Measuring The Quality Of Pennsylvania's Commercial HMOs

CALENDAR YEAR 2003

TECHNICAL REPORT

THE PENNSYLVANIA HEALTH CARE COST CONTAINMENT COUNCIL

March 2005

TABLE OF CONTENTS

Tables

Copies of the *Measuring the Quality of Pennsylvania's Commercial HMOs* report and this document, the *Technical Report*, can be obtained by contacting the Council, or can be accessed electronically via the Council's Web site.

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TECHNICAL REPORT

MEASURING THE QUALITY OF PENNSYLVANIA'S COMMERCIAL HMOS CALENDAR YEAR 2003

OVERVIEW

This technical supplement accompanies the calendar year 2003 version of the *Measuring the Quality of Pennsylvania's Commercial HMOs* report. Included in this *Technical Report* are detailed descriptions of the data and their sources, explanations for the adjustments to the data, and presentation of the methodology used for risk adjustment of the utilization and clinical outcomes data. Also included are detailed explanations for data collection and verification procedures, selection of clinical conditions and outcomes for study, and other comparative measures. Descriptions of financial indicators, ratings of HMOs by members, and plan profile information are further explained.

The *Measuring the Quality of Pennsylvania's Commercial HMOs* report provides information related to the quality of health care services received by members of commercial Health Maintenance Organizations (HMOs) and related Point of Service (POS) plans licensed by the Department of Health to do business in Pennsylvania. The report brings together information from several sources that are of interest to purchasers, consumers, payors, and providers. This collection of information and data allows all interested readers to make comparisons among HMOs based upon a comprehensive set of data.

Utilization and outcome measures are provided for seventeen specific clinical conditions/treatments included in the report. The research methodology that yielded utilization and outcome ratings was complex and differs for all clinical conditions. Methodology development was based upon state-of-the-art research practice. This development included a review of the current medical outcome literature, discussions with practicing medical professionals, and careful examination and approval by the Council's Technical Advisory Group. Each clinical condition was selected because:

- it is of high importance to purchasers and consumers,
- it is generally a high-volume, high-risk, or high cost condition/procedure, and
- its management by HMOs and their providers can reasonably be expected.

DATABASES

The databases used to analyze each of the seventeen clinical conditions were derived from discharge data submitted to PHC4 by Pennsylvania health care facilities.

The Statewide database was comprised of cases where the patient:

- was under 65 years of age (except for diabetes in which the age interval was 18 years through 75 years),
- met the clinical inclusion criteria for one of the conditions investigated (see Appendix A: "Description of Study Population"), and
- was discharged from a Pennsylvania *general acute care* (GAC) or *specialty GAC* hospital (or received care in an inpatient or ambulatory surgical setting for breast cancer procedures) between January 1, 2003 and December 31, 2003.

The HMO database was derived from the statewide database and included:

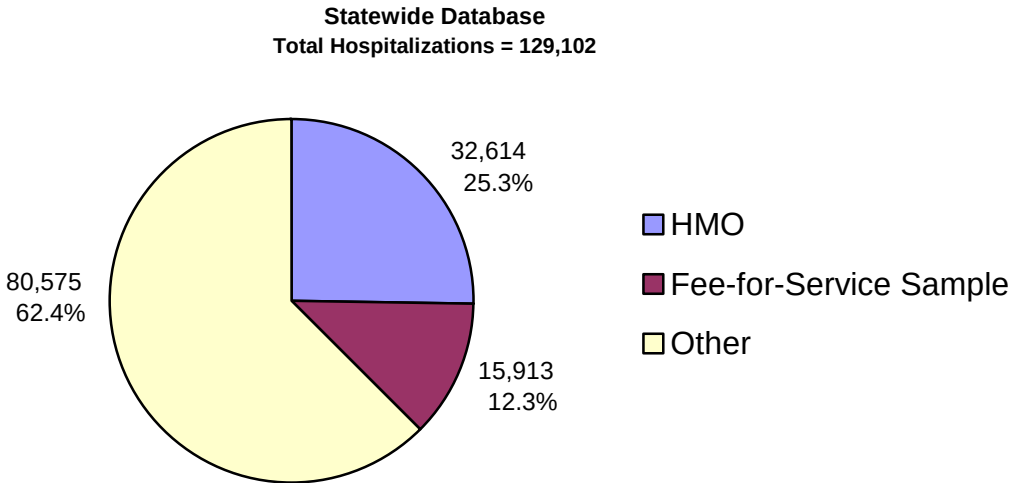
- aggregate hospitalizations for members of all commercial HMOs included in this report.

The "Fee-for-Service" Sample (Convenience) database was derived from the statewide database and included:

- aggregate hospitalizations for members of commercial, traditional "fee-for-service" plans (this group included only those patients who were clearly identified in a hospital record as a member of one of the larger fee-for-service plans in Pennsylvania). Hospitalization rates per member are not reported for this group because detailed enrollment data by plan were not available.

The "Other" group in the statewide database included:

- hospitalizations where the payor was Medicare, Medicaid, or self-pay, as well as those records where the payor could not be identified.



Databases Used in the Risk Adjustment Process

Depending upon the condition under study, individual HMO plan data was compared to the statewide database, the HMO and fee-for-service sample databases combined, or the HMO database alone. Table 1 lists the comparative databases that were used to determine expected percents for each appropriate PHC4 measure (where actual percents were compared to expected percents), and to risk adjust each PHC4 measure that involved risk adjustment. For example, the statewide database for neck and back procedures included those cases where the patients met the definition criteria for neck and back procedures and were under age 65 but over age 17. This statewide database was then used as the comparative standard when determining the risk-adjusted length of stay for each HMO plan for neck and back procedures.

Results are presented in the public report in a manner that allows the reader to visually compare the results for individual HMO plans and the HMO state total/average. When the comparative reference was the statewide database or the HMO and fee-for-service sample combined database, summary data are also shown for the fee-for-service sample.

Table 1. *Comparative References*

Reported Measure	Database Used
Hospitalization/Procedure Rate	
▪ Pediatric Ear, Nose and Throat Infections	HMO Hospitalizations (members 28 days – 17 years)
▪ Adult Ear, Nose and Throat Infections ▪ High Blood Pressure	HMO Hospitalizations (members 18 – 64 years)
▪ Gastrointestinal Infections ▪ Kidney/Urinary Tract Infections	HMO Hospitalizations (members 28 days – 64 years)
▪ Chronic Obstructive Pulmonary Disease	HMO Hospitalizations (members 18 – 64 years)
▪ Pediatric Asthma	HMO Hospitalizations (members 28 days – 17 years)
▪ Adult Asthma	HMO Hospitalizations (members 18 – 64 years)
▪ Diabetes	HMO Hospitalizations (members 18 – 75 years with diabetes)
▪ Heart Attack ▪ Hysterectomy ▪ Breast Cancer Procedures ▪ Neck and Back Procedures ▪ Prostatectomy	HMO Hospitalizations (members 18 – 64 years)
Length of Stay	
▪ Chronic Obstructive Pulmonary Disease	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 64 years)
▪ Pediatric Asthma	HMO and Fee-for-Service Sample Hospitalizations (members 28 days – 17 years)
▪ Adult Asthma	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 64 years)
▪ Diabetes	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 75 years with diabetes)
▪ Heart Attack* ▪ Hysterectomy ▪ Breast Cancer Procedures ▪ Neck and Back Procedures ▪ Prostatectomy	Statewide Hospitalizations (age 18 – 64 years)
Rehospitalization Rating –180 days	
▪ Chronic Obstructive Pulmonary Disease ▪ Asthma (adult only)	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 64 years)
▪ Diabetes	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 75 years with diabetes)
In-Hospital Mortality–30 days	
▪ Heart Attack	Statewide Hospitalizations (age 18 – 64 years)
In-Hospital Complications	
▪ Hysterectomy ▪ Breast Cancer Procedures ▪ Neck and Back procedures ▪ Prostatectomy	Statewide Hospitalizations (age 18 – 64 years)

*The Number of Days Hospitalized, rather than the Length of Stay, is reported for Heart Attack.

DATA SOURCES, COLLECTION, AND VERIFICATION

The data utilized in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report were obtained from several sources including: 1) discharge data submitted to PHC4 by Pennsylvania health care facilities, 2) the National Committee for Quality Assurance (NCQA) through the purchase of *Quality Compass®* (see the "Helping to Keep Members Healthy" section of the *Measuring the Quality of Pennsylvania's Commercial HMOs* report), 3) the Pennsylvania Department of Health, and 4) the Pennsylvania Insurance Department. Pennsylvania hospitals verified data used to generate utilization measures and clinical outcomes, and HMO plans verified payor information listed in the hospital-submitted records. A more detailed explanation of the data and data sources follows.

PHC4: Hospital-Submitted Data and HMO Verification of Payor

Data specific to the seventeen clinical conditions were submitted to PHC4 by licensed Pennsylvania health care facilities. Refer to Appendix A: "Description of Study Population" for a listing of the diagnosis and procedure codes that defined each clinical condition in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report.

The process used by PHC4 to identify specific HMO payors for hospitalizations relied upon several different data fields in the discharge record:

- the payor type code, which indicates the type of payor and type of product,
- the National Association of Insurance Commissioners (NAIC) code, which identifies the company that paid for the claim, and
- the payor name field, which is a free-form text field filled by the hospital staff.

All records that clearly identified an HMO plan as the principal payor by these fields were directly assigned to that respective HMO for verification. In addition, a record was sent to an HMO plan if any part of a discharge record pointed to that particular HMO plan as the payor. This was necessary to assure inclusion of all appropriate records.

Records that were identified through this process as belonging to an HMO were then sent to the respective HMO plan for verification. The HMO plan could then either agree that the claim was paid for by the plan (accept the record), or disagree (reject the record).

Rejection of records by HMOs occurred for one of three primary reasons: 1) the patient was not a member of the HMO at the time of the hospitalization, 2) the HMO was not the primary payor, or 3) the patient was a member of the HMO, but under a line of business not eligible for this study (e.g., a Medicare HMO enrollee). A fourth reason for rejecting a record was specific to diabetes records in which the patient did not meet the diabetes population-specific criteria.

Also, plans could provide additional records that were not originally identified as belonging to them during the payor identification process. These added records were included in the analysis only if PHC4 was able to match them to valid records in the study population that had not yet been attributed to other plans.

Every HMO and related POS plan that received a file for verification from PHC4 reviewed, verified, and returned the data.

National Committee for Quality Assurance (NCQA)

NCQA is a private, not-for-profit organization dedicated to assessing and reporting on the quality of managed care plans. NCQA collects data via the Health Plan Employer Data and Information Set® (HEDIS) and the Consumer Assessment of Health Plans Study® (CAHPS) survey. These instruments assess health plan performance and member satisfaction with their HMO. These data, available collectively in NCQA's *Quality Compass®* (the central repository of data collected

nationally from the NCQA accreditation surveys), are then available for purchase. Select outcome measures from NCQA's *2004 Quality Compass* (2003 measurement year) are included in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report and are described below.

