihood of an inpatient admission. This analysis provides a foundation for the selection of indicators that a state may consider including in a performance measurement program.

The results for each disease are presented independently in this section and are comprehensive, allowing the reader to select specific diseases of interest. A summary of key finding is offered below.

Summary of Key Findings

- *There is a strong direct relationship between health status (as measured by RUB severity) and utilization rates for inpatient admissions and ER visits.* These results, presented in Tables 10 and 11, suggest that health plans with a sicker case mix would be expected to have a higher percentage of enrollees with inpatient admissions or ER visits. Applying health-based risk adjustment to the results for these indicators improves the accuracy of the measurement by controlling for any variations in case mix across the plans.

Table 10. Percent of the Enrollees With at Least One Inpatient Admission by Disease and RUB (CY02)

RUB*	Asthma	Diabetes	HIV/AIDS	Schizophrenia (Medical)	Schizophrenia (Mental Health)
Non-Users	0.0	0.0	0.0	-	-
Healthy Users	0.0	0.0	0.0	-	-
Low Morbidity	3.1	0.9	0.0	0.0	14.3
Moderate Morbidity	7.7	6.2	4.0	2.4	19.6
High Morbidity	34.0	27.6	25.4	16.4	29.9
Very High Morbidity	64.0	68.0	66.2	55.8	38.0

Note: A dash indicates that there are no enrollees in the RUB.

*RUB=Resource Utilization Band, based on ACG case mix categories.

Table 11. Percent of the Enrollees With at Least One ER Visit by Disease and RUB (CY02)

RUB	Asthma	Diabetes	HIV/AIDS	Schizophrenia (Medical)
Non-Users	0.0	0.0	0.0	-
Healthy Users	8.2	0.0	28.6	-
Low Morbidity	19.7	9.5	20.9	5.0
Moderate Morbidity	35.8	15.8	15.8	14.1
High Morbidity	42.7	28.9	28.4	33.1
Very High Morbidity	46.1	36.7	40.8	46.2

Note: A dash indicates that there are no enrollees in the RUB.

- *There is a strong inverse relationship between health status and avoidable inpatient admissions for both children and adults with asthma.* One hypothesis for these interesting results is that enrollees with multiple co-morbidities are more likely to be admitted for conditions that are not sensitive to the level of ambulatory care services they receive.

Table 12. Percent of Asthma Inpatient Admissions That Were Avoidable by Age Group and RUB (CY02)

RUB	Children	Adults
Non-Users	-	-
Healthy Users	-	-
Low Morbidity	74.0	100.0
Moderate Morbidity	54.4	37.3
High Morbidity	38.3	11.2
Very High Morbidity	13.1	8.7

- *Performance on process measures is generally not sensitive to health status.* These results are consistent with clinical expectations. Standards of care that are appropriate for all enrollees with a certain diagnosis should be applied consistently regardless of health status. Applying health-based risk adjustment is not suitable for such indicators. Table 13 contains a subset of process measures representing these results.

Table 13. Percentage of Enrollees Who Met the Minimum Threshold for Various Preventive Measures by Disease and RUB (CY02)

RUB	Asthma	Diabetes	HIV/AIDS	Schizophrenia
	Medication Measure	Hemoglobin Measure	Viral Load Measure	Follow-up 7 days after a Mental Health Admission
Non-Users	72.8	7.4	4.6	-
Healthy Users	74.1	14.3	14.3	-
Low Morbidity	66.3	51.4	11.6	100.0
Moderate Morbidity	64.8	64.7	33.2	75.5
High Morbidity	63.4	62.3	43.0	79.0
Very High Morbidity	72.5	61.7	38.8	80.2

Note: A dash indicates that there are no enrollees in the RUB.
*RUB=Resource Utilization Band, based on ACG case mix categories.

- *Receiving ambulatory care services is associated with a decrease in the likelihood of an inpatient admission.* When controlling for other factors (including health status), enrollees who had two or more ambulatory care visits were approximately one-third less likely to have an inpatient admission than those enrollees who had fewer than two ambulatory care visits. This conclusion is consistent with the literature on ambulatory care sensitive conditions, which suggests that appropriate outpatient care can reduce the need for inpatient admissions for certain health conditions. Most states and health plans would agree on a goal of reducing inpatient admissions. Hence, this analysis further supports evidence that ambulatory care visits can decrease an enrollee's likelihood of admission,

thus supporting the inclusion of an ambulatory care visit threshold in any state's performance measurement program. Even states that do not have sophisticated data systems to stratify enrollees by morbidity or to risk adjust performance results can likely document ambulatory visits.

Summary of Plan Performance

One of the advantages of applying generic measures to several diseases is the opportunity to identify trends in health plan performance across diseases. With such information, states can identify whether some health plans use the ER more frequently than others. States can also identify plans that have consistently low ambulatory care visit rates and high inpatient admission rates, suggesting a need for more focused attention on primary care services.

The following patterns were noted from our analysis of health plan performance in CY02:

- For medical inpatient admissions, only one health plan (MCO B) performs below the mean (better than average) for all four diseases, after applying risk adjustment. None of the health plans consistently performs above the mean. The risk-adjusted results are presented in Table 14.[1]

Table 14. Ratio of Observed to Expected* Performance by Health Plan Measure: Percent of Enrollees with One or More Inpatient Admissions (CY02)

Health Plan	Asthma	Diabetes	Schizophrenia (Medical)	HIV/AIDS
MCO A	1.05	1.05	0.99	1.01
MCO B	0.61	0.81	0.88	0.89
MCO C	0.94	0.93	0.96	1.04
MCO D	1.10	1.00	1.04	1.01
MCO E	1.06	1.10	1.10	0.76
MCO F	0.93	1.01	0.98	1.03
All Health Plans	1.00	1.00	1.00	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

- The ER visit rates for two health plans (MCO B and MCO D) are below the state mean (better than average) for asthma, diabetes, and HIV/AIDS. Two other health plans (MCO E and MCO F) consistently perform above the mean (worse than average). The risk-adjusted results are presented in Table 15.

Table 15. Observed to Expected* Performance by Health Plan Measure: Percent of Enrollees with One or More ER Visits (CY02)

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[1] *The results for inpatient admissions and ER visits are presented in the form of ratios that compare the observed percentage to the expected percentage of enrollees with at least one admission (or ER visit). The expected percentage is determined by the case mix of the health plan. Health plans with a score greater than 1.0 have a higher percentage of enrollees with an admission than the statewide average, while those with a score less than 1.0 have a lower percentage of enrollees with an admission.*

Health Plan	Asthma	Diabetes	HIV/AIDS
MCO A	0.99	0.98	1.07
MCO B	0.75	0.76	0.77
MCO C	1.02	1.00	1.05
MCO D	0.77	0.77	0.81
MCO E	1.49	1.52	1.72
MCO F	1.20	1.28	1.39
All Health Plans	1.00	1.00	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

- The results for two of the health plans (MCO A and MCO B) are above the mean (better than average) for all four diseases on the measure of two or more ambulatory care visits. One health plan (MCO D) performs below the mean (worse than average) for all four diseases on this measure.

The results from the disease-specific process measures provide some insight into health plan performance for individual disease. The results suggest that:

- Three of the health plans perform above the mean (better than average) for diabetes and one health plans consistently performs below the mean (worse than average).

- One health plan performs above the mean (better than average) on measures for HIV/AIDS and two plans consistently perform below the mean (worse than average).

- There were no consistent patterns of performance for asthma- and schizophrenia-related indicators.

More detailed data describing the performance of all six health plans on treating enrollees with each of the four diseases follow.

Asthma

Defining the Cohort

Encounter data from calendar year 2002 (CY02) was used to identify the cohort. We applied a slightly modified version of the HEDIS® 2003 criteria to select the enrollees with asthma. There are 16,836 enrollees who met the clinical and enrollment criteria to become members of the asthma cohort.

Clinical Criteria

The asthma cohort includes all enrollees ages 5 to 56 years who met or exceeded at least one of the following utilization thresholds of medical care services:

- Four asthma medication dispensing events;
- One ER visit with an asthma diagnosis code;
- One inpatient visit with an asthma diagnosis code; or
- A combination of two asthma medication dispensing events and four ambulatory care visits with asthma diagnosis codes.

We defined the cohort and measured performance in the same calendar year. More details about the definition for the asthma cohort can be found in the Technical Appendix.

Enrollment Criteria

As mentioned in Section I, we also applied enrollment criteria to each cohort definition. Each member of the cohort had to be enrolled in the same health plan for at least 320 days, with no more than one gap in enrollment. The gap in enrollment could not exceed 45 days, and the person must have been enrolled as of December 31st of the study year; in this case, CY02.

Descriptive Statistics

For each disease, we examined the distribution of the cohort across health plans to identify any factors that might influence the results. The distribution for the asthma cohort is presented in Table 16. The cohort is fairly evenly distributed across the four largest health plans (between 21 and 27 percent of the cohort in each).

Table 16. Distribution of Asthma Cohort Across Health Plans (CY02)

Health Plan	Percent of Enrollees
MCO A	21.8
MCO B	2.0
MCO C	21.4
MCO D	27.2
MCO E	3.9
MCO F	23.7
All MCOs	100.0

The data indicate that 66 percent of the asthma cohort is under the age of 21, and 56 percent of the cohort is female. Approximately 40 percent of the cohort lives in urban areas of Maryland and 40 percent in suburban areas. The remaining 20 percent live in rural areas. Asthma is the one chronic disease that we studied that has more enrollees who are TANF beneficiaries (70 percent) than SSI beneficiaries. More specific demographic information on the asthma cohort can be found in Appendix III.

Once the cohort was identified, we used Adjusted Clinical Group (ACG) assignments for CY02 to obtain the distribution of enrollees by Resource Utilization Bands (RUBs). An enrollee's RUB assignment is a proxy for health status and is used to control for the impact of case mix on plan performance. The six RUBs, presented in increasing levels of morbidity, are: Non-Users,[2] Healthy Users,[3] Low Morbidity, Moderate Morbidity, High Morbidity, and Very High Morbidity.

The RUB distribution for the asthma cohort by health plan is provided in Table 17. The largest number of enrollees is assigned to the Moderate Morbidity RUB, accounting for 47.3 percent of the cohort statewide. The variation in case mix across health plans is evident. MCO B has 18.8 percent of its population in the Very High Morbidity RUB, while MCO F has only 8.2 percent in that RUB. The variation in the High Morbidity RUB ranges from 18.3 percent in MCO C to 32.8 percent in MCO B. The distribution of enrollees in the Moderate Morbidity RUB ranges from 40.5 percent to 49.7 percent. The Low Morbidity RUB distribution ranges from 6.7 percent to 21.0 percent across health plans.

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[2] *The Non-Users RUB includes members of the cohort who do not have enough diagnostic information on their claims/encounter data to be accurately classified into the appropriate risk strata. For example, an enrollee may qualify as a member of the asthma cohort by filling an asthma prescription at some point during the year. However, prescription information is not used by the ACG system to assign enrollees to ACGs/RUBs. Therefore, if an enrollee only received prescriptions and has no diagnosis information during the year, he would be a member of the Non-Users RUB.*

[3] *The Healthy Users RUB includes enrollees whose diagnostic information contains only data about preventive services or minor conditions. The data are not sufficient to accurately classify the enrollee into the appropriate risk group.*

Table 17. Distribution of Asthma Cohort Across Health Plans by RUB (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	1.3	0.6	2.0	2.0	0.9	2.0	1.7
Healthy Users	1.3	0.6	2.1	1.6	1.2	1.9	1.7
Low Morbidity	15.3	6.7	19.0	20.0	15.5	21.0	18.6
Moderate Morbidity	48.6	40.5	49.7	45.4	46.4	46.7	47.3
High Morbidity	21.8	32.8	18.3	20.2	21.0	20.3	20.5
Very High Morbidity	11.6	18.8	8.9	10.7	14.9	8.2	10.2
All RUBs	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Non-Users and Healthy Users make up a very small percentage of the cohort

Performance Measures

As described in Section I, we identified a set of performance measures on which to evaluate the health plans for each disease. The performance measures evaluate the enrollee's utilization of health care services, including disease-specific treatments. Results for each set of measures are described below.[4]

Generic Measures

We selected a generic set of measures on which to evaluate each disease cohort. We measured the percentage of enrollees in the cohort who had at least:

- One inpatient admission;
- One ER visit;[5] and
- Two ambulatory care visits.[6]

For each measure, the admission or visit is counted regardless of the diagnosis on the encounter. For example, if an enrollee who has asthma was admitted to the hospital for a ruptured spleen, the admission was counted, even though it was unrelated to the enrollee's asthma.

The results of the inpatient admissions measure are provided in Table 18. As expected, the percentage of enrollees with at least one inpatient admission increases with the severity of RUB assignment, from 3.1 percent for the Low Morbidity RUB to 64.0 percent for the Very High Morbidity RUB.[7] (This percentage of enrollees will be referred to from now on as the admission rate.) There is also variation in admission rates across health plans within RUBs. For the High Morbidity RUB, performance ranges from a low of 17.9 percent to a high of 37.3, with the

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[4] *Health plan performance for enrollees in the Non-Users and Healthy Users RUBs are included in the tables. However, because the percentage of enrollees in these RUBs is so low (1.7 percent in each), we do not attempt to draw meaningful conclusions from these results.*

[5] *An ER visit is defined as a visit to an emergency room that does not result in an inpatient admission.*

[6] *An ambulatory care visit is defined as a visit to an outpatient hospital department, a health clinic, or a physician's office.*

[7] *There are no admissions for the Non- and Healthy Users because the lowest RUB that an enrollee with an inpatient admission would be assigned to would be the Low Morbidity RUB.*

majority of health plans between 30.4 and 37.3 percent. For the Very High Morbidity RUB, performance ranges from 46.9 percent to 68.4, with five plans between 60.6 and 68.4 percent. As described in Section II, this measure is likely to be sensitive to risk adjustment, as the admission rate clearly increases with the severity of RUB assignment. MCO C's performance is below the mean (better than average) for all of the four most severe RUBs. MCO B's performance is below the mean (better than average) for the two most severe RUBs.

Table 18. Percent of the Asthma Cohort with at Least One Inpatient Admission (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Morbidity	2.3	8.7	1.6	4.9	0.0	3.0	3.1
Moderate Morbidity	8.9	7.3	6.4	9.0	10.5	6.1	7.7
High Morbidity	37.3	17.9	30.2	35.6	30.4	34.6	34.0
Very High Morbidity	64.2	46.9	60.6	67.0	68.4	64.0	64.0
All RUBs	20.3	18.2	14.4	19.4	21.5	15.7	17.7

The results for ER visits are presented in Table 19. As was the case with inpatient admissions, the percentage of the asthma cohort who had at least one ER visit (ER visit rate) during CY02 increases with the severity of RUB assignment, except in the case of MCO E.[8] However, the difference between RUBs is not as distinct as it is for inpatient admissions. There is considerable variation across health plans in the ER visit rate within RUBS. For example, for each RUB, both MCO E and MCO F have ER visit rates that are several percentage points above the statewide rate for all health plans. In contrast, the results for both MCO B and MCO D are consistently below the statewide mean (better than average).

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[8] *There are no ER visits listed for the Non-Users because the lowest RUB that an enrollee with an ER visit would be assigned to would be the Healthy Users RUB.*

Table 19. Percent of the Asthma Cohort with at Least One ER Visit (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	8.3	0.0	10.7	8.1	0.0	6.7	8.2
Low Morbidity	19.2	13.0	19.7	15.3	31.4	23.5	19.7
Moderate Morbidity	36.7	24.6	35.0	27.0	54.1	43.2	35.8
High Morbidity	40.7	33.0	43.6	31.3	67.4	54.3	42.7
Very High Morbidity	44.5	40.6	49.4	37.3	60.2	55.1	46.1
All RUBs	35.0	29.3	33.7	25.8	53.1	40.7	34.2

The results for ambulatory care visits are presented in Table 20. The percentage of enrollees receiving two or more ambulatory care visits (ambulatory care visit rate) increases as RUB severity increases, from 60.8 percent for the Low Morbidity RUB to 94.4 percent for the Very High Morbidity RUB. The change, however, is small, especially between the highest RUBs.[9] While there is some variation across health plans within each of the most severe RUBs, the variation is not as marked for ambulatory care visits as it is for inpatient admissions and ER visits. MCO C's performance is slightly above the state mean (better than average) for all of the four most severe RUBs, while MCO D's performance is slightly below (worse than average).

Table 20. Percent of the Asthma Cohort with at Least Two Ambulatory Care Visits (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	37.5	100.0	25.3	24.3	37.5	42.7	32.6
Low Morbidity	63.5	39.1	64.4	55.7	62.8	61.9	60.8
Moderate Morbidity	83.8	89.1	88.1	81.7	82.0	83.4	84.2
High Morbidity	92.2	93.8	95.0	88.5	91.3	89.1	91.0
Very High Morbidity	95.8	95.3	97.8	91.5	96.9	92.6	94.4
All RUBs	82.2	88.0	82.7	76.4	81.9	78.4	79.9

The ACG system, which captures multiple co-morbidities, is one method of stratifying a population based on health status. An alternative method is to use Expanded Diagnostic Clusters (EDCs). EDCs categorize enrollees based on their health status relative to a single disease rather than all of the diagnosis codes that have been assigned during the period. When we tested EDCs for a single disease, we discovered that it yielded similar results to the ACG method. Using EDCs restricts the ability to conduct cross-disease comparisons, however, because the strata are different for each disease. Appendix IV provides an example of how health plan performance can be measured using related EDCs to define the case mix.

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[9] *There are no visits listed for the Non-Users because the lowest RUB that an enrollee with an ambulatory care visit would be assigned to would be the Healthy Users RUB.*

Disease-Specific Measures

We have also identified a set of disease-specific measures that evaluate performance on process measures that are part of the standard of care for each disease. For asthma, we have selected the percentage of:

- Avoidable inpatient admissions for children;
- Avoidable inpatient admissions for adults; and
- Enrollees who received appropriate asthma medications.

More detail on the specific definitions for each measure can be found in the Technical Appendix.

In 2001, the Agency for Healthcare Research and Quality (AHRQ) published a collection of 16 ambulatory care sensitive conditions based on the current literature.[10] These conditions are defined as ones for which inpatient admissions can potentially be prevented if enrollees receive appropriate ambulatory care services. We applied the definition to the entire set of inpatient admissions for each age cohort to determine what percentage of the total admissions qualified as avoidable. The results are presented in Tables 21 and 22. The data show that the percentage of admissions that could have been avoided actually decreases with increasing RUB intensity. The same pattern is evident in both age groups. One hypothesis for these results is that enrollees with multiple co-morbidities are more likely to be admitted for conditions that are not sensitive to the level of ambulatory care services they receive. There is some variation within RUBs across the health plans. For children within the High Morbidity RUB, the avoidable admission rate ranges from 0 in MCO B to 45.9 percent in MCO F. There is much less variation in the Very High Morbidity RUB. Overall, MCO F has a higher than average (worse) rate of avoidable admissions for all of the four most severe RUBs, while MCO A and MCO E have a lower than average (better) rate.

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[10] *AHRQ Quality Indicators - Guide to Prevention Quality Indicators: Hospital Admission for Ambulatory Care Sensitive Conditions. Rockville, MD: Agency for Healthcare Research and Quality. Revision 3. (January 9, 2004). AHRQ Pub. No. 02-R0203.*

Table 21. Percent of Inpatient Admissions for the Child Asthma Cohort That Were Avoidable (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	-	-	-	-	-	-	-
Healthy Users	-	-	-	-	-	-	-
Low Morbidity	64.3	100.0	81.8	69.4	-	83.3	74.0
Moderate Morbidity	52.8	75.0	47.6	51.9	50.0	66.7	54.4
High Morbidity	32.5	0.0	31.8	41.5	36.4	45.9	38.3
Very High Morbidity	14.3	-	11.8	8.8	8.3	18.2	13.1
All RUBs	40.9	50.0	38.6	43.0	35.6	48.7	43.0

Note: Child is defined as under age 18; Total Inpatient Admissions = 1176

A dash indicates that there were no inpatient admissions for the enrollees in that RUB and MCO.

The results for the adult asthma cohort reveal less variation across health plans within each RUB. MCO D is consistently above the state mean (worse than average) for the three most severe RUBs, while MCO F is consistently below the mean (better than average) for the adult cohort.

Table 22. Percent of Inpatient Admissions for the Adult Asthma Cohort That Were Avoidable (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	-	-	-	-	-	-	-
Healthy Users	-	-	-	-	-	-	-
Low Morbidity	-	-	-	-	-	100.0	100.0
Moderate Morbidity	24.2	28.6	46.5	45.1	36.4	32.4	37.3
High Morbidity	10.3	30.4	9.9	13.2	12.2	8.7	11.2
Very High Morbidity	11.1	5.7	6.8	10.1	5.2	6.8	8.7
All RUBs	11.7	14.5	10.7	13.8	8.4	8.7	11.3

Note: Adult is defined as age 18+; Total Inpatient Admissions = 3794

A dash indicates that there were no inpatient admissions for the enrollees in that RUB and MCO.

The process measure for the use of appropriate medication for people with asthma was selected from HEDIS® 2003. The measure evaluates whether enrollees with asthma are prescribed the indicated medications for long-term asthma control. The medications include:

- Inhaled corticosteroids;
- Cromolyn sodium and nedocromil;
- Leukotriene modifiers; and
- Methylxanthines.

The measure was satisfied if an enrollee had at least one prescription filled for one of the above listed medications throughout the calendar year. The results are presented in Table 23. The percentage of enrollees who receive appropriate medications does not appear to be sensitive to RUB severity, except for the increase from 63.4 percent for the statewide population in the High RUB to 72.5 percent in the Very High RUB.[11] This result might suggest that enrollees in the most severe RUB have co-morbid conditions that increase the need for asthma medication. With the exception of MCO B, which performs consistently below the average, the results do not vary significantly across health plans within each RUB; there is slightly more variation in the Very High RUB.

Table 23. Percent of the Asthma Cohort Who Were Appropriately Prescribed Medication (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	72.3	50.0	80.3	74.4	66.7	65.4	72.8
Healthy Users	79.2	100.0	78.7	71.6	62.5	69.3	74.1
Low Morbidity	66.7	21.7	70.0	64.6	66.7	66.2	66.3
Moderate Morbidity	65.2	51.5	67.5	66.8	63.3	60.1	64.8
High Morbidity	62.3	52.7	66.5	66.9	59.4	60.0	63.4
Very High Morbidity	74.9	64.1	72.8	76.2	67.4	66.8	72.5
All RUBs	66.2	52.5	68.7	67.6	63.6	62.5	65.9

Risk-Adjusted Performance Results

The previous set of data stratified the performance results for each measure, allowing us to compare "apples" to "apples," or enrollees with the same health status in one MCO to similar enrollees in another MCO. Stratification of the performance results by RUB reduces the confounding effects of health status on the final result.

Applying regression techniques allows us to take the analysis one step further. Using logistic regression, we can account for both demographic and health status characteristics simultaneously when determining a health plan's performance on a given measure. In the following analysis, a logistic regression was used to relate enrollees' inpatient admissions to their RUB and four demographic characteristics: region, age, sex, and eligibility status. Dummy variables were created for each variable. We collapsed the Non-Users and Healthy Users into the Low Morbidity RUB[12] and created variables for the four remaining RUBs. Three regional variables were created (urban, rural, and suburban). Dummy variables for sex (M, F) and eligibility category (SSI, TANF) were also created.

The results of the regression analysis were then used to predict the likelihood that an enrollee would be admitted to a hospital. These probabilities were averaged over all of the enrollees in a

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[11] *The rates for the Non-User and Healthy Users RUBs are relatively high because the only way enrollees in those RUBs could have qualified for the asthma cohort is by receiving a prescription drug for asthma. The rates for these two RUBs are not 100 percent, however, because the list of drugs to qualify for the cohort and the list of appropriate asthma medications for this performance measure are different.*
[12] *The sizes of the Non-Users and Healthy Users RUBs were too small for meaningful analysis.*

health plan to predict the likelihood that the average enrollee would be admitted to the hospital. This was considered the "case mix expected" rate. These expected rates were then compared to the observed rates for each health plan. This comparison was used to determine whether a plan was performing better or worse than expected given the risk and demographic profiles of its enrollees.

Table 24 contains each health plan's performance results on the inpatient admission measure, both before and after risk adjustment. The first column reports the unadjusted percentage of enrollees in each health plan that had at least one inpatient admission.
The second column divides the observed value (from the first column) by the statewide admission rate (17.7). Health plans with a score greater than 1.0 have a higher percentage of enrollees with an admission than the statewide average, while those with a score less than 1.0 have a lower percentage of enrollees with an admission.

Table 24. Observed vs. Expected* Performance by Health Plan Measure: Inpatient Admissions for Asthma Cohort (CY02)

Health Plan	Unadjusted Results		Risk-Adjusted Results	
	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	20.3	1.15	19.4	1.05
MCO B	18.2	1.03	30.0	0.61
MCO C	14.4	0.81	15.4	0.94
MCO D	19.4	1.10	17.7	1.10
MCO E	21.5	1.21	20.3	1.06
MCO F	15.7	0.89	16.8	0.93
All Plans	17.7	1.00	17.7	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

The third column shows the percentage of enrollees with an admission that one would expect each health plan to have, given its risk and demographic profile, as predicted by the regression model. The final column compares the unadjusted results (column one) with the expected results (column three). How does the health plan perform compared to how we would expect it to perform, given its demographic and risk characteristics? Again, results greater than 1.0 indicate that the percentage of enrollees with an admission exceeds the statewide average, and scores less than 1.0 indicate that the percentage of enrollees with an admission is lower than the state average.

Risk adjustment influences the performance results for several of the health plans. For example, the unadjusted analysis shows that MCO B had 3 percent more enrollees with an admission than the statewide average (1.03 vs. 1.00). Once adjusted, MCO B's results were much better than the state average (0.61 vs. 1.00). The percentage by which MCO E exceeded the state average decreased (from 21 percent to 6 percent) with risk adjustment. Overall, the results for

four of the health plans changed by more than 10 percentage points; one plan's results changed by 4 percentage points; and the results for the remaining health plan did not change at all.

The results from a similar analysis of ER visits are presented in Table 25. Risk adjustment does not have much of an impact on the final performance results for most of the health plans in this case. Performance for one plan changed by 11 percentage points and another by 6 percentage points. The results for the remaining four plans changed by 3 points or fewer. These results suggest that the ER visit rates appropriately reflect actual performance on this indicator despite the relative case mix of each health plan.

Table 25. Observed vs. Expected* Performance by Health Plan Measure: ER Visits for Asthma Cohort (CY02)

Health Plan	Unadjusted Results		Risk-Adjusted Results	
	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	35.0	1.02	35.4	0.99
MCO B	29.3	0.86	38.9	0.75
MCO C	33.7	0.99	33.0	1.02
MCO D	25.8	0.75	33.7	0.77
MCO E	53.1	1.55	35.7	1.49
MCO F	40.7	1.19	34.0	1.20
All Plans	34.2	1.00	34.2	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

The conclusions that we draw from the stratified results presented in Tables 18 and 19 and the results from the regression analysis presented here are similar. The regression analysis, however, offers at least two benefits. First, it allows a state to control for additional demographic factors simultaneously. Also, where health plan performance may vary on a measure by RUB, the regression weighs the results according to the distribution of the population, resulting in a single number that reflects the overall performance of the health plan.