HEDIS Measures

HEDIS is a health plan performance tool developed by NCQA and is a component of the NCQA accreditation process. The "HMO State Average" for each measure (derived from the *Quality Compass* database and weighted by HMO enrollment) was calculated by PHC4. The *HEDIS Technical Specifications Manual* provides a detailed description of the calculations used to determine the numerator and denominator for these measures. The HEDIS "Effectiveness of Care" and "Use of Services" measures reported include:

Comprehensive Diabetes Care is a composite measure used to examine the frequency and results of certain tests for HMO members with diabetes. The measure evaluates HMO performance on six aspects of diabetes care using a single sample of members age 18 through 75 years of age who have Type 1 or Type 2 diabetes. The six components of the comprehensive diabetes care measure are expressed as a percent of members with diabetes who had each of the following:

- *Poorly Controlled Hemoglobin A1c Levels for Members with Diabetes*: Poor Hemoglobin A1c (HbA1c) control; that is, the most recent HbA1c test level within the calendar year 2003 that was greater than 9.5 percent. If no test was performed, then it was counted as poor HbA1c control.
- *Hemoglobin A1c Blood Tests for Members with Diabetes*: HbA1c tested; that is, at least one HbA1c test conducted during the calendar year 2003.
- *Eye Exams Performed for Members with Diabetes*: Eye exam performed; that is, an eye screening for diabetic retinal disease conducted during the calendar year 2003 or, in certain circumstances, the calendar year 2002.
- *Monitoring Kidney Disease for Members with Diabetes*: Kidney disease monitored; that is, a microalbuminuria screening performed during the calendar year 2003, or previous evidence of kidney disease such as a positive microalbuminuria screening or medical treatment for kidney disease.
- *Cholesterol Screening for Members with Diabetes*: LDL-C screening performed; that is, a low-density lipoprotein cholesterol test conducted during the calendar year 2002 or 2003.
- *"Bad" Cholesterol Controlled for Members with Diabetes*: LDL-C controlled; that is, the most recent low-density lipoprotein cholesterol test performed during the calendar year 2002 or 2003 that was less than 130 mg/dL. If there was no valid LDL-C value within the last two measurement years, it was counted as exceeding the threshold.

As a set, these six aspects of care provide a comprehensive picture of the clinical management of patients with diabetes. The specifications for this measure are consistent with recommendations of the Diabetes Quality Improvement Project.

Advising Smokers to Quit is reported as the percent of members 18 years and older who were continuously enrolled during calendar year 2003, who were either current smokers or recent quitters, who were seen by a plan practitioner during the measurement year, and who received advice to quit smoking.

Childhood Immunizations is reported as the percent of enrolled children who turned two years old during the calendar year 2003, who were continuously enrolled for 12 months immediately preceding their second birthday, and who were identified as having four DTP/DtaP, three IPV/OPV, one MMR, two H influenza type b, three hepatitis B, and one chicken pox vaccine. It is reported as a combination rate.

Timely Initiation of Prenatal Care is reported as the percent of women who delivered a live birth between November 6th of calendar year 2002 and November 5th of calendar year 2003, who

were continuously enrolled at least 43 days prior to delivery, and who received a prenatal care visit in the first trimester or within 42 days of enrolling in the HMO.

Screening for Breast Cancer is reported as the percent of women age 52 through 69 years, who were continuously enrolled during the calendar years 2002 and 2003, and who had a mammogram during either of those two years.

Screening for Cervical Cancer is reported as the percent of commercially enrolled women age 21 through 64 years, who were continuously enrolled during the calendar years 2001 through 2003, and who received one or more Pap tests during one of those three years.

Cholesterol Management after Acute Cardiovascular Events consists of two measures referred to as Cholesterol Screening after Acute Cardiovascular Events and "Bad" Cholesterol Controlled after Acute Cardiovascular Events in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report. The first measure reports the percent of members age 18 through 75 as of December 31, 2003 who were discharged alive during the prior year for AMI, CABG, or PTCA/Stent, and had evidence of receiving an LDL-C screening on or between 60-365 days after discharge during the measurement year. The second measure reports the percent of those members that received this screening who had an LDL-C level of less than 130mg/dL.

Appropriate Medications for Members with Asthma evaluates whether members (age 5 through 56) with persistent asthma are being prescribed medications acceptable as primary therapy for long-term control of asthma. Members with "persistent" asthma were approximated based on services received during the prior year and medication utilization, rather than by a clinical measure of severity. The consistent use of the following medications resulted in a member being added to the numerator: Inhaled Corticosteroids, Cromolyn Sodium and Nedocromil, Leukotrine Modifiers, and Methylxanthines. Use of long-acting, inhaled beta-2 agonists was not included in the numerator.

Controlling High Blood Pressure is an intermediate outcome measure that assesses whether blood pressure was controlled among adult members with diagnosed hypertension. This measure can only be calculated by using the hybrid method (for further explanation of the hybrid methodology, see the *HEDIS Technical Specifications Volume 2*). For the Controlling High Blood Pressure measure, the hybrid method used membership data and ambulatory claims/encounter data to identify members ages 46 through 85 years of age with a diagnosis of hypertension and a medical record review to confirm the hypertension diagnosis and to assess blood pressure control during the membership year.

Beta Blockers after a Heart Attack is reported as the percent of commercial HMO members age 35 years and older as of December 31, 2003 who were hospitalized and discharged alive from January 1, 2003 through December 24, 2003 with a diagnosis of acute myocardial infarction (AMI) and who received a prescription for beta blockers upon discharge. NCQA provides a list of contraindications to allow plans to adjust the number of commercial members who qualify for treatment.

Antidepressant Medication Management evaluates the successfulness of the pharmacological management of depression using the following three measures:

- *Members with At Least 3 Follow-Up Visits:* Percentage of members 18 years and older as of the 120th day of the measurement year who were diagnosed with a new episode of depression and who had at least three follow-up visits with a provider within 12-weeks of diagnosis (the Acute Treatment Phase).
- *Effective Acute Phase Treatment:* Percentage of members 18 years and older as of the 120th day of the measurement year who were diagnosed with a new episode of depression, were treated with antidepressant medication and remained on their prescribed drug during the entire 12-week Acute Treatment Phase.

- *Effective Continuation Phase Treatment:* Percentage of members 18 years and older as of the 120th day of the measurement year who were diagnosed with a new episode of depression who remained on their antidepressant prescription for at least 180 days.

Follow-up after Hospitalization for a Mental Health Condition reports the percent of members who received appropriate follow-up care within:

- *7-Days:* Percent of members six years and older hospitalized for a mental health disorder who followed up with a doctor's visit within seven days of hospital discharge.
- *30-Days:* Percent of members six years and older hospitalized for a mental health disorder who followed up with a doctor's visit within 30 days of hospital discharge.

Members Receiving Any Mental Health Services is reported as the percent of all members (no age restriction) receiving any mental health services during CY2003.

Inpatient Admission Rate is reported as the number of members (no age restriction) hospitalized for a mental health condition per 1,000 plan members.

Inpatient Hospitalization Average Length of Stay is reported as the average number of days spent in the hospital for members (no age restriction) treated for a mental health condition.

The source of the HEDIS data contained in the Measuring the Quality of Pennsylvania's Commercial HMOs report was Quality Compass® and was used with the permission of the NCQA. Any analysis, interpretation, or conclusion based on these data was solely that of PHC4; NCQA specifically disclaims responsibility for any such analysis, interpretation, or conclusion. Quality Compass is a registered trademark of NCQA.

HEDIS Rotation Strategy

Beginning with HEDIS 1999, NCQA implemented a measures rotation strategy. The purpose of the strategy is to reduce data collection burdens for the HMOs while still providing relevant and accurate data to consumers. The strategy allows HMOs to skip, for one year, the task of collecting data for certain HEDIS measures, and permits the plans to use the results from the previous year instead. Measures included in the rotation schedule must have been in the measurement set for two years and have stable data collection specifications. The following table provides a summary of all the plans that, per the NCQA guidelines, chose not to collect new data for 4 of the 24 HEDIS measures that were included in this year's managed care report:

Table 2. *Repeat of CY2002 HEDIS Measures in the CY2003 Report, by HMO*

	CIGNA Healthcare of PA.	Health America	First Priority	KHP Central	KHP East	KHP West
Breast Cancer Screening	✓	✓				✓
Cervical Cancer Screening	✓		✓		✓	✓
Controlling High Blood Pressure	✓		✓			✓
Timeliness of Prenatal Care	✓	✓	✓	✓	✓	✓

CAHPS Measures

Another important component of the NCQA accreditation process is the CAHPS survey instrument. Commercial HMOs hire vendors from an NCQA-approved list to administer this member satisfaction survey. The *Measuring the Quality of Pennsylvania's Commercial HMOs* report includes calendar year 2003 CAHPS scores for 10 Pennsylvania plans.

Pennsylvania Department of Health

Each HMO licensed by the Pennsylvania Department of Health files an *Annual Report* each April that summarizes enrollment, provider network and financial data from the previous calendar year (as of December 31st). Information from these *Annual Reports* is on the Council's Web site in the "Plan Profile" section.

Pennsylvania Insurance Department

Each HMO is required to file a detailed annual financial statement with the Pennsylvania Insurance Department. PHC4, at the request of the HMOs included in this report, calculated the financial indicators shown on the Council's Web site using these data.

DESCRIPTION OF HOSPITALIZATIONS USED IN ANALYSES

Discharge data submitted to PHC4 by Pennsylvania health care facilities is housed in the Database of Record (DBOR). Once the submitted data is verified by the hospitals, the DBOR is analyzed to identify unique patients and their hospitalization histories. This process involves linking the individual hospitalizations of each unique patient, identifying each hospitalization as an index or non-index hospitalization, and creating episodes of care. Accurate construction of hospitalization histories and correct identification of the various components within a hospitalization history is crucial to PHC4 research methodology. The following paragraphs define the components of a hospitalization history and explain their role in the analyses for the seventeen clinical conditions included in the report.

Procedures For Linking Hospitalizations

The patient Social Security Number (SSN), sex, and date of birth, as reported by the hospitals, are used to identify patients across hospitalizations. In the vast majority of instances these values are identical for the same patient. Inconsistencies in essential data elements were resolvable if the discrepancy was clearly a typographical error (e.g., October 13 and October 31 of the same year). In this instance both records are assigned to the same patient. Hospitalizations assigned to the same patient are linked to create the hospitalization history.

Index Hospitalizations

After the linking of hospitalizations for unique patients is complete, the index hospitalization for each particular condition represented in that patient's hospitalization history is identified. For any single patient, the index hospitalization is the first hospitalization in the study period that meets the study population inclusion criteria. Therefore, there is only one index hospitalization per patient per condition.