Selecting Performance Measures

For our final analysis, we applied regression techniques to identify the factors that are associated with an increase in the likelihood of an enrollee in the asthma cohort having an inpatient admission during the year. In addition to the risk factors applied in the above regressions (age, eligibility category, sex, region, and RUB), we added race and two variables that represent appropriate outpatient care to asthma enrollees: the presence of at least two ambulatory care visits and the receipt of appropriate asthma medication.

Table 26 presents the results of our analysis. The data suggest that most of the variables included in our analysis are significant. Black enrollees are almost one and a half times (1.48) more likely to have an admission than white enrollees. All other variables held constant. Females (1.20),

16

adults (1.23), urban residents (1.26), and TANF enrollees (1.17) are also more likely to have an inpatient admission than males, children, rural residents, and SSI enrollees, respectively. Enrollees in the Low Morbidity RUB are less likely to have an admission (.29) than enrollees in the Moderate Morbidity RUB; enrollees in the High (6.01) and Very High Morbidity RUBs (22.23) are more likely to have an admission than enrollees in the Moderate Morbidity RUB. This analysis also indicates that enrollees who have two or more ambulatory care visits during the year are less likely (.69) to have an inpatient admission than enrollees who do not meet that threshold.

Table 26. Odds Ratios for Factors that Impact the Likelihood of an Inpatient Admission for an Enrollee in the Asthma Cohort (CY02)

Variable	Estimate	Confidence Interval
Low Morbidity RUB	0.29***	0.23 - 0.36
High Morbidity RUB	6.01***	5.35 - 6.75
Very High Morbidity RUB	22.23***	19.08 - 25.89
Suburban	1.03	0.90 - 1.19
Urban	1.26***	1.10 - 1.45
Female	1.20***	1.08 - 1.34
Adult	1.23**	1.09 - 1.40
TANF	1.17**	1.04 - 1.31
Black	1.48***	1.32 - 1.66
Neither Black nor White	1.07	0.84 - 1.36
Ambulatory Visits (2+)	0.69***	0.60 - 0.80
Appropriate Medication	0.98	0.88 - 1.08

**p<.05; ***p<.01

Note: All dependent variables are dummy variables.

Conclusions

The results show that when performance indicators are monitored for multiple health plans, risk adjustment can improve a state's ability to compare performance on those measures that are sensitive to case mix. Some of the significant relationships we observed in our analysis of the asthma cohort include:

- A strong direct relationship between RUB severity and the utilization rates for two of the outcome measures (inpatient admissions and ER visits) and one of the process measures (ambulatory care visits).
- A strong inverse relationship between RUB severity and two of the outcome measures: avoidable inpatient admissions for both children and adults.
- The process measure for appropriate medications was not sensitive to RUB severity.
- Controlling for case mix had a large impact (greater than 5 percentage points) on the performance results for inpatient admission rates for four of the health plans. Three of the health plans improved their performance results by more than 10 percentage points. Only one plan went from better than average to worse than average.
- Enrollees who had two or more ambulatory care visits during the year were less likely to have an inpatient admission than enrollees who did not meet that threshold. This suggests that a measure of ambulatory care visits is potentially useful for states to monitor plan performance.

Diabetes

Defining the Cohort

Encounter data from calendar year (CY02) was evaluated to identify the cohort. We identified the 7,121 enrollees in the diabetes cohort using slightly modified clinical and enrollment decision rules from HEDIS® 2003.

Clinical Criteria

The following clinical criteria were applied to identify members in the cohort. All members were between 18 and 75 years of age and met or exceeded at least one of the following utilization thresholds of health care services:

- One dispensed insulin or oral hypoglycemic/antihyperglycemic agent;
- One ER visit with a diabetes diagnosis;
- One inpatient visit with a diabetes diagnosis; or
- Two ambulatory care visits with a diabetes diagnosis.

The cohort was defined and performance was measured in the same calendar year. More details on the definition of the diabetes cohort can be found in the Technical Appendix.

Enrollment Criteria

As mentioned in Section I, the enrollment criteria is consistent with HEDIS® 2003 specifications. This means that each member of the cohort had to be enrolled in the same health plan for at least 320 days throughout the calendar year, with no more than one gap in enrollment of up to a maximum of 45 days. In addition, the person must have been enrolled as of December 31ˢᵗ of the study year; in this case, CY02.

Descriptive Statistics

For each disease, we examined the distribution of the cohort across health plans to identify any factors that might influence the results. The four largest health plans account for about 93 percent of the population with diabetes. There is a slight variation in the population distribution among the four plans, ranging from a low of 19.9 percent to a high of 28.3 percent, while the two smaller plans combine to account for 7.2 percent of the population.

Table 27. Distribution of Diabetes Cohort Across Health Plans (CY02)

Health Plan	Percent of Enrollees
MCO A	23.3
MCO B	3.1
MCO C	19.9
MCO D	28.3
MCO E	4.1
MCO F	21.3
All MCOs	100.0

Almost twice as many members of the cohort have Type 1 diabetes (61.6 percent) compared to Type 2 diabetes (31.6 percent). As for location, 45.4 percent of the population in this cohort resides in urban areas, 19.3 percent live in rural areas, and 35.3 percent reside in suburban areas of Maryland. Women account for 71.8 percent of the cohort. The data also show that there are four times as many SSI beneficiaries (81.8 percent) than there are TANF beneficiaries. More specific demographic information on the diabetes cohort can be found in Appendix III.

We used a mutually exclusive stratification system to classify members of the cohort according to their health status into one of six groups, or Resource Utilization Bands (RUBs), based on their Adjusted Clinical Group (ACG) assignments in CY02. The six RUBs, presented in increasing levels of morbidity, are: Non-Users,[13] Healthy Users,[14] Low Morbidity, Moderate Morbidity, High Morbidity, and Very High Morbidity.

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[13] The Non-Users RUB includes members of the cohort who do not have enough diagnostic information on their claims/encounter data to be accurately classified into the appropriate risk strata. For example, an enrollee may qualify as a member of the diabetes cohort by filling an insulin prescription at some point during the year. However, *prescription information is not used by the ACG system to assign enrollees to ACGs/RUBs. Therefore, if an enrollee only received prescriptions, and has no diagnosis information during the year, he would be a member of the Non-Users RUB.*
[14] *The Healthy Users RUB includes enrollees whose diagnostic information contains only data about preventive services or minor conditions. The data are diagnostic information not sufficient to accurately classify the enrollee into the appropriate risk group.*

Table 28 provides the RUB distribution for the diabetes cohort by health plan. Sixty percent of the cohort is found in the two most severe RUBs (High and Very High Morbidity) while the Healthy Users, Non-Users, and Low Morbidity RUBs have a combined total of 4.8 percent of the population. Enrollees in the High and Very High Morbidity RUBs are fairly evenly distributed across health plans. Enrollment in the High Morbidity RUB ranges from 27.8 in MCO A to 30.9 in MCO F. There is more variation across health plans in the Moderate Morbidity RUB, where MCO B has 39.4 percent of its population and MCO E has only 29.6 percent.

Table 28. Distribution of Diabetes Cohort Across Health Plans by RUB (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	1.2	0.5	2.2	1.1	1.7	1.9	1.5
Healthy Users	0.4	-	0.2	0.1	0.3	0.1	0.2
Low Morbidity	2.4	2.3	3.2	3.3	2.4	3.8	3.1
Moderate Morbidity	35.6	39.4	32.4	33.2	29.6	35.1	34.0
High Morbidity	27.8	29.0	29.1	30.1	30.6	30.9	29.5
Very High Morbidity	32.7	29.0	32.9	32.2	35.4	28.2	31.6
All RUBs	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: A dash indicates that the MCO has no enrollees in the RUB.
Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Performance Measures

The analysis evaluates health plan performance using a set of generic performance measures as well as some disease-specific measures. The results for each set of measures as applied to the diabetes cohort are described below.[15]

Generic Measures

The generic measures used to evaluate performance for all diseases were the percentage of enrollees in the cohort who had at least:

- One inpatient admission;
- One ER visit;[16] and
- Two ambulatory care visits.[17]

For each measure, the admission or visit is counted regardless of the diagnosis on the encounter. For example, if an enrollee who has diabetes was admitted to the hospital for a ruptured spleen, the admission was counted, even though it was unrelated to the enrollee's diabetes.

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[15] *Health plan performance for enrollees in the Non-Users, Healthy Users, and Low Morbidity RUBs are included in the tables. However, because the percentage of enrollees in these RUBs is so low (1.5, 0.2, and 3.1 percent, respectively), we do not attempt to draw meaningful conclusions from these results.*

[16] *An ER visit is defined as a visit to an emergency room that does not result in an inpatient admission.*

[17] *An ambulatory care visit is defined as a visit to an outpatient hospital department, a health clinic, or a physician's office.*

Table 29 provides the results for the inpatient admissions measure. The data show that the percentage of enrollees with at least one inpatient admission increases as RUB severity increases.[18] (This percentage of enrollees will be referred to as the admission rate.) There is some variation in admission rates across health plans within each RUB. For example, in the High Morbidity RUB, MCO B has an 18.8 percent admission rate, while MCO E has a 34.4 percent rate. MCO B admitted 60.9 percent of its enrollees from the Very High Morbidity RUB, while both MCO E and F admitted 72.1 percent. For each of the three most severe RUBs, MCO B's performance is consistently below the mean (better than average), while MCO E's performance is consistently above the mean (worse than average). MCO C is below the mean (better than average) for two of the three RUBs.

Table 29. Percent of the Diabetes Cohort With at Least One Inpatient Admission (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	0.0	-	0.0	0.0	0.0	0.0	0.0
Low Morbidity	0.0	0.0	0.0	1.5	0.0	1.7	0.9
Moderate Morbidity	6.4	4.6	7.0	5.7	9.2	5.8	**6.2**
High Morbidity	30.4	18.8	22.0	29.5	34.4	27.3	**27.6**
Very High Morbidity	70.1	60.9	63.5	66.9	72.1	72.1	**68.0**
All RUBs (CY02)	33.6	24.9	29.5	32.4	38.8	30.9	31.8

Note: A dash indicates that the MCO has no enrollees in the RUB.
Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Table 30 presents the results for ER visits. In general, there is an increase in the percentage of enrollees with at least one ER visit (ER visit rate) as RUB severity increases.[19] There is a more distinct difference in health plan variation in the ER visit rate than observed in the admission rate. For example, in the Moderate Morbidity RUB, MCO B has an ER visit rate of 10.3 percent, while MCO E has a rate of 25.3 percent. Variation in the High Morbidity RUB ranges from 18.8 percent to 47.8 percent. In the Very High Morbidity RUB, MCO B has an ER visit rate of 31.3 percent, while MCO E has a rate of 52.9 percent. For ER visits in the three most severe RUBs, MCO B and MCO D consistently perform below the mean (better than average), while MCO E and MCO F are consistently above the mean (worse than average).

Table 30. Percent of the Diabetes Cohort With at Least One ER Visit (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs

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[18] *As expected, we do not have any admissions in the Non-Users and Healthy Users RUBs, because the lowest RUB that an enrollee with an inpatient admission would be assigned to is the Low Morbidity RUB.*
[19] *There are no members of the cohort with at least one ER visit in the Non-Users or Healthy Users RUB, because the lowest RUB that an enrollee with an ER visit can be assigned to is the Low Morbidity RUB.*

Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	0.0	-	0.0	0.0	0.0	0.0	0.0
Low Morbidity	15.0	20.0	6.7	9.0	14.3	6.9	9.5
Moderate Morbidity	15.4	10.3	15.0	12.9	25.3	19.7	15.8
High Morbidity	27.1	18.8	26.4	22.0	47.8	39.5	28.9
Very High Morbidity	37.6	31.3	36.5	28.8	52.9	44.5	36.7
All RUBs (CY02)	25.7	19.0	24.8	20.4	41.2	31.9	25.8

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

The results for the ambulatory care visits measure are presented in Table 31. The percentage of enrollees who had two or more ambulatory care visits (ambulatory care visit rate) increases only slightly with RUB severity, from 87.3 in the Moderate Morbidity RUB to 95.8 in the Very High Morbidity RUB.[20] There is some variation across health plans within the same RUB. In the Moderate Morbidity RUB, the ambulatory care visit rate ranges from 82.9 percent for MCO D to 95.4 percent for MCO B. The variation is not as large for the two most severe RUBs, however. Across the three most severe RUBs, MCO B consistently performs slightly above the mean (better than average), while MCO D performs slightly below the mean (worse than average).

Table 31. Percent of the Diabetes Cohort With at Least Two Ambulatory Care Visits (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	16.7	-	0.0	0.0	0.0	100.0	21.4
Low Morbidity	77.5	60.0	48.9	49.3	28.6	60.3	56.8
Moderate Morbidity	90.0	95.4	86.1	82.9	89.7	88.9	87.3
High Morbidity	94.1	96.9	97.8	91.8	91.1	94.9	94.3
Very High Morbidity	96.7	98.4	97.9	93.2	93.3	96.7	95.8
All RUBs (CY02)	91.7	95.5	90.1	86.7	88.1	90.2	89.6

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

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[20] *As expected, there are no members of the cohort in the Non-Users RUB because Non-Users, by definition, do not utilize ambulatory care services.*

Disease-Specific Measures

In addition to the generic measures, we identified several disease-specific measures that are part of the standard of care for diabetes. The measures we selected were the percentage of:

- Avoidable inpatient admissions; and
- Enrollees with at least one:
    - Hemoglobin (HbA1c) test;
    - Eye exam; and
    - LDL-C screening.

More information on the definition and diagnosis codes used for each measure can be found in the Technical Appendix.

In 2001, the Agency for Healthcare Research and Quality (AHRQ) published a collection of 16 ambulatory care sensitive conditions based on the current literature.[21] These conditions are defined as ones for which inpatient admissions can potentially be prevented if enrollees receive appropriate ambulatory care services. We applied the definition to the entire set of inpatient admissions to determine what percentage of the total admissions qualified as avoidable. The results, presented in Table 32, show that there is an initial increase followed by a decrease in avoidable admissions as the RUB severity increases. For example, there are no avoidable admissions in the Low Morbidity RUB, while 2.2 and 7.4 percent of the admissions in the Moderate and High Morbidity RUBs, respectively, are potentially avoidable. The occurrence of avoidable admissions decreases to 4.3 percent in the Very High Morbidity RUB. One hypothesis for this result is that enrollees in the most severe RUBs, given their multiple co-morbidities, are more likely to be admitted for conditions that are not sensitive to the level of ambulatory care services they receive. There is some variation across health plans within RUBs, with the largest variation in the High Morbidity RUB (0.0 for MCO B to 17.5 for MCO E).

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[21] *AHRQ Quality Indicators - Guide to Prevention Quality Indicators: Hospital Admission for Ambulatory Care Sensitive Conditions. Rockville, MD: Agency for Healthcare Research and Quality. Revision 3. (January 9, 2004). AHRQ Pub. No. 02-R0203.*

Table 32. Percent of Inpatient Admissions That Were Avoidable (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	-	-	-	-	-	-	-
Healthy Users	-	-	-	-	-	-	-
Low Morbidity	-	-	-	0.0	-	0.0	0.0
Moderate Morbidity	4.6	0.0	2.6	2.0	0.0	0.0	2.2
High Morbidity	4.5	0.0	8.6	8.8	17.5	7.3	7.5
Very High Morbidity	4.1	8.4	6.0	4.6	1.9	3.3	4.4
All RUBs	4.2	6.8	6.2	5.3	4.2	4.0	4.9

Note: Total Inpatient Admissions = 4605

A dash indicates that there were no inpatient admissions for the enrollees in that RUB and MCO.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Results for the HbA1c test measure are provided in Table 33. The standard of care for diabetes suggests that enrollees receive at least two HbA1c tests annually.[22] We adopted the HEDIS® 2003 standard that measures whether the enrollee received at least one HbA1c test during the year. Because every enrollee with diabetes should receive a hemoglobin test, this measure is much less sensitive to risk adjustment. Accordingly, the variation across the Moderate, High, and Very High Morbidity RUBs is minimal on a statewide basis (64.7, 62.3, and 61.7 percent, respectively). The results for both MCO A and B follow unexpected patterns with decreases of more than 5 percentage points between performance in the Moderate Morbidity RUB and the High Morbidity RUB. This trend continues for MCO A between the High Morbidity RUB and the Very High Morbidity RUB. There is some variation across health plans within the same RUB. MCO D has consistently low results for each of the three most severe RUBs, while MCO C, MCO E, and MCO F perform above average. Independent analysis suggests that the results for measures involving lab data may appear lower than they actual are because of data limitations.[23]

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[22] *AHRQ, National Guideline Clearinghouse*
http://www.guideline.gov/summary/summary.aspx?doc_id=3567&nbr=2793&string=diabetes (July 29, 2004).
[23] *Encounter data for lab tests that are provided in hospital inpatient and outpatient departments do not always contain enough specificity to identify the type of lab test provided. This limitation may disproportionately affect health plans that provide a large percentage of services in hospital-based departments. It should be noted that changes to data submission rules as a result of the Health Insurance Portability and Accountability Act (HIPAA) of 1996 should ameliorate this problem in future years.*

Table 33. Percent of the Diabetes Cohort With at Least One Hemoglobin Test (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	15.0	0.0	9.7	4.4	0.0	3.6	7.4
Healthy Users	16.7	-	0.0	0.0	0.0	50.0	14.3
Low Morbidity	60.0	40.0	55.6	40.3	57.1	55.2	51.4
Moderate Morbidity	67.2	67.8	70.7	51.7	72.4	71.2	64.7
High Morbidity	61.6	56.3	68.8	51.2	68.9	71.2	62.3
Very High Morbidity	56.6	71.9	69.3	51.5	68.3	72.1	61.7
All RUBs (CY02)	61.2	64.7	67.7	50.5	68.0	69.6	61.6

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

People with diabetes, regardless of disease severity, are expected to undergo an eye screening for diabetic retinal disease on an annual basis.[24] HEDIS® 2003 allows for exceptions to the annual standard for enrollees who meet certain clinical criteria. Because our data did not provide the information necessary to apply that clinical decision rule, we applied a slightly modified version of the HEDIS® 2003 standard, counting eye exams received in one year only. Table 34 shows the percentage of enrollees with at least one dilated eye exam in CY02. As with hemoglobin tests, the statewide rates are not that sensitive to RUB, although there is a measurable difference between the Moderate and High Morbidity RUBs, both statewide and within each health plan. The difference between the High and Very High Morbidity RUBs is negligible, except within MCO B. The variation across health plans within the same RUB is substantial. For the Moderate Morbidity RUB, the results range from 17.2 percent in MCO D to 46.0 percent in MCO B. For the High Morbidity RUB, the results range from 21.6 percent to 50.0 percent. The Very High Morbidity RUB ranges from 22.9 percent to 40.6 percent. MCO B, MCO C, and MCO E all perform above the state mean (better than average) on this measure, while MCO D and MCO F consistently perform below the mean (worse than average).

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[24] *AHRQ, op.cit.*

Table 34. Percent of the Diabetes Cohort With at Least One Eye Exam (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	3.2	4.4	0.0	0.0	1.9
Healthy Users	0.0	-	0.0	0.0	0.0	0.0	0.0
Low Morbidity	12.5	0.0	20.0	6.0	0.0	0.0	8.1
Moderate Morbidity	22.7	46.0	30.0	17.2	24.1	17.9	22.4
High Morbidity	28.6	50.0	38.5	21.6	41.1	23.7	28.6
Very High Morbidity	28.8	39.1	40.6	22.9	39.4	24.8	29.6
All RUBs	25.7	43.9	35.0	19.8	33.7	20.6	25.7

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Low-Density Lipoprotein Cholesterol (LDL-C) is a test that all enrollees in the cohort should have to detect "bad" cholesterol. National guidelines suggest that enrollees with diabetes receive this test at least annually, or bi-annually if they have very low lipid values.[25] The HEDIS® 2003 measure evaluates whether the test was received in the measurement year or the year prior. We applied a modified standard, looking only at the measurement year, recognizing that the results would be less than 100 percent. Table 35 shows the percentage of enrollees with at least one LDL-C screening in CY02. Overall, the measure does not appear to be sensitive to RUB severity. There is some variation in the results across health plans within each RUB. Results in the Moderate Morbidity RUB range from 45.6 percent in MCO D to 66.7 percent in MCO B. In the High Morbidity RUB, the results range from 38.9 percent to 62.1 percent. The Very High Morbidity RUB results show a similar variation. MCO B, MCO C, and MCO F consistently perform higher than the mean (better than average), while MCO D performs below the mean (worse than average) for this measure. As with the HbA1c test, independent analysis suggests that the results for measures involving lab data may appear lower than they actually are because of data limitations.[26]

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[25] *AHRQ, op.cit.*

[26] *Encounter data for lab tests that are provided in hospital inpatient and outpatient departments do not always contain enough specificity to identify the type of lab test provided. This limitation may disproportionately affect health plans that provide a large percentage of services in hospital-based departments.*

Table 35. Percent of the Diabetes Cohort With at Least One LDL-C Screening (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	15.0	0.0	9.7	0.0	0.0	3.6	6.5
Healthy Users	0.0	-	33.3	0.0	0.0	0.0	7.1
Low Morbidity	52.5	40.0	44.4	35.8	57.1	53.5	46.0
Moderate Morbidity	58.0	66.7	60.2	45.6	56.3	59.8	**55.7**
High Morbidity	51.4	56.3	57.4	38.9	51.1	62.1	**51.5**
Very High Morbidity	49.6	68.8	60.9	41.7	56.7	57.6	**52.1**
All RUBs (CY02)	52.6	63.3	58.0	41.5	53.7	58.5	52.2

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Risk-Adjusted Performance Results

As demonstrated by the results presented so far, stratification according to health status can improve a state's ability to make fairer comparisons of health plans for certain performance measures. Applying logistic regression techniques facilitates the comparison by developing a single risk-adjusted number for each health plan that reflects its performance.

Logistic regression also allows states to simultaneously control for variation in demographic characteristics across health plans, in addition to variation in health status when determining a health plan's performance on a given measure. In the following analysis, a logistic regression was used to show the relationship between the dependent variable and the independent variables that may influence the outcome or process measure of interest. The independent variables we controlled for were: age, sex, region, eligibility status, and RUB category. The Non-Users, Healthy Users, and Low Morbidity RUBs were collapsed into the Moderate Morbidity RUB.[27] Three regional variables were created (urban, rural, and suburban). Dummy variables for sex (M, F) and eligibility category (SSI, TANF) were also created. Finally, age was included in the regression as a continuous variable to capture the effect of each additional year on the measure of interest.

The results from the regression were used to predict the likelihood that an enrollee in the cohort would be admitted to a hospital. The individual expected probabilities were then averaged over all the enrollees by health plan to predict the likelihood that an enrollee in a particular health plan would be admitted to a hospital. The predicted values were compared to the observed rates for each plan. The comparison was used to determine whether a plan was performing better or worse than expected given its case mix and the demographic profiles of its enrollees.

Table 36 provides the results of the observed and expected performance rates for each health plan based on inpatient admission rate. The first column of data reports the observed or

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[27] *The sizes of the Non-Users, Healthy Users, and Low Morbidity RUBs were too small for meaningful analysis.*

unadjusted percentage of enrollees in each plan that had at least one inpatient admission. The second column shows the observed value from the first column divided by the state average. The state average admission rate, also referred to as the all-plan average, is 31.8 percent, as indicated in the last row of the first data column. Health plans with a score greater than 1.0 have a higher percentage of enrollees with an admission than the statewide average, while those with a score less than 1.0 have a lower percentage of enrollees with an admission.

The third column is the risk-adjusted case mix expected value that is derived from the logistic regression mentioned earlier in this section. The fourth and final column in the table shows the observed-to-expected ratio. To get this ratio, we divided the observed percentage (from data column one) by the case mix expected (from data column three) for each health plan. Given the demographic and risk characteristics, how do the health plans perform compared to how we would expect them to?

After risk adjusting to control for the differences in demographics and case mix across plans, we found that most of the health plans are performing as expected on this measure. Only MCO E had a large change in performance, dropping 12 percentage points, from 22 percent above average to 10 percent above average. The remaining five health plans changed by 4 percentage points or less; one did not change at all.

Table 36. Observed vs. Expected* Performance by Health Plan Measure: Inpatient Admissions for Diabetes Cohort (CY02)

Health Plan	Unadjusted Results		Risk-Adjusted Results	
	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	33.6	1.06	31.9	1.05
MCO B	24.9	0.78	30.7	0.81
MCO C	29.5	0.93	31.9	0.93
MCO D	32.4	1.02	32.3	1.00
MCO E	38.8	1.22	35.2	1.10
MCO F	30.9	0.97	30.5	1.01
All Plans	31.8	1.00	31.8	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

The results from a similar analysis of ER visits are presented in Table 37. Risk adjustment has some impact on the final performance results for health plans in this case; however, the change is not significant. Three health plans change only 2 percentage points; two others move 4 percentage points, and the last one (MCO E) changes by 8 percentage points.

Table 37. Observed vs. Expected* Performance by Health Plan Measure: ER Visits for Diabetes Cohort (CY02)

	Unadjusted Results		Risk-Adjusted Results	
Health Plan	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	25.7	1.00	26.2	0.98
MCO B	19.0	0.74	25.0	0.76
MCO C	24.8	0.96	24.7	1.00
MCO D	20.4	0.79	26.7	0.77
MCO E	41.2	1.60	27.0	1.52
MCO F	31.9	1.24	25.0	1.28
All Plans	25.8	1.00	25.8	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

While we draw the same conclusions about health plan performance from the stratified results in Tables 29 and 30 and the regression analysis presented here, the regression technique provides two advantages. First, multivariate regression techniques allow a state to control for additional demographic differences across health plan populations. Second, the development of a single number that consolidates the results of the analysis facilitates the comparison of results across health plans.

Selecting Performance Measures

For our final analysis, we applied regression techniques to identify the factors that are associated with an increase in the likelihood of an enrollee having an inpatient admission or an ER visit during the year. In addition to the risk factors applied in the above regressions (age, eligibility category, sex, region, and RUB), we added race and a variable that represents appropriate outpatient care to people with diabetes: the presence of at least two ambulatory care visits. Table 38 shows the result of the analysis. We observe that women are 1.19 times more likely than men to have an inpatient admission. The results also show that members of the cohort who reside in an urban area are more likely (1.24) to have an inpatient admission than those who live in rural areas. Further, black enrollees are more likely (1.15) to have an admission than white enrollees. On the other hand, having at least two ambulatory care visits decreases the likelihood (0.73) of an enrollee in the cohort having an inpatient admission. Each additional year of age slightly reduces the likelihood of an inpatient admission. Finally, compared to enrollees in the High Morbidity RUB, enrollees in the Moderate Morbidity RUB were less likely (.15) to have an admission, while those in the Very High Morbidity RUB had an increased likelihood (6.09) of having an inpatient admission.