Episode Of Care

An episode of care is comprised of the acute care hospitalization(s) associated with a patient's need for inpatient care. Single-hospitalization episodes of care are especially frequent for the preventable hospitalizations such as those in the "Preventing Hospitalization through Primary

Care" section of the *CY2003 Measuring the Quality of Pennsylvania's Commercial HMOs* report. Multiple-hospitalization episodes are more frequent for chronic illnesses (i.e., COPD, Asthma, Diabetes) and Heart Attack. Episodes involving more than one hospitalization are an important aspect of PHC4 methodology in that they account for the intricately related hospitalizations that are typical of the comprehensive care required to treat an illness.

For conditions other than Heart Attack:

- Multiple-hospitalization episodes consist of a string of contiguous acute care inpatient hospitalizations. For two contiguous hospitalizations to be considered part of the same episode, the discharge date of the first hospitalization must be the same date as the admission date of the second hospitalization.
- Multiple-hospitalization episodes may be comprised of hospitalizations with identical or differing principal diagnosis or procedure codes. For example, within the same diabetes episode a hospitalization with a principal diagnosis of diabetes may be followed by a hospitalization with a principal diagnosis of COPD.

For Heart Attack:

- Multiple-hospitalization episodes consist of the index AMI hospitalization and the acute care MDC 5 (Major Diagnostic Category 5: Diseases and Disorders of the Circulatory System*****) hospitalizations that began within 30 days of the admit date of the index heart attack hospitalization.
- These hospitalizations may or may not be contiguous. It is <u>not</u> necessary for the discharge date of the first hospitalization to be the same date as the admission date of the second hospitalization.
- Multiple-hospitalization episodes may be comprised of hospitalizations with identical or differing principal diagnoses as long as the hospitalization is classified as MDC 5.

Hospitalizations and Measures

All utilization and outcome measures for the seventeen clinical conditions in the *CY2003 Measuring the Quality of Pennsylvania's Commercial HMOs* report relied on the linking of hospitalizations and the proper identification of index and non-index hospitalizations. Table 3 lists all the measures reported for each clinical condition and details the hospitalizations that were used to extract utilization and/or clinical information for each measure. All episodes in a patient's hospitalization history and all hospitalizations in a multiple-hospitalization episode were not necessarily used for each measure. For example:

- The hospitalization rates for COPD were based upon the number of individual members that were hospitalized for this condition. If a person was hospitalized several times during the study period, only the index hospitalization was counted. Non-index cases were excluded so that a single member was counted in the hospitalization rate analysis rather than individual hospitalizations. Therefore, the number of members hospitalized for COPD was the basis of the hospitalization rate, not the number of hospitalizations for COPD.
- The percent rehospitalized for diabetes was also derived from the index hospitalization of each patient. However, to accurately assess percent rehospitalized across all HMO members hospitalized, the discharge date of the last acute care hospitalization in the diabetes episode was used to determine if the member had been rehospitalized within six months.

Additional hospitalizations were excluded from the analysis if they met certain clinical and procedural exclusion criteria. Refer to subsequent sections of this report that pertain to each

*Major Diagnostic Categories, used by the DRG system, are a broad classification of diagnoses typically grouped by body system.

clinical condition for detailed descriptions of the particular records excluded for each relevant measure.

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition*

Condition	Data Source	Measure	Hospitalizations[1]
Ear, Nose and Throat Infections	PHC4	*Pediatric and Adult reported separately:* • Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
High Blood Pressure	PHC4	• Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
	HEDIS	• Controlling High Blood Pressure	Not Applicable
Gastrointestinal Infections	PHC4	• Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
Kidney/Urinary Tract Infections	PHC4	• Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
Chronic Obstructive Pulmonary Disease	PHC4	• Number of Hospital Admissions • Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate • Length of Stay (risk-adjusted)	• Index hospitalization only (one per member)[2]
		• Statistical Rating for Rehospitalizations – 180 day	• Index hospitalization (one per member)[2] • Any respiratory-related hospitalization beginning no more than 180 days after the discharge date of the last acute care hospitalization[3] linked to the index hospitalization
Asthma	PHC4	*Pediatric and Adult reported separately:* • Number of Hospital Admissions • Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate • Length of Stay (risk-adjusted)	• Index hospitalization only (one per member)[2]
		Adult only: • Statistical Rating for Rehospitalizations – 180 day	• Index hospitalization (one per member)[2] • Any respiratory-related hospitalization beginning no more than 180 days after the discharge date of the last acute care hospitalization[3] linked to the index hospitalization
	HEDIS	Appropriate Medications for Members (age 5 – 56; percent)	Not Applicable

[1]Identifies the hospitalizations that were used to extract utilization and/or clinical information for the associated measure.
[2]Records with missing/invalid SSNs cannot be linked to a single member, and therefore were counted as separate members for the hospitalization rate. If records had matching valid social security numbers but had inconsistent birth dates or sex identifiers that could not be resolved, each record was counted as a single index hospitalization.
[3]Non-index hospitalization that may or may not have a principal diagnosis related to condition analyzed.

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1]
Diabetes	PHC4	• Number of Members with Diabetes	Not Applicable
		• Number of Hospital Admissions • Hospitalization Rate per 10,000 Members with Diabetes (age & sex-adjusted) • Statistical Rating for Hospitalization Rate • Length of Stay (risk-adjusted) • Percent of Admissions for Short-term Complications of Diabetes	• Index hospitalization only (one per member)[2]
		• Statistical Rating for Rehospitalizations – 180 day	• Index hospitalization (one per member)[2] • Any diabetes-related hospitalization beginning no more than 180 days after the discharge date of the last acute care hospitalization[3] linked to the index hospitalization
	HEDIS	• Poorly Controlled Hemoglobin A1c Levels (percent) • Hemoglobin A1c Blood Tests (percent) • Eye Exam Performed (percent) • Monitoring Kidney Disease (percent) • Cholesterol Screening (percent) • "Bad" Cholesterol Controlled (percent)	Not Applicable
Heart Attack (AMI)	PHC4	• Number of Hospital Admissions • Hospitalization Rate per 10,000 Members (age & sex-adjusted)	• Index hospitalization only (one per member)[2]
		• Number of Days Hospitalized (risk-adjusted)	• All hospitalizations[4] beginning no more than 30 days from the admission date of the AMI index hospitalization
		• Expected In-Hospital Mortality—30 Day (risk-adjusted; percent) • Actual In-Hospital Mortality—30 Day (percent) • Statistical Rating for In-Hospital Mortality—30 Day	• Index hospitalization (one per member)[2] • Any hospitalization[4] ending in death where the death occurred no more than 30 days from the admit date of the index AMI hospitalization
		• Percent Receiving Diagnostic Catheterization Procedure	• Index hospitalization (one per member)[2] • Any hospitalization[4] in which a catheterization procedure was performed no more than 30 days from (or 3 days prior to) the date of admission of the index hospitalization
		• Percent Receiving PTCA/Stent Procedure • Percent Receiving Coronary Artery Bypass Graft (CABG) Procedure	• Index hospitalization (one per member)[2] • Any hospitalization[4] in which the procedure was performed no more than 30 days from the date of admission of the index hospitalization
	HEDIS	• Cholesterol Management after Acute Cardiovascular Events o Cholesterol Screening after Acute Cardiovascular Events (percent) o "Bad" Cholesterol Controlled after Acute Cardiovascular Events (percent) • Beta Blockers after a Heart Attack (percent)	Not Applicable

[1]Identifies the hospitalizations that were used to extract utilization and/or clinical information for the associated measure.
[2]Records with missing/invalid SSNs cannot be linked to a single member, and therefore were counted as separate members for the hospitalization rate. If records had matching valid social security numbers but had inconsistent birth dates or sex identifiers that could not be resolved, each record was counted as a single index hospitalization.
[3]Non-index hospitalization that may or may not have a principal diagnosis related to condition analyzed.
[4]May be an index or a non-index hospitalization. An Index hospitalization must have a principal diagnosis of AMI. A non-index hospitalization need not have a principal diagnosis for AMI, but must be classified as MDC 5.

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1]
Hysterectomy	PHC4	• Total Hysterectomy Hospital Admissions • Procedure Rate per 10,000 Female Members (age-adjusted) • Statistical Rating for Procedure Rate *Abdominal and Vaginal reported separately:* • Number of Hospital Admissions • Procedure Rate per 10,000 Female Members (age-adjusted) • Statistical Rating for Procedure Rate • Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Index hospitalization only (one per member)[2]
	HEDIS	• Screening for Cervical Cancer (percent)	Not Applicable
Breast Cancer Procedures	PHC4	• Total Breast Cancer Procedures • Procedure Rate per 10,000 Female Members (age-adjusted) *Lumpectomy and Mastectomy reported separately:* • Number of Procedures • Percent Performed Inpatient	• Single Encounters [3,4]
		• Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications *Mastectomy procedures reported:* • Percent of Mastectomies with Reconstruction During the Same Admission	• Single Hospitalizations (inpatient only)[4]
	HEDIS	• Screening for Breast Cancer (percent)	Not Applicable
Neck and Back Procedures	PHC4	• Total Neck and Back Procedures • Procedure Rate per 10,000 Members (age & sex-adjusted) *With Fusion and Without Fusion reported separately:* • Number of Procedures • Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Single Hospitalizations[4]
Prostatectomy	PHC4	• Total Prostatectomy Procedures • Procedure Rate per 10,000 Male Members (age-adjusted) • Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Index hospitalization only (one per member)[2]

[1] Identifies the hospitalizations that were used to extract utilization and/or clinical information for the associated measure.
[2] Records with missing/invalid SSNs cannot be linked to a single member, and therefore were counted as separate members for the hospitalization rate. If records had matching valid social security numbers but had inconsistent birth dates or sex identifiers that could not be resolved, each record was counted as a single index hospitalization.
[3] Encounter refers to a single patient visit, not number of procedures (i.e., if a patient had both a lumpectomy and a mastectomy in the same medical visit, only the more invasive procedure was counted as a single patient encounter).
[4] Over the course of the study period, a single patient may have more than one hospitalization for said condition. If so, all of the single hospitalizations were analyzed.

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1]
Mental Health	HEDIS	• Antidepressant Medication Management o Members with At Least 3 Follow-Up Visits (percent) o Effective Acute Phase Treatment (percent) o Effective Continuation Phase Treatment (percent) • Follow-Up After Hospitalization for a Mental Health Condition o 7-Days (percent) o 30-Days (percent) • Members Receiving any Mental Health Service (percent) • Inpatient Admission Rate • Inpatient Hospitalization Average Length of Stay	Not Applicable
Other Measures	HEDIS	• Advising Smokers to Quit • Childhood Immunizations • Timely Initiation of Prenatal Care	Not Applicable

[1]Identifies the hospitalizations that were used to extract utilization and/or clinical information for the associated measure.