Table 38. Odds Ratios for Factors that Impact the Likelihood of an Inpatient Admission in the Diabetes Cohort (CY02)

Variable	Estimate	Confidence Interval
Moderate Morbidity RUB	0.15***	0.12 - 0.18
Very High Morbidity RUB	6.09***	5.32 - 6.98

Suburban	1.10	0.92 - 1.31
Urban	1.24*	1.04 - 1.49
Female	1.19*	1.04 - 1.37
Age	0.99**	0.99 - 1.00
TANF	1.14	0.95 - 1.37
Black	1.15*	1.00 - 1.33
Neither Black nor White	1.19	0.88 - 1.61
Ambulatory Visits (2+)	0.69**	0.55 - 0.88

*p<0.1; **p<0.05; ***p<0.01

Note: All dependent variables are dummy variables except age, which is continuous.

Conclusion

The results show that when performance indicators are monitored for multiple health plans, risk adjustment can improve a state's ability to compare performance on those measures that are sensitive to case mix. Some of the significant relationships we observed in our analysis of the diabetes cohort include:

- A strong direct relationship between RUB severity and the utilization rates for two of the outcome measures: inpatient admission and ER visits.
- The process measures (ambulatory care visits, HbA1c tests, eye exams, and LDL-C tests) were not markedly sensitive to RUB severity.
- Controlling for case mix had a slight impact (less than 5 percentage points) on the performance results for inpatient admission rates for five of the six health plans. Only one plan improved its result (by 12 percentage points). This suggests that the results for most of the health plans are accurate without adjustment for risk.
- Controlling for case mix had a slight impact (less than 5 percentage points) on the performance results for ER visit rates for five of the six health plans. One plan improved its results (by 8 percentage points). The ER visit rates for the health plans appear to be accurate given the case mixes of their populations.
- Having at least two ambulatory care visits during CY02 reduced the likelihood that an enrollee would have an inpatient admission. This supports the literature about ambulatory care sensitive conditions by suggesting that receiving ambulatory care visits is an important measure in predicting the likelihood of having an inpatient admission, and therefore a good indicator for monitoring plan performance.

HIV/AIDS

Defining the Cohort

We defined the cohort of enrollees with HIV/AIDS by selecting those enrollees who qualified for either the HIV or AIDS capitation payments. In Maryland, health plans receive enhanced capitation payments for enrollees who have been documented as having either HIV or AIDS. There are 2,619 members in the HIV/AIDS cohort in calendar year (CY02) who meet the clinical and enrollment criteria.

Clinical Criteria

An enrollee is categorized as having HIV based on evidence of a positive HIV test result. This is required in order for a health plan to receive the HIV payment rate for an enrollee. Clinical evidence is also required before an enrollee meets the AIDS definition, enabling the health plans to receive the AIDS payment rate. Hence our clinical definition for this cohort was derived from health plan payment rates.

The cohort includes all enrollees age 21 and older who were eligible for one of the two payment rates in CY02. We defined the cohort and measured performance in the same calendar year. More details on the definition for the HIV/AIDS cohort can be found in the Technical Appendix.

Enrollment Criteria

As mentioned in Section I, we also included enrollment criteria in each cohort definition. Each member of the cohort had to be enrolled in the same health plan for at least 320 days, with no more than one gap in enrollment. The gap in enrollment could not exceed 45 days, and the person must have been enrolled as of December 31st of the study year; in this case, CY02.

Descriptive Statistics

For each disease, we examined the distribution of the cohort across health plans to identify any factors that might influence the results. The distribution for the HIV/AIDS cohort is presented in Table 39. Seventy-one percent of enrollees in the cohort are enrolled in one of two health plans.

Table 39. Distribution of HIV/AIDS Cohort Across Health Plans (CY02)

Health Plan	Percent of Enrollees
MCO A	24.7
MCO B	4.9
MCO C	6.5
MCO D	46.3
MCO E	2.6
MCO F	14.9
All MCOs	100.0

Fifty-seven percent of the cohort is female and 79 percent are SSI beneficiaries. Seventy-four percent live in urban areas of Maryland and 21 percent in suburban areas. Fifty-three percent of the cohort is eligible for the AIDS payment rate, and 47 percent are eligible for the HIV rate. More specific demographic information on the HIV/AIDS cohort can be found in Appendix III.

Once the cohort was identified, we used Adjusted Clinical Group (ACG) assignments for CY02 to obtain the distribution of enrollees by Resource Utilization Bands (RUBs). An enrollee's RUB assignment is a proxy for health status and is used to control for the impact of case mix on plan performance. The six RUBs, presented in increasing levels of morbidity, are: Non-Users,[28] Healthy Users,[29] Low Morbidity, Moderate Morbidity, High Morbidity, and Very High Morbidity.

The RUB distribution for the HIV/AIDS cohort by health plan is provided in Table 40. Over 92 percent of the enrollees are in the three most severe RUBS: Moderate Morbidity (28.6), High Morbidity (31.2), and Very High Morbidity (32.8). Five percent of the cohort is in the Non-Users RUB. There is marked variation in the distribution of the cohort across health plans. For example, MCO C has 33.9 percent of its enrollees in the Moderate Morbidity RUB, while MCO B has only 17.2 percent of its enrollees in that RUB. In contrast, MCO B has 79.7 percent of its enrollees in the High and Very High Morbidity RUBs, while MCO C has 49.2 percent of its enrollees in those RUBS.

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[28] *The Non-Users RUB includes members of the cohort who do not have enough diagnostic information on their claims/encounter data to be accurately classified into the appropriate risk strata. For example, an enrollee may qualify as a member of the asthma cohort by filling an asthma prescription at some point during the year. However, prescription information is not used by the ACG system to assign enrollees to ACGs/RUBs. Therefore, if an enrollee only received prescriptions, and does not have any diagnosis information during the year, he would be a member of the Non-Users RUB.*

[29] *The Healthy Users RUB includes enrollees whose diagnostic information contains only data about preventive services or minor conditions. The data are not sufficient to accurately classify the enrollee into the appropriate risk group.*

Table 40. Distribution of HIV/AIDS Cohort Across Health Plans by RUB (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	4.3	3.1	12.3	4.0	7.3	5.9	5.0
Healthy Users	0.6	0.0	0.6	0.9	0.0	1.3	0.8
Low Morbidity	0.9	0.0	4.1	1.6	0.0	2.8	1.6
Moderate Morbidity	25.3	17.2	33.9	31.3	30.4	26.6	28.6
High Morbidity	32.9	39.1	24.6	31.6	29.0	28.1	31.2
Very High Morbidity	36.0	40.6	24.6	30.6	33.3	35.3	32.8
All RUBs	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Performance Measures

As described in Section I, we identified a set of performance measures on which to evaluate the health plans for each disease. The performance measures evaluate the enrollee's utilization of health care services, including disease-specific treatments. Results for each set of measures are described below.[30] [31]

Generic Measures

We selected a generic set of measures on which to evaluate every disease cohort. We measured the percentage of enrollees in the cohort who had at least:

- One inpatient admission;
- One ER visit;[32] and
- Two ambulatory care visits.[33]

For each measure, the admission or visit is counted regardless of the diagnosis on the encounter. For example, if an enrollee who has HIV goes to the ER for a broken leg, the ER visit was counted even though it was unrelated to the enrollee's HIV.

The results of the inpatient admissions measure are provided in Table 41. As expected, the percentage of enrollees with at least one inpatient admission increases with the severity of RUB assignment, from 4.0 percent for the Moderate Morbidity RUB to 66.2 percent for the Very High Morbidity RUB.[34] (This percentage of enrollees will be referred to from now on as the admission rate.) There is also variation in admission rates across health plans within RUBs.

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[30] Health plan performance for enrollees in the Non-Users, Healthy Users, and Low Morbidity RUBs are included in the tables. However, because the percentage of enrollees in these RUBs is so low (5.0, 0.8, and 1.6 percent, respectively), we do not attempt to draw meaningful conclusions from these results.

[31] It is important to note that, unlike the other disease cohorts, the HIV/AIDS population is disproportionately distributed across the health plans. Forty-six percent of the cohort is enrolled in a single health plan, increasing that plan's influence on the all-plan average for each measure.

[32] An ER visit is defined as a visit to an emergency room that does not result in an inpatient admission.

[33] An ambulatory care visit is defined as a visit to an outpatient hospital department, a health clinic, or a physician's office.

[34] As expected, we do not have any admissions in the Non-Users and Healthy Users RUBs, because the lowest RUB that an enrollee with an inpatient admission would be assigned to is the Moderate Morbidity RUB.

MCO C has an admission rate of 73.8 percent for the Very High Morbidity RUB, while MCO E has a rate of 43.5 percent. The variation across health plans is much less within the Moderate Morbidity and High Morbidity RUBs. None of the health plans are consistently above or below the mean for all of the three most severe RUBs. As described in Section II, this measure is likely to be sensitive to risk adjustment, as the admission rate clearly increases with the severity of RUB assignment.

Table 41. Percent of the HIV/AIDS Cohort With at Least One Inpatient Admission (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	0.0	-	0.0	0.0	-	0.0	0.0
Low Morbidity	0.0	-	0.0	0.0	-	0.0	0.0
Moderate Morbidity	3.1	4.6	1.7	4.0	4.8	6.7	4.0
High Morbidity	27.2	20.0	23.8	25.3	25.0	25.5	25.4
Very High Morbidity	65.2	57.7	73.8	67.9	43.5	68.1	66.2
All RUBs	33.2	32.0	24.6	30.0	23.2	33.0	30.8

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

The results for ER visits are presented in Table 42. As was the case with inpatient admissions, the percentage of the HIV/AIDS cohort who had at least one ER visit (ER visit rate) during CY02 increases with the severity of RUB assignment, from 15.8 percent for Moderate Morbidity to 40.8 percent for Very High Morbidity. The one exception is MCO C, whose results show a slight decline from the High to the Very High Morbidity RUB. The difference between RUBs, however, is not as distinct for ER visits as it is for inpatient admissions. There is considerable variation across health plans in the ER visit rate within RUBs. Both MCO E and MCO F have ER visit rates that are several percentage points above the statewide rate (worse than average) for all health plans in the High and Very High Morbidity RUBs. MCO A, MCO B, and MCO D are all consistently below the statewide rate (better than average) for the three most severe RUBs.

Table 42. Percent of the HIV/AIDS Cohort With at Least One ER Visit (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Healthy Users	0.0	-	100.0	18.2	-	60.0	28.6
Low Morbidity	33.3	-	16.3	10.5	-	36.4	20.9
Moderate Morbidity	16.5	13.6	15.5	13.2	14.3	25.0	15.8
High Morbidity	31.0	24.0	38.1	21.2	65.0	40.0	28.4
Very High Morbidity	45.9	26.9	35.7	34.0	69.6	52.2	40.8
All RUBs	31.2	22.7	24.6	21.5	46.4	38.1	27.3

Note: A dash indicates that the MCO has no enrollees in the RUB.
Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

The results for ambulatory care visits are presented in Table 43. The percentage of enrollees receiving two or more ambulatory care visits (ambulatory care visit rate) increases with RUB intensity from the Moderate to the Very High Morbidity RUBs. However, the increase is not dramatic between the High and Very High Morbidity RUBs (81.5 to 85.3). While there is some variation across health plans within each of the most severe RUBs, it is not as distinct for ambulatory care visits as it is for inpatient admissions and ER visits. MCO A and MCO F are consistently above the mean (better than average) for the three most severe RUBs, while MCO D is consistently below the mean (worse than average).

Table 43. Percent of the HIV/AIDS Cohort With at Least Two Ambulatory Care Visits (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	2.0	0.0	0.0	0.8
Healthy Users	50.0	-	0.0	9.1	-	0.0	14.3
Low Morbidity	16.7	-	28.6	10.5	-	9.1	14.0
Moderate Morbidity	77.4	77.3	72.4	52.5	76.2	83.7	65.2
High Morbidity	90.1	80.0	81.0	74.7	80.0	90.0	81.5
Very High Morbidity	91.0	88.5	90.5	78.7	82.6	91.3	85.3
All RUBs	82.4	80.5	67.8	64.4	73.9	80.1	72.5

Note: A dash indicates that the MCO has no enrollees in the RUB.
Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Disease-Specific Measures

We have also identified a set of disease-specific measures that evaluate performance on process measures that are part of the standard of care for each disease. For HIV/AIDS, we have selected the percentage of:

- Enrollees with at least one viral load test;
- Enrollees with at least one CD4 test; and
- Female enrollees with at least one Pap test.

More detail on the specific definitions for each measure can be found in the Technical Appendix.

One of the standard lab tests used for monitoring HIV is the viral load test. Most guidelines recommend that people with HIV receive a viral load test every four to six months, or more frequently under certain clinical conditions.[35] We applied a standard of at least one viral load test or one lab test performed in an outpatient hospital setting[36] during the year. Table 44 presents the data on viral load testing for all the health plans. The data indicate that most of the health plans are well below the clinical standard, which should approach 100 percent. All enrollees in the cohort are supposed to receive the test; therefore, one would not expect performance on this measure to be sensitive to RUB. The data confirm this expectation. With the exception of MCO B, there is no noticeable pattern of increase or decrease in performance statewide or within health plans as the RUB severity changes. There is considerable variation, however, within RUBs across health plans on this measure. For example, MCO B has a 78.9 percent viral load test rate in the Very High RUB, while MCO A has a 59.7 percent rate in the same RUB.

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[35] A. Wu, et al., "Quality of Care Indicators for HIV/AIDS," *Disease Management Health Outcomes, June 2000; 7(6): 315-330.*
[36] *When we tested the data for this measure, we noticed markedly low results for the two health plans that rely heavily on outpatient hospital departments for the provision of care to HIV/AIDS enrollees. The information submitted by outpatient hospital departments only indicates that a lab test was performed; it does not specify which test. We decided to count any lab test performed in an outpatient hospital facility as a proxy for both viral load and CD4 test. While not a perfect substitute, the performance of a lab test suggests that some care was being provided. If we had not adjusted our definition, we would have run the risk of penalizing health plans for billing aberrations beyond their control. It should be noted that changes to data submission rules as a result of the Health Insurance Portability and Accountability Act (HIPAA) of 1996 should ameliorate this problem in future years.*

Table 44. Percent of the HIV/AIDS Cohort With at Least One Viral Load Test (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	4.8	8.2	0.0	4.4	4.6
Healthy Users	25.0	-	0.0	18.2	-	0.0	14.3
Low Morbidity	16.7	-	28.6	5.3	-	9.1	11.6
Moderate Morbidity	52.4	54.6	58.6	53.0	85.7	62.5	55.6
High Morbidity	64.8	66.0	61.9	65.5	75.0	71.8	66.3
Very High Morbidity	59.7	78.9	61.9	65.5	73.9	73.9	66.1
All RUBs	56.3	67.2	52.0	57.9	72.5	63.4	58.8

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Another lab test that people with HIV are expected to receive annually is the CD4 test. The guidelines suggest that the CD4 test be administered with the same frequency as the viral load test.[37] As with the viral load, we applied a standard of at least one CD4 test or one lab test performed in an outpatient hospital setting during the year. The results for this measure are presented in Table 45. The data show that the health plans performance ranges between 52 and 72 percent. MCO B and MCO D show a noticeable pattern of increase in performance as RUB severity increases. The statewide performance on this measure also shows a similar increasing pattern in CD4 test rate as RUB severity increases. Performance on CD4 testing also varies significantly across health plans, within the same RUBs. For example MCO B has an 86.5 percent CD4 test rate in the Very High RUB compared to MCO A's 59.7 percent rate in the same RUB.

Table 45. Percent of the HIV/AIDS Cohort With at Least One CD4 Test (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	4.8	12.2	0.0	4.4	6.2
Healthy Users	25.0	-	0.0	18.2	-	0.0	14.3
Low Morbidity	16.7	-	14.3	21.1	-	9.1	16.3
Moderate Morbidity	50.0	59.1	58.6	58.6	90.5	61.5	58.0
High Morbidity	62.9	68.0	61.9	70.0	70.0	75.5	68.3
Very High Morbidity	59.7	86.5	64.3	72.5	69.6	76.8	70.1
All RUBs	55.1	71.9	52.0	63.6	71.0	65.2	61.6

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

The final disease-specific measure we evaluated was Pap tests. Clinical guidelines recommend that females with HIV disease receive at least one Pap test during the year, and we applied that

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[37] Wu, et al., op.cit.

same standard.[38] Table 46 presents the results for the percentage of females in the cohort who received at least one Pap test during CY02 by health plan. The measure is not sensitive to RUB and there is considerable variation across health plans in their performance on this measure. None of the health plans approach the expected standard of 100 percent. MCO D and MCO E are both consistently higher than the statewide mean (better than average) while MCO C is consistently below the mean (worse than average).

Table 46. Percent of the Female HIV/AIDS Cohort Who Received a Pap Test (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	0.0	0.0	0.0	7.4	0.0	0.0	2.7
Healthy Users	0.0	-	0.0	16.7	-	0.0	9.1
Low Morbidity	25.0	-	33.3	23.1	-	14.3	22.2
Moderate Morbidity	28.6	37.5	17.7	40.3	58.3	37.7	35.6
High Morbidity	40.0	23.1	26.1	40.0	36.4	40.3	38.4
Very High Morbidity	27.5	11.8	24.0	41.3	44.4	30.4	33.4
All RUBs	30.6	20.8	20.0	38.6	45.5	33.1	33.8

Note: A dash indicates that the MCO has no enrollees in the RUB.

Non-Users, Healthy Users, and Low Morbidity RUBs make up a very small percentage of the cohort

Total number of women = 1124

Risk-Adjusted Performance Results

The previous set of data stratified the performance results for each measure, allowing us to compare "apples" to "apples," or enrollees with the same health status in one health plan to similar enrollees in another health plan. Stratification of the performance results by RUB reduces the confounding effects of health status on the final result.

Applying regression techniques allows us to take the analysis one step further. Using logistic regression, we can account for both demographic and health status characteristics simultaneously when determining a health plan's performance on a given measure. In the following analysis, a logistic regression was used to relate enrollees' inpatient admissions to their RUB and four demographic characteristics: region, age, sex, and eligibility status. Dummy variables were created for each variable, except age, which was included as a continuous variable. We collapsed the Non-Users, Healthy Users, and Low Morbidity RUBs into the Moderate Morbidity RUB[39] and created variables for the three remaining RUBs. Three regional variables were created (urban, rural, suburban). Dummy variables for sex (M, F) and eligibility category (SSI, TANF) were also created.

The results of the regression analysis were then used to predict the likelihood that an enrollee would be admitted to a hospital. These probabilities were averaged over all of the enrollees in a health plan to predict the likelihood that the average enrollee would be admitted to the

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[38] *Wu, et al., op.cit.*
[39] *The sizes of the Non-Users, Healthy Users, and Low Morbidity RUBs were too small for meaningful analysis.*

hospital. These predicted values were then compared to the observed rates for each health plan. This comparison was used to determine whether a plan was performing better or worse than expected given the risk and demographic profiles of its enrollees.

Table 47 contains each health plan's performance results on the inpatient admission measure, both before and after risk adjustment. The first column of data reports the unadjusted percentage of enrollees in each health plan that had at least one inpatient admission. The second column divides the observed value (from the first column) by the statewide admission rate (30.8). Health plans with a score greater than 1.0 have a higher percentage of enrollees with an admission than the statewide average, while those with a score less than 1.0 have a lower percentage of enrollees with an admission.

The third column shows the predicted admission rate that each health plan would be expected to have. The regression model calculates the predicted admission rate after controlling for each plan's risk and demographic profile. The final column compares the unadjusted results (column one) with the expected results (column three). How does each health plan perform compared to how we would expect it to perform, given its demographic and risk characteristics? As mentioned earlier, results greater than 1.0 indicate that the percentage of enrollees with an admission exceeds the statewide average, and scores less than 1.0 indicate that the percentage of enrollees with an admission is less than the state average.

Risk adjusting the results had a large impact on the performance results for two of the health plans: MCOs B and C. Instead of being 4 percent higher than the statewide average, MCO B appears to be 11 percent lower than average after risk adjustment, a difference of 15 percentage points. MCO C moved 24 percentage points; from 20 percentage points better than the state average before risk adjustment to 4 percentage points worse than the state average after adjustment. The other health plans all moved between 1 and 7 percentage points, all closer to the state average.

Table 47. Observed vs. Expected* Performance by Health Plan Measure: Inpatient Admissions for HIV/AIDS Cohort (CY02)

Health Plan	Unadjusted Results		Risk-Adjusted Results	
	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	33.2	1.08	32.9	1.01
MCO B	32.0	1.04	35.9	0.89
MCO C	24.6	0.80	23.7	1.04
MCO D	30.0	0.97	29.8	1.01
MCO E	23.2	0.75	30.7	0.76
MCO F	33.0	1.07	32.0	1.03
All Plans	30.8	1.00	30.8	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

Table 48 presents the results before and after risk adjustment for ER visits. The risk-adjusted results change for all of the health plans. MCO A is still performing higher than the mean, but improved its score by 7 percentage points. MCO B improved its score by 6 percentage points, resulting in a score that is even lower than the statewide average. MCO C's score increased by 15 percentage points, changing the result from below average to above average. The results for the remaining three health plans changed by less than 3 percentage points.

Table 48. Observed vs. Expected* Performance by Health Plan Measure: ER Visits for HIV/AIDS Cohort (CY02)

Health Plan	Unadjusted Results		Risk-Adjusted Results	
	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	31.2	1.14	29.2	1.07
MCO B	22.7	0.83	29.4	0.77
MCO C	24.6	0.90	23.4	1.05
MCO D	21.5	0.79	26.6	0.81
MCO E	46.4	1.70	26.9	1.72
MCO F	38.1	1.40	27.4	1.39
All Plans	27.3	1.00	27.3	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

Using multivariate regression techniques provides states with several advantages over the stratified results presented in Tables 41 and 42. First, multivariate regression allows states to control for demographic variations across health plan populations, while adjusting for health status, simultaneously. Regression techniques also simplify the data analysis process by enabling states to produce one number for comparison, rather than several numbers for each health plan.

A single number that weighs the results for each RUB facilitates comparisons for health plans with inconsistent results. Inpatient admission for HIV/AIDS patients is a good example. While none of the health plans consistently performed above or below average for each RUB, the regression weighs the results, providing one number that represents overall performance.

Selecting Performance Measures

For our final analysis, we applied regression techniques to identify the factors that are associated with an increase in the likelihood of an enrollee in the HIV/AIDS cohort having an inpatient admission during the year. We created dummy variables similar to the ones described in the above regressions. We also added race, whether the enrollee had AIDS, and one variable that represents appropriate outpatient care to HIV and AIDS enrollees: the presence of at least two ambulatory care visits. Table 49 presents the results of our analysis. Enrollees in the Moderate Morbidity RUB are less likely (.08) to have an inpatient admission than enrollees in the High Morbidity RUB, and enrollees in the Very High Morbidity RUB are 6.32 times more likely to have an admission than enrollees in the High Morbidity RUB. Females are more likely (1.26) to have an admission than males, and enrollees with AIDS are 1.6 times more likely to have an admission than enrollees who have not been diagnosed with AIDS. Individuals who have two or more ambulatory care visits during the year are less likely (.63) to have an inpatient admission than enrollees who have less than two visits. Age was included as a continuous variable and the results suggest that the likelihood of an admission decreases slightly with every additional year.

Table 49. Odds Ratios for Factors that Impact the Likelihood of an Inpatient Admission for an Enrollee in the HIV/AIDS Cohort (CY02)

Variable	Estimate	Confidence Interval
Moderate Morbidity RUB	0.08***	0.05 - 0.12
Very High Morbidity RUB	6.32***	5.05 - 7.92
Suburban	1.38	0.81 - 2.36
Urban	1.23	0.75 - 2.04
Female	1.26**	1.00 - 1.57
Age	0.98***	0.97 - 0.99
TANF	1.10	0.80 - 1.51
Black	1.18	0.83 - 1.68
Neither Black nor White	1.06	0.52 - 2.16
Ambulatory Visits (2+)	0.63***	0.48 - 0.83
AIDS	1.60***	1.29 - 1.98

**$p<0.05$; ***$p<0.01$
Note: All dependent variables are dummy variables except age, which is continuous.

Conclusion

The results show that case mix has a demonstrated relationship with some of the performance measures analyzed in this report. Because of this relationship, risk adjustment can improve the

validity of the results for those measures where the case mix varies across health plans. Some of the significant relationships we observed in our analysis include:

- A strong direct relationship between RUB severity and the utilization rates for the two outcome measures: inpatient admissions and ER visits.
- The process measures (ambulatory care visits, viral load tests, CD4 tests, and Pap tests) were not markedly sensitive to RUB severity.
- Controlling for case mix had a large impact (between 7 and 24 percentage points) on the performance results for inpatient admission rates for three of the health plans. Results for the remaining three health plans changed by less than 5 percentage points. One plan changed from worse than average to better than average, and two others changed in the reverse direction.
- Controlling for case mix had a large impact (between 7 and 15 percentage points) on the performance results for ER visit rates for three of the health plans. Results for the remaining three health plans changed minimally.
- Enrollees who had two or more ambulatory care visits during the year were less likely to have an inpatient admission than enrollees who did not meet that threshold. This empirical evidence supports the inclusion of a performance measure related to ambulatory care access in performance measurement programs for states that are interested in reducing inpatient utilization.

Schizophrenia

Defining the Cohort

Encounter and fee-for-service (FFS) data from calendar year 2002 (CY02) was used to identify the cohort. Mental health services are carved out of the HealthChoice program in Maryland and services provided by mental health providers are paid FFS. We developed our cohort criteria by combining diagnosis codes from the expanded diagnostic cluster[40] (EDC) for schizophrenia with information from a Schizophrenia Patient Outcome Research Team (PORT) study. In CY02, 5,038 enrollees met the clinical and enrollment criteria for schizophrenia.

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[40] *EDCs, developed by Johns Hopkins University, are broad groups of diagnostic codes (see www.acg.jhsph.edu). They represent disease markers. A person may have more than one EDC.*

Clinical criteria

The schizophrenia cohort includes all enrollees under age 65 who met or exceeded at least one of the following utilization thresholds of health care services.

- One inpatient admission with a schizophrenia diagnosis;
- Two ambulatory care visits[41] with a schizophrenia diagnosis; or
- A combination of one schizophrenia-related prescription and one ambulatory care visit with a schizophrenia diagnosis code.

We defined the cohort and measured performance in the same calendar year. More details about the development of the definition for the schizophrenia cohort can be found in the Technical Appendix.

Enrollment Criteria

As mentioned in Section I, we applied enrollment criteria to each cohort definition. Each member of the cohort had to be enrolled in the same health plan for at least 320 days, with no more than one gap in enrollment. The gap in enrollment could not exceed 45 days, and the person had to be enrolled as of December 31st of the study year; in this case, CY02.

Descriptive Statistics

We examined the distribution of the cohort across health plans to identify any factors that might influence the results. The distribution for the schizophrenia cohort is presented in Table 50. The cohort is fairly evenly distributed across the four largest health plans (between 21 and 28 percent of the cohort in each).