RISK ADJUSTMENT METHODOLOGY

Risk Adjustment Approach for Hospitalization/Procedure Rates

Age and Sex Adjustment

Hospitalization and procedure rates are age and sex adjusted to account for differences in the mix of members (by sex or age) in one HMO plan compared to another. For example, older populations often experience more health problems. When this is true, PHC4's system "expected" more health problems in the HMO with an older population and made appropriate adjustments. Sex is often an important risk factor, therefore the system also accounted for differences among HMOs in this category. The hospitalization rate data were adjusted using age and sex cohorts derived from the total membership population of each HMO. These cohorts were constructed with the assistance and review of each HMO. The age cohorts used in the risk adjustment of hospitalization/procedure rates are described in Appendix D.

To standardize hospitalization/encounter data across plans and across age categories, only records for those patients age 64 or younger as of December 31, 2003 were included in the analysis. HMO members were excluded from an analysis if they turned 65 at any point during 2003, even if the individual was age 64 at the time of their hospitalization. Likewise, in conditions involving adults only, records were included for patients who were 18 years or older as of December 31, 2003. As part of the data verification process, HMOs were instructed to follow this same age criterion when adding records to the file of verified data. (Note that diabetes records were included if the patient was 18 years or older and 75 years or younger as of December 31, 2003 and excluded if the patient turned 76 at any time during the 2003 calendar year even if the patient was 75 at the time of the hospitalization.)

Calculation of Adjusted Hospitalization/Procedure Rates

Indirect standardization, using the risk factors of age and sex, was used to compare the hospitalization rates for each HMO plan against the hospitalization rate for the HMO aggregate for each clinical condition (see the "Statistical Ratings" section.) Because enrollment data were not collected from the insurance groups that comprise the "fee-for-service" sample, hospitalization rates cannot be reported for this sample.

Risk Adjustment Approach for Outcome Measures

Regression techniques were used to construct "risk-adjustment models" for length of stay, rehospitalizations–180 days, in-hospital mortality–30 day, and in-hospital complications. These models were used to calculate expected (predicted) results. HMO plans whose membership was characterized by a greater number of risk factors (e.g., severity of illness, comorbidity, demographic factors, socioeconomic factors, etc.) were given "credit" in the system; patients with significant risk factors were expected to have longer lengths of stay and a greater probability of rehospitalization, death, and/or complications.

The first step in building the risk adjustment models was to identify possible risk-adjustment factors—those factors that potentially contribute to a particular event for a particular condition. In doing so, both clinical and demographic factors identified in the literature were considered. The *Atlas Outcomes*^{TM} Predicted Probability of Death (MQPredDeath) and Predicted Length of Stay (MQPredLOS) scores were also considered. The process for gathering and reporting the Atlas information is explained in the following section.

Atlas Outcomes™ Approach for Risk Adjustment

In a contractual agreement with MediQual Systems®, Inc., a business of Cardinal Health in Marlborough, Massachusetts, acute care hospitals are required to use MediQual's *Atlas Outcomes™* Severity of Illness System to assess each patient's condition from date of admission through the first two days of the hospital stay (or a maximum of 30 hours, based on when the patient was admitted to the hospital). This system represents a summarization of patient risk/severity, characterized as scores such as predicted probability of death (MQPredDeath) or predicted length of stay (MQPredLOS). These scores, determined from objective data abstracted from medical records, were included as potential risk factors in this report. The MQPredDeath is derived from a logistic regression model and has a value from 0.000 to 1.000. The MQPredLOS is derived from a linear regression model and has no bounds.

The *Atlas Outcomes™* system is based on the examination of numerous Key Clinical Findings (KCFs) such as lab tests, EKG readings, vital signs, the patient's medical history, imaging results, pathology, age, sex, and operative/endoscopy findings. Hospital personnel abstract these KCFs during specified timeframes in the hospitalization. Some pre-admission data are also captured (e.g., cardiac catheterization findings), as are some history findings. The KCF results are entered into algorithms that calculate the overall predicted probability of death or the predicted length of stay.

PHC4 Model Selection

Model selection identified those candidate variables that were statistically significant predictors of the relevant event (i.e., length of stay, rehospitalization–180 day, in-hospital mortality–30 day, or in-hospital complication). Linear regression models were used for length of stay, while binary logistic regression models were used for rehospitalization, mortality, and complication outcomes. Forward stepwise model selection methods were used to determine the significant risk factors. Factors were included in the model if they met the $p < 0.10$ significance criteria. Evaluation of model performance for linear regression models was accomplished by considering the R-squared (R^2) values. The measures of model adequacy applied to the binary logistic regression models included the percentage explained, R^2, and the ROC area.

PHC4 Model Coefficients

The coefficients associated with the significant risk factors and their p-values are listed in the following table. (See Appendix D for descriptions of the variables.)

Table 4. Coefficients of Significant Predictors

Significant Predictors	Coefficient	p-value
COPD		
Length of Stay		
• Intercept	-0.2158	
• MQPredLOS[1]	0.4974	<.0001
• Median Household Income	0.0133	0.0038
• Female[4]	0.2996	0.0058
• Age	0.0192	0.0189
• Psychological Disorder[4]	0.2713	0.0428
Rehospitalization		
• Intercept	0.7465	
• Logit of MQ PredDeath[5]	0.4437	<.0001
• Psychological Disorder[4]	0.4213	0.0032
• Poverty Rate	1.4188	0.0802
Pediatric Asthma		
Length of Stay		
• Intercept	0.6501	
• Age	0.0474	<.0001
• MQPredLOS[1]	0.3418	<.0001
• Asthma with Status Asthmaticus[4]	0.2584	0.0039
• Female[4]	0.1193	0.0405
Adult Asthma		
Length of Stay		
• Intercept	0.8863	
• MQPredLOS[1]	0.5679	<.0001
• Chronic Obstructive Asthma[4]	0.5329	<.0001
• Psychological Disorder[4]	0.2768	0.0049
• Asthma with Status Asthmaticus[4]	0.2478	0.0226
• Diabetes	0.2383	0.0341
Rehospitalization		
• Intercept	-3.3046	
• MQPredLOS[1]	0.3119	<.0001
• Chronic Obstructive Asthma[4]	0.4666	0.0003
• Poverty Rate	2.0088	0.0005
• Asthma with Status Asthmaticus[4]	0.4493	0.0137
• Psychological Disorder[4]	0.2840	0.0357
• Age	-0.0114	0.0606
Diabetes		
Length of Stay		
• Intercept	3.8937	
• MQPredLOS[1]	0.5740	<.0001
• Medical DRG	-3.0443	<.0001
• Heart Failure[4]	1.0553	<.0001
• Renal Failure[4]	0.7764	0.0002
• Female[4]	0.3367	0.0061
• Diabetes Complications - Long Term	-0.3437	
• Diabetes Complications - None	-0.2708	0.0492
• Diabetes Complications - Short Term	0.0000	
Rehospitalization		
• Intercept	-2.1027	
• MQPredLOS[1]	0.2026	<.0001
• Age	-0.0393	<.0001
• Medical DRG[4]	0.8708	0.0006
• Diabetes Complications - Long Term	0.4832	
• Diabetes Complications - None	-1.1662	0.0003
• Diabetes Complications - Short Term	0.0000	
• Renal Failure[4]	0.3773	0.0579

Significant Predictors	Coefficient	p-value
Heart Attack		
Length of Stay		
• Intercept	-0.1408	
• MQPredLOS[1]	0.6620	<.0001
• Heart Failure[4]	2.6367	<.0001
• Renal Failure[4]	1.8575	<.0001
• Age	0.0516	<.0001
• Poverty Rate	1.8196	0.0047
• AMI Type II (Anterior)[4]	0.2173	0.0990
Mortality		
• Intercept	-0.4702	
• Logit of MQ PredDeath[5]	0.9589	<.0001
• Renal Failure[4]	0.5219	0.0063
• AMI Type I (Q Wave)[4]	0.5254	0.0003
• Renal Dialysis[4]	0.6442	0.0268
• Median Household Income	-0.0097	0.0786
Abdominal Hysterectomy		
Length of Stay		
• Intercept	0.3893	
• MQPredLOS[1]	0.7445	<.0001
• Poverty Rate	1.8065	<.0001
In-Hospital Complications		
• Intercept	-4.5021	
• MQPredLOS[1]	0.6853	<.0001
• Poverty Rate	2.0224	<.0001
Vaginal Hysterectomy		
Length of Stay		
• Intercept	0.5512	
• MQPredLOS[1]	0.4755	<.0001
• Laparoscopic Procedure[4]	-0.2646	<.0001
• Age	0.0061	<.0001
• Poverty Rate	0.8176	<.0001
• PDxGrp[3] - Bleeding/Other PDx	-0.0729	0.0013
• PDxGrp[3] -Fibroids/Hyperplasia/etc.	0.0000	
In-Hospital Complications		
• Intercept	-4.4085	
• MQPredLOS[1]	1.3326	<.0001
• Age	-0.0187	0.0030
• Laparoscopic Procedure	-0.2929	0.0096
Lumpectomy		
Length of Stay		
• Intercept	0.0227	
• MQPredLOS[1]	0.5436	<.0001
• Poverty Rate	0.6955	0.0052
• Obesity[4]	0.3192	0.0067
• Breast Cancer Type - In Situ	0.3071	
• Breast Cancer Type - Malignant Neoplasm	0.0636	0.0516
• Breast Cancer Type - Metastatic Cancer	0.0000	
In-Hospital Complications		
• Intercept	-4.9567	
• MQPredLOS[1]	0.5544	0.0007
• Obesity[4]	1.5091	0.0317
• Hypertension[4]	0.9466	0.0616

Table 4. *Coefficients of Significant Predictors* continued

Significant Predictors	Coefficient	p-value
Mastectomy		
Length of Stay		
• Intercept	0.2044	
• Reconstruction - Concurrent[4]	1.8641	<.0001
• MQPredLOS[1]	0.8099	<.0001
• Diabetes[4]	0.4291	0.0006
• PxGroup[2] – Radical	0.5419	0.0046
• Breast Cancer Type - In Situ	-0.1199	
• Breast Cancer Type - Malignant Neoplasm	0.0844	0.0540
• Breast Cancer Type - Metastatic Cancer	0.0000	
• Poverty Rate	0.7446	0.0640
In-Hospital Complications		
• Intercept	-3.2566	
• Reconstruction - Concurrent[4]	0.8462	<.0001
• Diabetes[4]	0.8146	0.0182
• Obesity[4]	0.9605	0.0587
Neck and Back Procedure With Fusion		
Length of Stay		
• Intercept	2.0944	
• Location – Cervical/Atlas-Axis	-1.8358	
• Location – Dorsal and Dorslumbar	0.7241	<.0001
• Location – Lumbar and Lumbosacral	0.0000	
• MQPredLOS[1]	0.5490	<.0001
• PDxGroup[3] – Disc Degeneration	-0.4435	
• PDxGroup[3] – Disk Displacement	-0.6126	<.0001
• PDxGroup[3] – Narrow Spinal Canal	-0.2629	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• Technique - Anterior	-0.0151	
• Technique - Multiple	0.3451	<.0001
• Technique – Posterior/Lateral	0.0000	
• Poverty Rate	1.9104	<.0001
• PxGroup[2] – Both	0.4976	
• PxGroup[2] - Discectomy	0.1320	0.0012
• PxGroup[2] - Laminectomy	0.0000	
• Alcohol/Drug Abuse[4]	0.5407	0.0025
• Obesity[4]	0.2285	0.0101
• Age	0.0046	0.0298
• Diabetes[4]	0.1360	0.0477
In-Hospital Complications		
• Intercept	-3.4592	
• Location – Cervical/Atlas-Axis	-1.3332	
• Location – Dorsal and Dorslumbar	0.5516	<.0001
• Location – Lumbar and Lumbosacral	0.0000	
• MQPredLOS[1]	0.2795	<.0001
• Age	0.0132	0.0296
• PDxGroup[3] – Disc Degeneration	0.1122	
• PDxGroup[3] – Disk Displacement	-0.3176	0.0258
• PDxGroup[3] – Narrow Spinal Canal	-0.0084	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• PxGroup[2] – Both	0.6341	
• PxGroup[2] - Discectomy	0.0865	0.0624
• PxGroup[2] - Laminectomy	0.0000	
• Poverty Rate	1.3260	0.0853

Significant Predictors	Coefficient	p-value
Neck and Back Procedure Without Fusion		
Length of Stay		
• Intercept	-0.1426	
• MQPredLOS[1]	1.0323	<.0001
• PDxGroup[3] – Disc Degeneration	0.0235	
• PDxGroup[3] – Disk Displacement	-0.6813	<.0001
• PDxGroup[3] – Narrow Spinal Canal	-0.3696	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• Poverty Rate	1.1981	<.0001
• Female[4]	-0.0876	0.0011
• PxGroup[2] – Both	0.1647	
• PxGroup[2] – Discectomy	-0.0243	0.0044
• PxGroup[2] - Laminectomy	0.0000	
• Age	0.0229	0.0149
• Age Squared	-0.0003	0.0040
In-Hospital Complications		
• Intercept	-4.0593	
• PDxGroup[3] – Disc Degeneration	1.0258	
• PDxGroup[3] – Disk Displacement	-0.0299	0.0014
• PDxGroup[3] – Narrow Spinal Canal	0.4536	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• MQPredLOS[1]	0.2359	0.0001
• Age	0.0162	0.0018
• Obesity[4]	0.4380	0.0087
• PxGroup[2] - Both	0.5598	
• PxGroup[2] - Discectomy	-0.0077	0.0054
• PxGroup[2] - Laminectomy	0.0000	
• Median Household Income	-0.0098	0.0077
Prostatectomy		
Length of Stay		
• Intercept	2.2832	
• MQPredLOS[1]	0.2851	<.0001
• Hypertension[4]	0.2080	0.0006
• Median Household Income	-0.0065	0.0005
In-Hospital Complications		
• Intercept	-5.5068	
• MQPredLOS[1]	0.4294	0.0010
• Age	0.0376	0.0296
• Median Household Income	-0.0099	0.0594

[1] Atlas Outcomes ™ Predicted Length of Stay
[2] Procedure Group
[3] Principal Diagnosis Group
[4] These factors were tested as binary variables.
[5] Atlas Outcomes™ Predicted Probability of Death

Calculation of Risk-Adjusted Outcomes

Actual and expected rates and statistical ratings (greater than expected, as expected, or less than expected) were calculated for length of stay, rehospitalizion – 180 day, in-hospital mortality—30 day, and/or in-hospital complications for each appropriate clinical condition. The expected rate was based on the risk factors of the hospitalizations included. Actual and expected rates could then be compared to determine if differences were statistically significant.

Determining Actual (Observed) Rates

Length of Stay	This value was determined as the arithmetic mean length of stay for the hospitalizations included for a particular condition.
Percent Rehospitalized	This rate was determined by dividing the total number of members rehospitalized (at least once) to a general or specialty acute care hospital within 180 days of discharge (from the last hospitalization in the episode) by the total number of members hospitalized for that particular principal diagnoses.
In-Hospital Mortality *(Heart Attack only)*	This rate was determined by dividing the total number of patients who died in the hospital within 30 days of the admit date of the index heart attack hospitalization by the total number of patients hospitalized with a heart attack.
In-Hospital Complication	This rate was determined by dividing the total number of hospitalizations with at least one complication by the total number of hospitalizations included for that particular condition.

Determining Expected Rates

The models for each outcome used the risk factor values and corresponding coefficients to provide a predicted value (predicted length of stay, probability of rehospitalization, predicted probability of death, or probability of complication) for each observation after exclusions. The expected rate for an individual HMO plan was the average of these predicted values for all observations associated with the plan.

For both the linear and logistic regression models, the first step to determine these predicted values was to multiply the vector of model coefficients (ß) by the vector of risk factors (X). This value, ßX, is calculated for each patient and equals:

$$ßX, = ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 \ldots$$

where

$ß_n$ = the relevant model coefficient (see Table 4; $ß_0$ is the intercept)
X_n = the value of the risk factor for this patient

(risk factors that are binary, i.e., yes/no, were coded as yes = 1 and no =0)

For linear models, the value ßX was the final predicted value. For logistic models, the predicted value was calculated as:

$$p = \frac{e^{ßX}}{1 + e^{ßX}}$$

where e ≈ 2.7182818285

Linear Example – Calculations Used in COPD Length of Stay (LOS)

Total Cases: Number of hospitalizations after exclusions (equal to n).

Actual Length of Stay: Mean of the length of stay for each hospitalization.

Expected Length of Stay: Mean of the predicted length of stay for each hospitalization.

Step 1: Calculate each patient's predicted length of stay (PLOS):

$$PLOS = ßX$$
$$= ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 + ß_4x_4 + ß_5x_5$$
$$= -0.2158 + (0.4974)(x_1) + (0.\ 0133)(x_2) + (0.2996)(x_3) + (0.0192)(x_4) + (0.2713)(x_5)$$

where
- x_1 = MediQual PredLOS value
- x_2 = Median Household Income
- x_3 = Female (yes=1, no=0)
- x_4 = Patient Age in Years
- x_5 = Psychological Disorder (yes = 1, no = 0)

(ß's can be found in Table 4.)

Step 2: Calculate the mean PLOS for an HMO plan:

$$\text{Mean PLOS} = \frac{\Sigma\ \text{PLOS}}{n}$$

Risk-Adjusted Length of Stay: $\frac{\text{Mean Actual LOS}}{\text{Mean PLOS}}\left(\text{Mean Actual LOS for the HMO and FFS databases combined}\right)$

Logistic Example – Calculations used in COPD Percent Rehospitalized

Total Cases: Number of hospitalizations after exclusions (equal to n).

Actual Percent Rehospitalized: Total number of members rehospitalized at least once / total number of hospitalizations.

Predicted Percent Rehospitalized: Mean of the predicted probability of rehospitalization for each hospitalization.

Step 1: Calculate each patient's predicted rehospitalization percent (PRehosp):

$$ßX = ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3$$
$$= 0.7465 + (0.4437)(x_1) + (0.4213)(x_2) + (1.4188)(x_3)$$

where
- x_1 = MediQual PredDeath
- x_2 = Psychological Disorder (yes = 1, no = 0)
- x_3 = Poverty Rate of patient's zip code

(ß's can be found in Table 4.)

$$\text{PRehosp} = \frac{e^{\beta X}}{1 + e^{\beta X}}$$

Step 2: Calculate the mean PRehosp for an HMO plan:

$$\text{Mean PRehosp} = \frac{\Sigma\ \text{PRehosp}}{n}$$

Statistical Ratings

Significance tests (using binomial distribution) were performed for the measures listed in the table below.

Table 5. *Binomial Distribution, by Measure*

Measure	Clinical Conditions
Hospitalization Rate (Members hospitalized for a given clinical condition per HMO population)	Ear, Nose and Throat Infections; High Blood Pressure; Gastrointestinal Infections; Kidney/Urinary Tract Infections; Chronic Obstructive Pulmonary Disease; Asthma; Diabetes
Procedure Rate (Members hospitalized for a hysterectomy)	Hysterectomy
In-Hospital Mortality (Death vs. No Death)	Heart Attack
In-Hospital Complications (Complication vs. No Complication)	Hysterectomy; Breast Cancer Procedures; Neck and Back Procedures; Prostatectomy
Percent Rehospitalized (Rehospitalized vs. Not Rehospitalized)	COPD; Adult Asthma; Diabetes

Although the measures for any single HMO plan may be comparable to the statewide norm (or HMO aggregate), random variation plays a role in such comparisons. Statistical evaluation was used to determine whether the difference between the observed and the expected (or average) value was *too large* to be attributed solely to chance.

Binomial Distribution

The use of binomial distribution required the following assumptions:

- each observation included in the study had one of two observable events (e.g., in-hospital complication vs. no in-hospital complication). In other words, the response was dichotomous.
- the probability of the event (e.g., having a complication) for each observation studied within a clinical condition group was equal to the probability provided by the risk models.
- the result for any one observation in the analyses had no impact on the result of another observation. In other words, the observations were independent.

The probability distributions were based on the HMO plans' predicted or expected rates. Using the probability distribution, a p-value was calculated for each observed value. This p-value is the probability, or likelihood, that the observed value could have occurred by chance. If it was very unlikely ($p < 0.05$; see "Inferential Error" section below) that the observed value could have occurred only by chance, then it was concluded that the observed value was "significantly different" from the expected value.

Calculation of p-values

Calculating the p-value for the binomial test is defined by a formula that sums discrete probabilities based upon the binomial distribution. The binomial formula (see below) was used, in part, to derive the p-value. The probability that a binomial random variable takes on a specific value is defined by the following equation (i.e., the binomial formula):

$$P(X=a) = [(N!)/(a!(N-a)!)]\ p^{a}(1-p)^{N-a}$$

where (for in-hospital complications analysis),

P(X=a) is the probability that the binomial random variable (X) takes on a specific value (a); that is, a = 1 hospitalization with complication, a = 2 hospitalizations with complications, etc.

X is the binomial random variable. X is a discrete random variable that can range from 0 through N ($0 \leq X \leq N$).

N is the number of observations for a particular HMO plan's clinical condition.

p is the overall expected probability of patient in-hospital complications for a particular HMO plan's clinical condition.

The p-value for a specific result is determined to be the sum of all probabilities associated with that result and all other results that are more extreme. The p-value associated with the observed number of in-hospital complications was calculated for each HMO plan and clinical condition.