Table 50. Distribution of Schizophrenia Cohort Across Health Plans (CY02)

Health Plan	Percent of Enrollees
MCO A	21.7
MCO B	2.2
MCO C	20.8
MCO D	27.8
MCO E	3.9
MCO F	23.7
All MCOs	100.0

The data indicate that half of the schizophrenia cohort is female. Forty-two percent of the enrollees in the cohort live in urban areas, 42 percent reside in suburban areas and the remaining 16 percent live in rural areas of Maryland. A majority of the enrollees in the cohort

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[41] An ambulatory care visit is defined as a visit to an outpatient hospital department, a health clinic, or a physician's office.

are SSI beneficiaries (93.6 percent) while the remaining 6.4 percent are TANF recipients. More specific demographic information on the schizophrenia cohort can be found in Appendix III.

Once the cohort was identified, we used Adjusted Clinical Group (ACG) assignments for CY02 to obtain the distribution of enrollees by Resource Utilization Bands (RUBs). An enrollee's RUB assignment is a proxy for health status and is used to control for the impact of case mix on plan performance. The six RUBs, presented in increasing levels of morbidity, are: Non-Users,[42] Healthy Users,[43] Low Morbidity, Moderate Morbidity, High Morbidity, and Very High Morbidity.

The RUB distribution for the schizophrenia cohort is provided by health plan in Table 51. The largest number of enrollees is assigned to the Moderate Morbidity RUB, which accounts for 56.1 percent of the cohort statewide. The variation in case mix across health plans is evident. For example, MCO E has 23.2 percent of its population in the Very High Morbidity RUB, while MCO B has only 14.7 percent in that RUB. The percentage of enrollees in the High Morbidity RUB ranges from 23.2 percent (MCO E) to 31.2 percent (MCO B). Since an enrollee, by definition, had to use a physician, outpatient, or inpatient service to be included in the cohort, there are no enrollees in the two lowest RUBs (Non-Users and Healthy Users).

Table 51. Distribution of Schizophrenia Cohort Across Health Plans by RUB (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Non-Users	-	-	-	-	-	-	-
Healthy Users	-	-	-	-	-	-	-
Low Morbidity	0.6	0.0	0.4	0.3	0.0	0.5	0.4
Moderate Morbidity	54.3	54.1	54.8	56.1	53.5	59.4	56.1
High Morbidity	24.0	31.2	24.7	24.6	23.2	24.1	24.5
Very High Morbidity	21.1	14.7	20.2	19.0	23.2	16.1	19.1
All RUBs	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: There are no enrollees in the Non-User and Healthy User RUBs.
*There are very few enrollees in the Low Morbidity RUB

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[42] *The Non-Users RUB includes members of the cohort who do not have enough diagnostic information on their claims/encounter data to be accurately classified into the appropriate risk strata. For example, an enrollee may qualify as a member of the schizophrenia cohort by filling a schizophrenia prescription at some point during the year. However, prescription information is not used by the ACG system to assign enrollees to ACGs/RUBs. Therefore, if an enrollee only received prescriptions, and does not have any diagnosis information during the year, he would be a member of the Non-Users RUB.*
[43] *The Healthy Users RUB includes enrollees whose diagnostic information contains only data about preventive services and minor conditions. The data are not sufficient to accurately classify the enrollee into the appropriate risk group.*

Performance Measures

As described in Section I, a set of performance measures on which to evaluate the health plans was identified for each disease. The performance measures selected evaluate the enrollee's utilization of health care services, including disease-specific treatments. Results for each set of measures are described below.[44]

It is important to note that mental health services in Maryland's Medicaid managed care program are delivered through a mental health carve-out. Health plans are not financially or clinically responsible for managing the mental health care services administered to their enrollees. Health plans are expected to appropriately refer enrollees in need of mental health services and to coordinate medical care with the mental health services being provided. The results in this section are reported separately to indicate which system was responsible for the care provided (medical vs. mental health). We also report the combined data from both systems. Although we present performance results for measures related to mental health care in this report according to health plan, we recognize the limited responsibility that health plans have for the care provided in the mental health system. The following results, therefore, should be interpreted with caution.

Generic Measures

We selected a set of generic measures on which to evaluate each disease cohort. We measure the percentage of enrollees in the cohort who had at least:

- One inpatient admission;
- One ER visit[45]; and
- Two ambulatory care visits.

The results of the inpatient admissions utilization measure are provided in Table 52. The percentage of enrollees who are admitted in either setting increases as RUB severity increases. For example, the percentage of enrollees with at least one inpatient admission (either medical or mental health) statewide increases from 20.9 in the Moderate Morbidity RUB to 39.3 and 68.7 percent in the High and Very High Morbidity RUBs, respectively. The percentage of enrollees with an admission will be referred to from now on as the admission rate.

This analysis also reveals that medical admission rates have a much stronger correlation with the severity of the RUB assignment than the mental health admission rates. Admissions for a medical diagnosis increase from 2.4 percent for enrollees in the Moderate Morbidity RUB to 55.8 percent for enrollees in the Very High Morbidity RUB. Mental health admissions increase from 19.6 percent for enrollees in the Moderate Morbidity RUB to 38.0 percent for enrollees in the Very High Morbidity RUB.

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[44] *Health plan performance for enrollees in the Low Morbidity RUB are included in the tables, however, because the percentage of enrollees in this RUB is so low (0.4 percent), we do not attempt to draw meaningful conclusions from these results.*
[45] *An ER visit is defined as a visit to an emergency room that does* <u>not</u> *result in an inpatient admission.*

There is some variation in admission rates across health plans within RUBs for both medical and mental health admissions. For example, in the High Morbidity RUB, performance ranges from a low of 33.3 percent (MCO C) to a high of 43.9 percent (MCO A and MCO F). For the Very High Morbidity RUB, performance ranges from 65.9 percent (MCO C) to 75.0 (MCO B). For mental health admissions, MCO E consistently performs below the mean (better than average). For medical admissions, MCO D consistently performs above the mean (worse than average). As described in Section II, this measure is likely to be sensitive to risk adjustment, as the admission rate clearly increases with the severity of RUB assignment.

Table 52. Percent of the Schizophrenia Cohort
With at Least One Inpatient Admission (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity							
Medical	0.0	-	0.0	0.0	-	0.0	0.0
Mental Health	0.0	-	25.0	25.0	-	16.7	14.3
Combined	0.0	-	25.0	25.0	-	16.7	14.3
Moderate Morbidity							
Medical	2.7	0.0	2.8	2.7	4.7	1.6	2.4
Mental Health	16.4	25.4	22.7	21.0	15.1	18.4	19.6
Combined	18.1	25.4	23.4	22.9	18.9	19.1	20.9
High Morbidity							
Medical	17.9	17.7	13.2	17.7	15.2	16.4	16.4
Mental Health	32.8	26.5	27.1	25.5	26.1	35.9	29.9
Combined	43.9	35.3	33.3	37.1	37.0	43.9	39.3
Very High Morbidity							
Medical	52.6	56.3	53.6	57.1	60.9	58.9	55.8
Mental Health	38.7	43.8	36.0	34.6	37.0	43.8	38.0
Combined	66.1	75.0	65.9	68.8	71.7	73.4	68.7
All RUBs							
Medical	16.9	13.8	15.6	16.7	20.2	14.3	16.0
Mental Health	24.9	28.4	26.5	24.7	22.7	26.7	25.8
Combined	34.3	35.8	34.4	35.1	35.4	33.8	34.5

Note: There are no enrollees in the Non-User and Healthy User RUBs.
*There are very few enrollees in the Low Morbidity RUB

The results for ER visits are presented in Table 53. As was the case with inpatient admissions, the percentage of the enrollees with schizophrenia who had at least one ER visit (ER visit rate) during CY02 increases as RUB severity increases. This pattern is more evident in the medical than the mental health system. On a combined basis, the percentage of members with at least one ER visit increases from 19.4 percent for the Moderate Morbidity RUB to 51.2 percent for the Very High Morbidity RUB. We also observe considerable variation in the ER visit rate across health plans within the same RUB. This variation is greater in the medical than the

mental health system. MCO F's ER visit rates for medical visits are above the statewide mean (worse than average) for each RUB, while MCO D's ER visit rates are below the mean (better than average). For mental health, MCO A's ER visit rates are above the state mean (worse than average), while MCO C consistently performs below the mean (better than average).

Table 53. Percent of the Schizophrenia Cohort With at Least One ER Visit (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity							
Medical	0.0	-	25.0	0.0	-	0.0	5.0
Mental Health	16.7	-	0.0	50.0	-	16.7	20.0
Combined	16.7	-	25.0	50.0	-	16.7	25.0
Moderate Morbidity							
Medical	15.7	15.3	12.8	10.0	13.2	18.5	14.1
Mental Health	9.3	6.3	8.1	11.8	4.7	6.5	8.8
Combined	20.1	20.3	16.9	19.4	16.0	21.1	19.4
High Morbidity							
Medical	29.9	35.3	36.5	22.0	45.7	43.9	33.1
Mental Health	15.3	17.7	9.6	13.6	13.0	13.8	13.3
Combined	34.9	38.2	38.5	29.6	52.2	47.1	37.7
Very High Morbidity							
Medical	45.0	37.5	47.4	37.4	73.9	52.9	46.2
Mental Health	22.5	6.3	15.0	17.4	19.6	18.9	18.3
Combined	51.1	43.8	50.7	45.2	76.1	55.5	51.2
All RUBs							
Medical	25.2	24.8	25.8	18.2	34.9	30.1	24.9
Mental Health	13.6	10.1	9.9	13.4	10.1	10.3	11.8
Combined	30.2	29.4	29.2	27.0	38.4	32.8	30.0

Note: There are no enrollees in the Non-User and Healthy User RUBs.

*There are very few enrollees in the Low Morbidity RUB

The results for ambulatory care visits (medical) and mental health visits are presented in Table 54 and Table 55 respectively. The results show a direct correlation between RUB severity and the percentage of enrollees receiving two or more ambulatory care visits (ambulatory care visit rate). However, there is a much smaller difference between the High and Very High Morbidity RUBs than between the Moderate Morbidity and High Morbidity RUBs. MCO B and MCO C perform above the statewide mean (better than average) on ambulatory care visits, while MCO D and MCO E perform below the mean (worse than average).

The results for mental health visits are different. There is little difference by RUB in the percentage of enrollees who receive two or more mental health visits (mental health visit rate) statewide; performance ranges from 91.3 to 92.7 percent. For this measure, MCO C is above the mean (better than average) and MCO E is at or above the mean (better than average) for the

three most severe RUBs. MCO B, MCO F and MCO A are below the mean (worse than average) on this measure.

**Table 54. Percent of the Schizophrenia Cohort
With at Least Two Ambulatory Care Visits (CY02)**

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity	42.9	-	50.0	75.0	-	33.3	47.6
Moderate Morbidity	47.6	54.2	49.6	44.8	31.1	44.4	45.9
High Morbidity	79.8	91.2	89.5	75.9	73.9	78.1	80.4
Very High Morbidity	89.1	93.8	94.3	80.5	87.0	88.0	87.6
All RUBs	64.1	71.6	68.5	59.3	54.0	59.4	62.3

Note: There are no enrollees in the Non-User and Healthy User RUBs.

**Table 55. Percent of the Schizophrenia Cohort
With at Least Two Mental Health Visits (CY02)**

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity	85.7	-	100.0	100.0	-	66.7	85.7
Moderate Morbidity	91.1	91.5	94.9	92.5	98.1	92.0	92.7
High Morbidity	92.4	85.3	95.0	91.9	95.7	91.3	92.5
Very High Morbidity	90.4	75.0	92.4	93.6	91.3	89.1	91.3
All RUBs	91.2	87.2	94.5	92.6	96.0	91.2	92.4

Note: There are no enrollees in the Non-User and Healthy User RUBs.

One of the concerns with a mental health carve-out is whether enrollees' care is coordinated between their mental health providers and medical providers. One way to assess this coordination is to evaluate the visits the enrollee receives in each setting. Table 56 presents the result of coordination of care between the mental health and medical system by looking at the percentage of enrollees who had at least two ambulatory care visits as well as two mental health visits. We find that on average 57.6 percent of the enrollees in the cohort had at least two visits in both systems. There is a direct relationship between RUB severity and the percentage of enrollees with at least two visits in both settings; 42.6 percent of enrollees in the Moderate Morbidity RUB are seen in both settings, compared to 80.2 percent of the enrollees in the Very High Morbidity RUB. As evidenced by the results presented above, this increase is driven by ambulatory care visits, rather than mental health visits. For this measure, MCO C consistently performs above the mean (better than average), while MCO D, MCO E, and MCO F perform below the mean (worse than average).

Table 56. Percent of the Enrollees in the Schizophrenia Cohort With at Least Two Mental Health Visits and at Least Two Ambulatory Care Visits (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity	28.6	-	50.0	75.0	-	16.7	38.1
Moderate Morbidity	44.1	49.2	47.5	40.6	31.1	40.7	42.6
High Morbidity	73.3	76.5	84.9	69.9	71.7	72.5	74.6
Very High Morbidity	80.4	75.0	88.2	75.6	78.3	78.7	80.2
All RUBs	58.7	61.5	64.9	54.5	51.5	54.3	57.6

Note: There are no enrollees in the Non-User and Healthy User RUBs.

Disease-Specific Measures

We have also identified a set of disease-specific measures that evaluate performance on process measures that are part of the standard of care for each disease. For schizophrenia, we have selected the percentage of:

- Follow-up visits within 7 days after a mental health hospitalization;
- Follow-up visits within 30 days after a mental health hospitalization; and
- Continuous dispensing events of antipsychotic drugs.

More detail about the specific definitions for each measure can be found in the Technical Appendix.