Inferential Error

A type of inferential error that can be made in statistics is called a Type I error or "false positive." The probability of committing a Type I error is equal to the level of significance established by the researcher. For the current analysis, the level of significance was set to 0.05. In the context of the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, a Type I error occurred when the difference between the observed in-hospital complications percent and the expected in-hospital complications percent was declared statistically significant, when in fact, the difference was due to chance. That is, for a particular clinical condition, the HMO plan was declared to be statistically higher or lower than expected, when in reality the HMO plan's level of performance was comparable to the statewide norm. Since the level of significance was set to 0.05, there was a 5% (or 1 in 20) chance of committing this type of error.

Assignment of Statistical Rating

A statistical rating was assigned to each HMO if the difference between what was observed and what was expected in a particular clinical condition was statistically significant. The p-value, calculated in terms of a "two-tailed" test was compared to the level of significance. For example, in the calculation of in-hospital complications percent for each HMO:

- if the calculated p-value was greater than or equal to 0.05, then the conclusion was made that the difference between what was expected and what was observed was *not* statistically significant. It *cannot be concluded* that the in-hospital complications percent for that particular clinical condition in that particular HMO was different from the comparative reference.

- if the calculated p-value was less than 0.05, then the conclusion was made that the difference between what was expected and what was observed *was* statistically significant.

- If the observed in-hospital complications percent was lower than expected, which was based on the statewide in-hospital complications percent, the HMO was assigned the symbol "○" (as shown in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report) to indicate the in-hospital complications percent was significantly lower than expected for a particular clinical condition.

- If the observed in-hospital complications percent was higher than expected, which was based on the statewide in-hospital complications percent, the HMO was assigned the symbol "●" (as shown in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report) to indicate the in-hospital complications percent was significantly higher than expected for a particular clinical condition.

In the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, statistical ratings are shown for HMO plans that have sufficient records. When the number of records for analysis was less than 10, "NR" (Not Reported) is displayed (except for analyses related to the rate of hospitalizations or procedures).

Treatment Measures Calculated by PHC4

PREVENTING HOSPITALIZATION THROUGH PRIMARY CARE

Pediatric Ear, Nose and Throat Infections

Inclusion Criteria

Cases were included in the data analysis for pediatric ear, nose, and throat infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." Pediatric HMO members included in this analysis were 0 through 17 years of age. A total of 701 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of pediatric index hospitalizations per 10,000 pediatric members. Of the 741 hospitalizations for pediatric ear, nose, and throat infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 40 records were excluded. These hospitalizations are listed in Table 6A. The HMO database was used as the comparative reference.

Table 6A. *Exclusions from "Hospitalization Rate" Analysis for Pediatric Ear, Nose and Throat Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*741*	*100.0*
Exclusions:		
❖ Neonate (age < 28 days)	26	3.5
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	6	0.8
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	0	0.0
❖ Mechanical Ventilation*	4	0.5
❖ Tracheitis*	4	0.5
❖ Metastatic Cancer; Ear, Nose, and Throat Cancer; Lung Cancer; HIV Infection; Tracheostomy; Cleft Lip and Palate Repair*	0	0.0
Total exclusions	*40*	*5.4*
Total members remaining in analysis	*701*	*94.6*

*See Appendix B for definitions of clinically complex exclusions.

Adult Ear, Nose and Throat Infections

Inclusion Criteria

Cases were included in the data analysis for adult ear, nose, and throat infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." Adult HMO members included in this analysis were 18 through 64 years of age. A total of 533 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of adult index hospitalizations per 10,000 adult members. Of the 551 hospitalizations for adult ear, nose, and throat infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 18 records were excluded.

These hospitalizations are listed in Table 6B. The HMO database was used as the comparative reference.

Table 6B. *Exclusions from "Hospitalization Rate" Analysis for Adult Ear, Nose and Throat Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	551	100.0
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	7	1.3
❖ Metastatic Cancer*	1	0.2
❖ HIV Infection*	2	0.4
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	0	0.0
❖ Mechanical Ventilation*	3	0.5
❖ Tracheostomy*	0	0.0
❖ Ear, Nose, and Throat Cancer; Lung Cancer; Cleft Lip and Palate Repair; Tracheitis*	5	0.9
Total exclusions	*18*	*3.3*
Total members remaining in analysis	*533*	*96.7*

*See Appendix B for definitions of clinically complex exclusions.

High Blood Pressure (Hypertension)

Inclusion Criteria

Only adult (18 through 64 years of age) HMO members were included in this analysis. Cases were included in the data analysis for high blood pressure if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." A total of 569 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of index hospitalizations per 10,000 adult members. Of the 672 hospitalizations for hypertension submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 103 records were excluded. These hospitalizations are listed in Table 6C. The HMO database was used as the comparative reference.

Table 6C. *Exclusions from "Hospitalization Rate" Analysis for High Blood Pressure*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*672*	*100.0*
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	24	3.6
❖ Metastatic Cancer*	2	0.3
❖ Renal Dialysis*	3	0.5
❖ Open Heart Surgery*	2	0.3
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	69	10.3
❖ PTCA/Stent*	1	0.2
❖ HIV Infection; Mechanical Ventilation; Tracheostomy*	2	0.3
Total exclusions	*103*	*15.3*
Total members remaining in analysis	*569*	*84.7*

*See Appendix B for definitions of clinically complex exclusions.

Gastrointestinal Infections

Inclusion Criteria

Cases were included in the data analysis for gastrointestinal infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." HMO members included in this analysis were 0 through 64 years of age. A total of 1,166 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of index hospitalizations per 10,000 members. Of the 1,224 hospitalizations for gastrointestinal infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 58 records were excluded. These hospitalizations are listed in Table 6D. The HMO database was used as the comparative reference.

Table 6D. *Exclusions from "Hospitalization Rate" Analysis for Gastrointestinal Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,224*	*100.0*
Exclusions:		
❖ Neonate (age < 28 days)	2	0.2
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	23	1.9
❖ Gastrointestinal Cancer*	15	1.2
❖ Metastatic Cancer*	5	0.4
❖ HIV Infection*	2	0.2
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	4	0.3
❖ Major Large and Small Bowel Procedures*	5	0.4
❖ Other Digestive System OR Procedures with Complications*	2	0.2
Total exclusions	*58*	*4.7*
Total members remaining in analysis	*1,166*	*95.3*

*See Appendix B for definitions of clinically complex exclusions.

Kidney/Urinary Tract Infections

Inclusion Criteria

Cases were included in the data analysis for kidney/urinary tract infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." HMO members included in this analysis were 0 through 64 years of age. A total of 1,449 records, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of index hospitalizations per 10,000 members. Of the 1,603 hospitalizations for kidney/urinary tract infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 154 records were excluded. These hospitalizations are listed in Table 6E. The HMO database was used as the comparative reference.

Table 6E. *Exclusions from "Hospitalization Rate" Analysis for Kidney/Urinary Tract Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,603*	*100.0*
Exclusions:		
❖ Neonate (age < 28 days)	7	0.4
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	70	4.4
❖ Metastatic Cancer*	19	1.2
❖ Kidney/Urinary Tract Cancer*	6	0.4
❖ HIV Infection*	3	0.2
❖ Chronic Renal Failure*	8	0.5
❖ Renal Dialysis*	8	0.5
❖ Cases in DRGs Unrelated to Kidney/Urinary Tract Infections *	33	2.1
Total exclusions	*154*	*9.6*
Total members remaining in analysis	*1,449*	*90.4*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define Kidney/Urinary Tract Infections.

MANAGING ON-GOING ILLNESSES

Chronic Obstructive Pulmonary Disease (COPD)

Inclusion Criteria

Only adult (18 through 64 years of age) HMO members were included in this analysis. Cases were included in the data analysis for COPD if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." A total of 1,150 admissions, after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of index hospitalizations per 10,000 adult HMO members. Of the 1,452 hospitalizations for COPD submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 302 records were excluded. These hospitalizations are listed in Table 7A. The HMO database was used as the comparative reference.

Table 7A. *Exclusions from "Hospitalization Rate" Analysis for COPD*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,452*	*100.0*
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	226	15.6
❖ Cases in DRGs Unrelated to COPD*	56	3.9
❖ Metastatic Cancer*	9	0.6
❖ Lung Cancer*	11	0.8
❖ HIV Infection*	0	0.0
❖ Mechanical Ventilation; Tracheostomy*	0	0.0
Total exclusions	*302*	*20.8*
Total members remaining in analysis	*1,150*	*79.2*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define COPD.

Length of Stay (risk-adjusted). The inpatient length of stay measure was calculated from the COPD index hospitalization only, beginning with the date of admission and ending with the date of discharge of the index hospitalization (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for

COPD are listed in Table 7B. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7B. *Exclusions from "Length of Stay" (LOS) Analysis for COPD*

	Total HMO and Fee-for-Service Hospitalizations		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*2,206*	*100.0*	*4.5*
Exclusions:			
❖ Hospitalization Rate Exclusions	443	20.1	6.8
❖ Death in Hospital	2	0.1	2.5
❖ Missing *Atlas Outcomes™* Score	28	1.3	3.8
❖ Outlier[1]/Missing or Invalid[2] LOS	5	0.2	18.8
Total exclusions	*478*	*21.7*	*6.7*
Total members remaining in analysis	*1,728*	*78.3*	*3.9*

[1]LOS values that were > 15 days.
[2]LOS value < 0.

Rehospitalizations (risk-adjusted). To calculate the percent rehospitalized, the first return hospitalization for respiratory-related acute care (MDC 4) within 180 days of discharge from an acute care facility in Pennsylvania was used. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which may not be COPD-related) in the COPD episode was used as the start point for counting the 180 days. If a member was rehospitalized multiple times, he or she was still counted as one member who was rehospitalized. Exclusions are listed in Table 7C. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7C. *Exclusions from "Rehospitalizations" Analysis for COPD*

	Total HMO and Fee-for-Service Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*2,206*	*100.0*
Exclusions:		
❖ Length of Stay Exclusions	478	21.7
❖ Patient was transferred and died in hospital	1	<0.1
❖ Non-PA Resident	28	1.3
❖ Invalid Social Security Number	3	0.1
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex	0	0.0
Total exclusions	*510*	*23.1*
Total members remaining in analysis	*1,696*	*76.9*

Pediatric and Adult Asthma

Inclusion Criteria

Pediatric (0 through 17 of age) and adult (18 through 64 years of age) cases were analyzed separately. HMO cases were included in the data analysis if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." A total of 1,597 pediatric admissions and 2,268 adult admissions, after exclusions, matched these criteria.

Utilization/ Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of asthma index hospitalizations per 10,000 pediatric/adult members. Of the 1,686 pediatric hospitalizations for asthma submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 89 records were excluded. Of the 2,626 adult hospitalizations submitted, 358 records were excluded. These hospitalizations are listed in Table 7D. The HMO database was used as the comparative reference.

Table 7D. *Exclusions from "Hospitalization Rate" Analyses for Asthma*

	Total HMO Hospitalizations			
	Pediatric		*Adult*	
	N	***% of Total***	***N***	***% of Total***
Total hospitalizations before exclusions	*1,686*	*100.0*	*2,626*	*100.0*
Exclusions:				
❖ Neonate (age < 28 days)	1	0.1	NA	NA
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	83	4.9	321	12.2
❖ HIV Infection*	0	0.0	4	0.2
❖ Metastatic Cancer*	0	0.0	3	0.1
❖ Lung Cancer*	0	0.0	2	0.1
❖ Tracheostomy*	0	0.0	2	0.1
❖ Mechanical Ventilation*	5	0.3	26	1.0
Total exclusions	*89*	*5.3*	*358*	*13.6*
Total members remaining in analysis	*1,597*	*94.7*	*2,268*	*86.4*

*See Appendix B for definitions of clinically complex exclusions.
NA: Not Applicable

Length of Stay (risk-adjusted). Length of stay was calculated from the asthma index hospitalization only, beginning with the date of admission and ending with the date of discharge of the index hospitalization (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for asthma are listed in Table 7E. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7E. *Exclusions from "Length of Stay" (LOS) Analyses for Asthma*

	Total HMO and Fee-for-Service Hospitalizations					
	Pediatric			*Adult*		
	N	***% of Total***	***Avg. LOS***	***N***	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*2,132*	*100.0*	*2.0*	*3,574*	*100.0*	*3.6*
Exclusions:						
❖ Hospitalization Rate Exclusions	106	5.0	2.3	463	13.0	4.8
❖ Death in Hospital	0	0.0	NA	0	0.0	NA
❖ Missing *Atlas Outcomes*™ Score	16	0.8	1.6	47	1.3	3.1
❖ Outlier[1]/Missing or Invalid[2] LOS	3	0.1	11.7	12	0.3	21.8
Total exclusions	125	5.9	2.5	*522*	*14.6*	*5.0*
Total members remaining in analysis	*2,007*	*94.1*	*2.0*	*3,052*	*85.4*	*3.3*

[1]LOS values that were > 10 days for pediatric asthma and > 15 days for adult asthma.
[2]LOS value < 0.
NA: Not Applicable

Rehospitalizations (risk-adjusted). The percent rehospitalized was calculated for adult asthma only. Because pediatric cases frequently lack social security number identification, potential rehospitalizations cannot be linked to previous hospitalizations. Thus, the rehospitalization analysis was not performed for pediatric asthma cases.

To calculate the percent rehospitalized, the first return hospitalization for respiratory-related acute care (MDC 4) within 180 days of discharge from an acute care facility in Pennsylvania was used. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which may not be asthma-related) in the asthma episode was used as the start point for counting the 180 days. If a member was rehospitalized multiple times, he or she was still counted as one member who was rehospitalized. Exclusion criteria for rehospitalizations are listed in Table 7F. The HMO and the fee-for-service combined database were used as the comparative reference.

Table 7F. *Exclusions from "Rehospitalizations" Analysis for Adult Asthma*

	Total HMO and Fee-for-Service Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*3,574*	*100.0*
Exclusions:		
❖ Length of Stay Exclusions	522	14.6
❖ Patient was transferred and died in hospital	0	0.0
❖ Non-PA Resident	46	1.3
❖ Invalid Social Security Number	32	0.9
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex	0	0.0
Total exclusions	*600*	*16.8*
Total members remaining in analysis	*2,974*	*83.2*

Diabetes

Inclusion Criteria

Hospitalizations for HMO members (18 through 75 years of age) were included in this analysis only if: 1) the member was identified as having diabetes according to HEDIS NCQA guidelines, 2) met continuous enrollment requirements set by NCQA, and 3) the hospitalization had a principal diagnosis of diabetes (ICD-9-CM codes are listed in Appendix A: *Description of Study Population).* Note that the age interval for this analysis is different from the other clinical treatments/conditions included in the report. A total of 1,425 admissions, after exclusions, were included in the hospitalization rate analysis.

Utilization/Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of adult HMO members with diabetes hospitalized per 10,000 diabetic members. Of the 2,079 hospitalizations for diabetes submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 654 records were excluded. These hospitalizations are listed in Table 7G. The HMO database was used as the comparative reference.

Table 7G. *Exclusions from "Hospitalization Rate" Analysis for Diabetes*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*2,079*	*100.0*
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	335	16.1
❖ Metastatic Cancer*	16	0.8
❖ HIV Infection*	1	< 0.1
❖ Major Organ Transplant*	16	0.8
❖ Cases in DRGs Unrelated to Diabetes*	286	13.8
Total exclusions	654	31.5
Total members remaining in analysis	*1,425*	*68.5*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define diabetes.

Length of Stay (risk-adjusted). Length of stay was calculated from the diabetes index hospitalization, beginning with the date of admission and ending with the date of discharge of the hospitalization (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for diabetes are listed in the Table 7H. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7H. *Exclusions from " Length of Stay" (LOS) Analysis for Diabetes*

	Total HMO and Fee-for-Service Hospitalizations		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*3,175*	*100.0*	*5.0*
Exclusions:			
❖ Hospitalization Rate Exclusions	973	30.6	6.9
❖ Death in Hospital	7	0.2	11.0
❖ Missing *Atlas Outcomes™* Scores	43	1.4	5.1
❖ Outlier[1]/ Missing or Invalid[2] LOS	*9*	*0.3*	*38.6*
Total exclusions	*1,032*	*32.5*	*7.1*
Total members remaining in analysis	*2,143*	*67.5*	*4.0*

[1]LOS values that were > 30 days.
[2]LOS value < 0.

Percent of Admissions for Short-Term Complications of Diabetes. For all diabetes hospitalizations included in the hospitalization rate analysis, PHC4 also calculated the percent that were hospitalized due to short-term complications of diabetes. These hospitalizations may be an immediate reflection of how well members are managing their diabetes. Short-term complications of diabetes are acute, life-threatening events related to blood sugar control. The following codes were used to identify short-term complications: 250.02, 250.03, 250.10-250.13, 250.20-250.23, 250.30-250.33.

Rehospitalizations (risk-adjusted). To calculate the percent rehospitalized, the first return hospitalization for diabetes-related acute care within 180 days of discharge from an acute care facility in Pennsylvania was used. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which may not be diabetes-related) in the diabetes episode was used as the start point for counting the 180 days. If a member was rehospitalized multiple times, he or she was still counted as one member who was rehospitalized. Exclusion criteria for rehospitalizations are listed in Table 7I. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7I. *Exclusions from "Rehospitalizations" Analysis for Diabetes*

	Total HMO and Fee-for-Service Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*3,175*	*100.0*
Exclusions:		
❖ Length of Stay Exclusions	1,032	32.5
❖ Patient was transferred and died in hospital	0	0.0
❖ Non-PA Resident	52	1.6
❖ Invalid Social Security Number	17	0.5
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex	0	0.0
Total exclusions	*1,101*	*34.7*
Total members remaining in analysis	*2,074*	*65.3*

HEART ATTACK (AMI)

Inclusion Criteria

Only adult (18 through 64 years of age) HMO members were included in this analysis. Cases that were assigned a principal diagnosis of one of the ICD-9-CM codes for heart attack (see Appendix A: "Description of Study Population") were included in the analyses. A total of 3,131 admissions, after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of AMI index hospitalizations per 10,000 adult members. Of the 3,714

hospitalizations for heart attack submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 583 records were excluded. These hospitalizations are listed in Table 8A. The HMO database was used as the comparative reference.

Table 8A. *Exclusions from "Hospitalization Rate" Analysis for Heart Attack*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*3,714*	*100.0*
Exclusions:		
❖ Case in which patient returned to the hospital after identified as having died	0	0.0
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	569	15.3
❖ HIV Infection*	2	0.1
❖ Metastatic Cancer*	10	0.3
❖ Heart or Heart and Lung Transplant*	2	0.1
Total exclusions	*583*	*15.7*
Total members remaining in analysis	*3,131*	*84.3*

*See Appendix B for definitions of clinically complex exclusions.

In-Hospital Mortality (risk-adjusted). Because the treatment of AMI is complex, a 30-day period is used to determine in-hospital mortality. In this analysis, the death must: 1) occur within the index AMI hospitalization itself or another acute care (MDC 5) hospitalization in the AMI episode, and 2) occur within 30 days of the admit date of the index AMI hospitalization. The exclusions to the analysis of in-hospital mortality for heart attack are listed below in Table 8B. The statewide database was used as the comparative reference.

Table 8B. *Exclusions from "In-Hospital Mortality" Analysis for Heart Attack*

	Total Statewide Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*14,252*	*100.0*
Exclusions:		
❖ Hospitalization Rate Exclusions	2,286	16.0
❖ Missing *Atlas Outcomes™* Score	108	0.8
❖ Invalid Social Security Number*	180	1.3
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex*	0	0.0
Total exclusions	*2,574*	*18.1*
Total members remaining in analysis	*11,678*	*81.9*

*Hospitalizations were excluded because it was indeterminable (due to invalid SSN, dates, sex, etc.) whether these patients were hospitalized (and died) at another time following the index AMI hospitalization.

Number of Days Hospitalized (risk-adjusted). Rather than reporting length of stay, the Number of Days hospitalized for individual heart attack patients is reported as an indicator of the time spent in the hospital(s) for heart attack treatment. The Number of Days hospitalized for heart attack patients consists of the total time spent in the hospital or the sum of individual MDC 5 hospitalizations that began no more than 30 days from the admit date of the index heart attack hospitalization. The exclusions to the Number of Days hospitalized analysis for heart attack are listed in Table 8C. The statewide database was used as the comparative reference.

Table 8C. *Exclusions from "Number of Days Hospitalized" Analysis for Heart Attack*

	Total Statewide Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*14,252*	*100.0*
Exclusions:		
❖ In-Hospital Mortality Exclusions	2,574	18.1
❖ Death in Hospital Within 30 Days[1]	318	2.2
❖ Death in Hospital After 30 Days but Within an AMI Episode[2]	22	0.2
❖ Outliers[3]/Missing or Invalid[4] LOS	87	0.6
Total exclusions	*3,001*	*21.1*
Total hospitalizations remaining in analysis	*11,251*	*78.9*

[1]Refers to a death that occurs within 30 days of the admission date of the index hospitalization.
[2]Refers to a death that occurs beyond 30 days of the admission date of the index hospitalization.
[3]Hospitalizations in which days hospitalized > 45.
[4]LOS value < 0.

Other Cardiac Procedures Associated with Any Single Heart Attack Patient

Percent Receiving Cardiac Catheterization. The diagnostic cardiac catheterization procedure (ICD-9-CM codes 37.22 or 37.23) must have been performed (in any MDC 5 hospitalization, regardless of principal diagnosis) within 30 days of (or 3 days prior to) the index hospitalization admit date for a heart attack. Calculation of the catheterization percent incorporated the number of heart attack patients receiving catheterization procedures by plan in the numerator and the number of heart attack patients for each plan in the denominator. Note, when a procedure code for a diagnostic catheterization was not present in a heart attack record, it was assumed that the procedure was performed in conjunction with or prior to PTCA/Stent procedures and CABG surgeries, since all cases require a diagnostic catheterization in order to undergo therapeutic intervention/coronary revascularization.