The first two disease-specific measures were adopted from HEDIS® 2003. These measures evaluate the percentage of members who receive a mental health visit within 7 and 30 days of a mental health admission. The results by health plan and RUB are provided in Tables 57 and 58. The majority of the enrollees receive a mental health visit following a mental health admission, with 78.2 percent of patients seen within 7 days. MCO E has the lowest follow-up rate at 70.9 percent, and MCO A has the highest follow-up rate at 80.7 percent. Within 30 days of an inpatient admission, 86.4 percent of the patients are seen. There is less variation in the results across health plans for this measure, with the rates ranging from 84.5 to 88.5 percent. There is no apparent correlation between RUB severity and whether an enrollee had a follow up visit after a hospitalization.

Table 57. Percent of Follow-Up Visits Within 7 Days of a Hospitalization (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity	-	-	100.0	100.0	-	100.0	100.0
Moderate Morbidity	72.2	75.0	77.7	76.7	82.8	73.7	75.5
High Morbidity	81.1	86.7	77.0	79.5	77.4	78.0	79.0
Very High Morbidity	86.9	63.6	79.7	76.1	60.0	82.7	80.2
All RUBs	80.7	73.8	78.2	77.3	70.9	78.4	78.2

Total inpatient admissions = 3083

Note: There are no enrollees in the Non-User and Healthy User RUBs

*There are very few enrollees in the Low Morbidity RUB

Table 58. Percent of Follow-Up Visits Within 30 Days of a Hospitalization (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity	-	-	100.0	100.0	-	100.0	100.0
Moderate Morbidity	79.9	91.7	85.5	82.7	93.1	85.1	83.9
High Morbidity	85.1	93.3	85.4	85.9	93.6	85.9	86.0
Very High Morbidity	92.3	81.8	89.6	86.0	82.0	90.5	89.2
All RUBs	86.4	88.5	86.9	84.5	88.2	87.4	86.4

Total inpatient admissions = 3083

Note: There are no enrollees in the Non-User and Healthy User RUBs.

*There are very few enrollees in the Low Morbidity RUB

Out of the 5038 enrollees in the cohort, 4555 members filled at least one prescription for an antipsychotic drug in CY02. An important consideration with antipsychotic medications is that the enrollees receive their medication on a continuous basis without any gaps between their prescription refills. Prescription data was used to identify gaps of 15 days or more between prescriptions for antipsychotic drugs.

Table 59 presents the results of this measure. Enrollees in the Moderate Morbidity RUB has the lowest percentage of enrollees (59.4 percent) with a gap between prescriptions. As RUB severity increases, the percentage of enrollees with at least one gap in antipsychotic drugs of 15 days or more increases to a high of 69.9 percent for the Very High RUB. MCO A and MCO B consistently performs higher than the mean (worse than average) for the three most severe RUBS on this measure, while MCO C consistently performs lower than the mean (better than average).

Table 59. Percent of Enrollees With at Least One Prescription Gap
of 15 Days or More (CY02)

RUB	MCO A	MCO B	MCO C	MCO D	MCO E	MCO F	All MCOs
Low Morbidity	66.7	-	100.0	100.0	-	100.0	90.9
Moderate Morbidity	61.1	73.6	58.4	57.6	51.6	60.9	59.4
High Morbidity	64.1	77.4	58.1	66.6	65.0	63.3	63.7
Very High Morbidity	71.0	91.7	62.9	74.5	67.5	69.1	69.9
All RUBs	64.0	77.1	59.3	63.1	58.4	62.9	62.5

Total number of enrollees who had a prescription dispensed = 4555
Note: There are no enrollees in the Non-User and Healthy User RUBs.
*There are very few enrollees in the Low Morbidity RUB

Risk-Adjusted Performance Results

The previous set of data stratified the performance results for each measure, allowing us to compare "apples" to "apples," or enrollees with the same health status in one MCO to similar enrollees in another MCO. Stratification of the performance results by RUB reduces the confounding effects of health status on the final result.

Applying regression techniques allows us to take the analysis one step further. Using logistic regression we can account for both demographic and health status characteristics simultaneously when determining a health plan's performance on a given measure. In the following analysis, a logistic regression was used to relate enrollees' inpatient admissions to their RUB and four demographic characteristics: region, age, sex, and eligibility status. We created dummy variables for the three RUB[46] groups, three regional variables (urban, rural, and suburban), sex (M, F), and eligibility category (SSI, TANF). Age was included as a continuous variable.

The results of the regression analysis were then used to predict the likelihood that an enrollee would be admitted to a hospital. These probabilities were averaged over all of the enrollees in a health plan to predict the likelihood that the average enrollee would be admitted to the hospital. These predicted values were then compared to the observed rates for each health plan. The comparison between the observed rates and the predicted rate was used to determine whether a plan was performing better or worse than expected given the risk and demographic profiles of its enrollees.

Table 60 contains each health plan's performance results on the medical inpatient admission measure, before and after risk adjustment. The first column of data reports the unadjusted percentage of enrollees in each health plan that had at least one inpatient admission. The second column divides the observed value (from the first column) by the statewide admission rate (16.0). Health plans with a score greater than 1.0 have a greater percentage of enrollees with a medical admission than the statewide average, while those with a score less than 1.0 have a lower percentage of enrollees with a medical admission.

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[46] *The size of the Low Morbidity RUB was too small for meaningful analysis; therefore, we combined the Low Morbidity RUB with the Moderate Morbidity RUB.*

Table 60. Observed vs. Expected* Performance by Health Plan Measure: Medical Inpatient Admissions for Schizophrenia Cohort (CY02)

Health Plan	Unadjusted Results		Risk-Adjusted Results	
	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	16.9	1.05	17.0	0.99
MCO B	13.8	0.86	15.6	0.88
MCO C	15.6	0.97	16.2	0.96
MCO D	16.7	1.04	16.0	1.04
MCO E	20.2	1.26	18.4	1.10
MCO F	14.3	0.89	14.6	0.98
All Plans	16.0	1.00	16.0	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

The third column shows the percentage of enrollees with an admission that one would expect each health plan to have, given its risk and demographic profile, as predicted by the regression model. The final column compares the unadjusted results (column one) with the expected results (column three). How does the health plan perform compared to how we would expect it to perform, given its demographic and risk characteristics? Again, results greater than 1.0 indicate that the percentage of enrollees with an admission exceeds the statewide average, and scores less than 1.0 indicate that the percentage of enrollees with an admission is less than the state average

Risk adjustment does influence the performance results for several of the health plans. For example, the unadjusted results show that MCO A had 5 percent higher medical admission rate than the statewide average (1.05 vs. 1.00). Once the results were adjusted, MCO A's results were better than the state average (0.99 vs. 1.00). The percent by which MCO E exceeded the state average decreased from 26 percent to 10 percent above average with risk adjustment. Overall, the result for half of the health plans changed by more than 5 percentage points.

The results from a similar analysis of mental health admissions are presented in Table 61. Risk adjustment does not have much of an impact on the final performance results for mental health admissions. The data show the results for three plans changed by 2 percentage points, while the results for one of the plans changed by only a single percentage point. The remaining two plans had no change in performance. These results suggest that the mental health admission rates appropriately reflect actual performance on this indicator despite the relative case mix of each health plan.

Table 61. Observed vs. Expected* Performance by Health Plan Measure: Mental Health Inpatient Admissions for Schizophrenia Cohort (CY02)

	Unadjusted Results		Risk-Adjusted Results	
Health Plan	Observed	Observed/ State Avg	Case Mix Expected	Observed/ Expected
MCO A	24.9	0.97	25.3	0.99
MCO B	28.4	1.11	25.6	1.11
MCO C	26.5	1.04	26.0	1.02
MCO D	24.7	0.97	25.8	0.96
MCO E	22.7	0.89	25.6	0.89
MCO F	26.7	1.04	25.3	1.06
All Plans	25.6	1.00	25.6	1.00

*The "expected" rates adjust for a series of case mix and demographic factors. See text.

Selecting Performance Measures

For our final analysis, we applied regression techniques to identify the factors that are associated with an increase in the likelihood of an enrollee in the schizophrenia cohort having a mental health or medical inpatient admission during the year. In addition to the risk factors applied in the above regressions (age, eligibility category, sex, region, and RUB), we added race and two variables that represent appropriate outpatient care to enrollees with schizophrenia: the receipt of antipsychotic medication without a gap of more than 15 days and the presence of at least two ambulatory care visits and two mental health visits.

Table 62 shows the results for medical inpatient admissions. The data suggest that some of the variables included in our analysis have a significant impact in predicting whether enrollees are at an increased or decreased risk of having a medical inpatient admission. Receiving a combination of at least two ambulatory visits and at least two mental health visits (0.67) decreases the likelihood that an enrollee will have a medical admission by one-third, demonstrating that outpatient care is associated with a decrease in medical admissions. Enrollees who live in urban areas (1.35), and female enrollees (1.22) are more likely to have a medical inpatient admission compared to their rural and male counterparts respectively. Enrollees in the Moderate Morbidity RUB are less likely to have an admission (0.11) compared to enrollees in the High Morbidity RUB, while enrollees in the Very High Morbidity RUB (6.97) are about 7 times more likely to have an admission than enrollees in the High Morbidity RUB. We also find that patients who had at least one gap of 15 days or more between prescriptions are more likely (1.37) to have an inpatient admission compared to patients who did not have a gap. While sex and location seem to have a significant impact in determining whether an enrollee would have a medical admission, other variables such as race, age, and eligibility category are not significant.

Table 62. Odds Ratios for Factors that Impact Likelihood of a Medical Inpatient Admission for Members of the Schizophrenia Cohort (CY02)

Variable	Estimate	Confidence Interval
Moderate Morbidity RUB	0.11***	0.09 - 0.15

Very High Morbidity RUB	6.97***	5.66 - 8.59
Suburban	1.18	0.90 - 1.56
Urban	1.35**	1.01 - 1.79
Female	1.22**	1.01 - 1.47
Age	1.00	0.99 - 1.00
TANF	1.25	0.82 - 1.90
Black	0.94	0.76 - 1.16
Neither Black nor White	1.14	0.71 - 1.84
(2+) Ambulatory Visits and (2+) Mental Health Visits	0.67***	0.54 - 0.83
(1+) Gaps of 15 days or more in medication prescribed	1.37**	1.13 - 1.65

**p<0.05; ***p<0.01

Note: All dependent variables are dummy variables except age, which is continuous.

Table 63 presents the results of the mental health inpatient admission analysis. The goal of this regression is to observe what variables matter in determining the likelihood of having a mental health inpatient admission. We also wanted to see whether the significant variables differ from the ones we observed for medical admissions. The data suggest that receiving a combination of at least two ambulatory care visits and at least two mental health visits (0.84) decreases the likelihood that an enrollee will have a mental health admission. Female enrollees (1.17) are more likely to have a mental health inpatient admission compared to their male counterparts. There is a significant and direct relationship between RUB severity and mental health admissions similar to the one we found in the medical admissions. We also find that patients who had at least one gap of 15 days or more in filling prescriptions are almost three times as likely (2.93) to have a mental health admission compared to patients who do not have a gap in their prescriptions. Each additional year of age slightly decreases (0.97) the likelihood of having a mental health admission. This differs from our results in the medical admissions regression. While sex, age, and RUB seem to have a significant impact in predicting whether an enrollee would have a mental health admission, other variables such as location, race, and eligibility category are not significant.

Table 63. Odds Ratios for Factors that Impact Likelihood of a Mental Health Inpatient Admission for Members of the Schizophrenia Cohort

Variable	Estimate	Confidence Interval
Moderate Morbidity RUB	0.53***	0.45 - 0.63
Very High Morbidity RUB	1.72***	1.42 - 2.09
Suburban	1.15	0.94 - 1.41
Urban	1.02	0.82 - 1.26
Female	1.17**	1.02 - 1.34
Age	0.97***	0.96 - 0.97
TANF	1.20	0.91 - 1.58
Black	1.02	0.87 - 1.20
Neither Black nor White	0.90	0.65 - 1.24
(2+) Ambulatory Visits and (2+) Mental Health Visits	0.84**	0.73 - 0.98
(1+) Gaps of 15 days or more in medication prescribed	2.93***	2.53 - 3.40

**p<0.05; ***p<0.01
Note: All dependent variables are dummy variables except age, which is continuous.

Conclusions

The results show that case mix has a demonstrated relationship with some of the performance measures analyzed in this report. Because of this relationship, risk adjustment can improve the validity of the results for those measures when the case mix varies across health plans. Some of the significant relationships we observed in our analysis include:

- A strong direct relationship between RUB severity and utilization rates for three outcome measures (medical inpatient admissions, mental health inpatient admissions, and medical ER visits) and one process measure (ambulatory care (medical) visits).
- One of the outcome measures (mental health ER visits) and two of the process measures (mental health visits and follow-up visits after a hospitalization) did not show a strong relationship with the RUB severity.
- Controlling for case mix had a substantial impact (between 6 and 16 percentage points) on the performance results for medical inpatient admission rates for three of the health plans. Results for two of the health plans changes by less than 3 percentage points. One plan did not change at all.
- Controlling for case mix had a minimal impact on the performance results for mental health inpatient admissions.
- Enrollees who had at least one gap of 15 days or more in antipsychotic drugs were more likely to have a medical inpatient admission and more likely to have a mental health admission, as compared to members who did not have any gaps in medication. These results suggest that continuity in medication is associated with reduced inpatient admissions.
- Enrollees who had at least two ambulatory care visits and at least two mental health visits during the year were less likely to have a medical inpatient admission and less

likely to have a mental health admission than enrollees who did not meet that threshold. This evidence supports the inclusion of a performance measure related to ambulatory care access in performance measurement programs for states that are interested in reducing inpatient utilization.