Percent Receiving PTCA/Stent. The codes associated with PTCA/Stent include ICD-9-CM codes 36.01, 36.02, 36.05, 36.06, and 36.07. To be included in the analyses, these procedures must have been performed in any MDC 5 hospitalization within 30 days of the index hospitalization admit date for a heart attack. Calculation of this percent incorporated the number of heart attack patients receiving PTCA/Stent procedures for individual HMO plans in the numerator and the number of heart attack patients per plan in the denominator.

Percent Receiving Coronary Artery Bypass Graft (CABG). The ICD-9-CM codes associated with bypass surgery include 36.10-36.17, and 36.19. One or more of these procedure codes must have been present in any MDC 5 hospitalization within 30 days of the index hospitalization admit date for a heart attack. Calculation of the bypass surgery percent incorporated the number of heart attack patients receiving CABG procedures by plan in the numerator and the number of heart attack patients by plan in the denominator.

SURGICAL PROCEDURES

Hysterectomy

Inclusion Criteria

In the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, data are reported for abdominal and vaginal hysterectomies combined and separately. The study population included hospitalizations that were assigned a principal or secondary procedure code of hysterectomy (see Appendix A: "Description of Study Population"). Only adult (18 through 64 years of age) female HMO members were included in this analysis. Hysterectomies performed due to cancer (ICD-9-CM diagnosis codes 179, 180.0-180.9, 181, 182.0-182.8, 183.0-183.9, 184.0-184.9, 198.6, 198.82, 233.1-233.3, 236.0-236.3, and 239.5 in any position), trauma of the female reproductive system (ICD-9-CM diagnosis codes 867.4-867.9, 868.00, 868.03, 868.04, 868.09, 868.10, 868.13,

868.14, 868.19, 869.0, 869.1, 879.6-879.9, 906.0, 908.2, 939.1, and 947.4 in any position), or other emergent occurrences such as pregnancy related complications were not included. Thus, only non-traumatic and non-female reproductive malignant hysterectomies were analyzed. A total of 7,666 admissions (5,300 abdominal and 2,366 vaginal hysterectomies), after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age-adjusted). The procedure rate shown for each HMO used the total number of adult female index hospitalizations per 10,000 adult female members. Of the 7,832 hospitalizations for hysterectomy submitted to PHC4 for inclusion in the report, 166 records were excluded; of the 5,444 hospitalizations for abdominal hysterectomy, and 2,388 hospitalizations for vaginal hysterectomy, 144 and 22 records were excluded, respectively. These hospitalizations are listed in Table 9A. The HMO database was used as the comparative reference.

Table 9A. *Exclusions from "Procedure Rate" Analyses for Hysterectomy*

	Total HMO Hospitalizations					
	Total		*Abdominal*		*Vaginal*	
	N	*% of Total*	*N*	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	*7,832*	*100.0*	*5,444*	*100.0*	*2,388*	*100.0*
Exclusions:						
❖ Multiple Hysterectomies for One Patient	0	0.0	0	0.0	0	0.0
❖ Cancer[1, 2]	65	0.8	57	1.0	8	0.3
❖ Hemorrhage on Admission[2]	0	0.0	0	0.0	0	0.0
❖ Cases in DRGs Unrelated to Hysterectomy[2]	101	1.3	87	1.6	14	0.6
❖ HIV Infection[2]	0	0.0	0	0.0	0	0.0
Total exclusions	*166*	*2.1*	*144*	*2.6*	*22*	*0.9*
Total members remaining in analysis	*7,666*	*97.9*	*5,300*	*97.4*	*2,366*	*99.1*

[1]These hospitalizations were excluded due to cancer status of other body sites. As explained under "Inclusion Criteria," hysterectomies performed due to cancer were not included in the data verified by the plans.
[2]See Appendix B for definitions of clinically complex exclusions and DRGs used to define hysterectomy.

In-Hospital Complications (risk-adjusted). This measure is reported separately for abdominal and vaginal adult hysterectomies and was calculated for each HMO. In-hospital complications are any one of a particular set of ICD-9-CM codes in any procedure or secondary diagnosis position in the index hysterectomy hospitalization (refer to Appendix C for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis for hysterectomy are outlined in Table 9B. The statewide database was used as the comparative reference.

Table 9B. *Exclusions from "In-Hospital Complications" Analyses for Hysterectomy*

	Total Statewide Hospitalizations			
	Abdominal		*Vaginal*	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	*14,247*	*100.0*	*6,161*	*100.0*
Exclusions:				
❖ Procedure Rate Exclusions	483	3.4	83	1.3
❖ Missing *Atlas Outcomes™* Score	102	0.7	31	0.5
Total exclusions	*585*	*4.1*	*114*	*1.9*
Total members remaining in analysis	*13,662*	*95.9*	*6,047*	*98.1*

Length of Stay (risk-adjusted). The inpatient length of stay for hysterectomy is the period of hospitalization beginning with the date of admission of the hospitalization in which the hysterectomy procedure was performed and ending with the date of discharge of the same hospitalization (length of stay was calculated as discharge date minus admit date). The exclusions to the risk-adjusted length of stay analysis for abdominal and vaginal hysterectomy are outlined in Table 9C. The statewide database was used as the comparative reference.

Table 9C. *Exclusions from "Length of Stay" (LOS) Analyses for Hysterectomy*

	Total Statewide Hospitalizations					
	Abdominal			*Vaginal*		
	N	*% of Total*	*Avg. LOS*	*N*	*% of Total*	*Avg. LOS*
Total hospitalizations before exclusions	*14,247*	*100.0*	*2.9*	*6,161*	*100.0*	*1.8*
Exclusions						
❖ In-Hospital Complications Exclusions	585	4.1	5.8	114	1.9	2.5
❖ Death in Hospital	0	0.0	NA	1	0.0	1.0
❖ Outlier[1]/ Missing or Invalid[2] LOS	8	0.1	29.8	4	0.1	14.8
Total exclusions	593	4.2	6.1	119	1.9	2.9
Total members remaining in analysis	*13,654*	*95.8*	*2.8*	*6,042*	*98.1*	*1.7*

[1]LOS > 20 days for abdominal and > 11 days for vaginal hysterectomy hospitalizations.
[2]LOS value < 0.

Breast Cancer Procedures

Inclusion Criteria

Only adult (age 18 through 64 years of age) female HMO members were included in this analysis. Cases were included in the data analysis for breast cancer procedures if they included a principal diagnosis of breast cancer and a procedure code, in any position, for lumpectomy and/or mastectomy (see Appendix A: "Description of Study Population" for a list of the ICD-9-CM and CPT codes included in the study). Results of analyses are reported for lumpectomy and mastectomy combined and separately. A total of 2,498 admissions (1,805 lumpectomy cases and 693 mastectomy cases), after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age-adjusted). The procedure rate is shown for each HMO using the total number of procedures (lumpectomies and mastectomies, both inpatient and ambulatory) per 10,000 adult female members. Procedure rates were based upon the *total number of breast cancer procedures,* not the number of patients receiving a breast cancer procedure. When two or more procedures (e.g., lumpectomy and mastectomy) were performed at the same time only the most invasive procedure (mastectomy) was included in the analysis. Thus, within an encounter, multiple procedures were tallied only once for the purpose of calculating the procedure rate; however, if a single patient had more than one encounter over the course of the study period, all encounters were included. Of the 2,498 breast cancer procedures (1,805 lumpectomy cases and 693 mastectomy cases) submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, none were excluded (see Table 9D). The HMO database served as the comparative reference.

Table 9D. *Exclusions from "Procedure Rate" Analyses for Breast Cancer Procedures–Inpatient and Ambulatory*

	Total HMO Procedures					
	Total		*Lumpectomy*		*Mastectomy*	
	N	*% of Total*	*N*	*% of Total*	*N*	*% of Total*
Total procedures before exclusions	*2,498*	*100.0*	*1,805*	*100.0*	*693*	*100.0*
Exclusions:						
❖ HIV Infection*	0	0.0	0	0.0	0	0.0
Total exclusions	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*
Total procedures remaining in analysis	*2,498*	*100.0*	*1,805*	*100.0*	*693*	*100.0*

*See Appendix B for definitions of clinically complex exclusions.

In-Hospital Complications (risk-adjusted). This measure was calculated only for inpatient procedures for each HMO and is reported separately for lumpectomy and mastectomy procedures. In-hospital complications are any one of a particular set of ICD-9-CM codes in any

procedure or secondary diagnosis position in a discharge record associated with the breast cancer procedure (refer to Appendix C for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis are found in Table 9E. The statewide database was used as the comparative reference.

Table 9E. *Exclusions from "In-Hospital Complications" Analyses for Breast Cancer Procedures–Inpatient Only*

	Total Statewide Procedures			
	Lumpectomy		*Mastectomy*	
	N	*% of Total*	*N*	*% of Total*
Total procedures[1] before exclusions	*6,016*	*100.0*	*2,387*	*100.0*
Exclusions:				
❖ Procedure Rate Exclusions	1	< 0.1	0	0.0
❖ Ambulatory Case[2]	5,382	89.5	313	13.1
❖ Missing *Atlas Outcomes™* Score	9	0.1	19	0.8
Total exclusions	*5,392*	*89.6*	*332*	*13.9*
Total hospitalizations remaining in analysis	*624*	*10.4*	*2,055*	*86.1*

[1]Includes inpatient and ambulatory cases.
[2]Lumpectomy and mastectomy statewide records related to ambulatory care were not analyzed in the in-hospital complications percent since this was derived from inpatient cases only.

Length of Stay (risk-adjusted) analyses are reported separately for lumpectomy and mastectomy procedures. Only inpatient hospitalizations were included in the length of stay outcome measure. Length of stay was calculated from a single hospitalization only, beginning with the date of admission and ending with the date of discharge (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the analysis are listed in Table 9F. The statewide database was used as the comparative reference.

Table 9F. *Exclusions from "Length of Stay" (LOS) Analyses for Breast Cancer Procedures–Inpatient Only*

	Total Statewide Procedures					
	Lumpectomy			*Mastectomy*		
	N	*% of Total*	*Avg. LOS[1]*	*N*	*% of Total*	*Avg. LOS[1]*
Total procedures[2] before exclusions	*6,016*	*100.0*	*1.3*	*2,387*	*100.0*	*2.4*
Exclusions:						
❖ In-Hospital Complications Exclusions	5,392	89.6	1.9	332	13.9	1.9
❖ Death in Hospital	0	0.0	NA	0	0.0	NA
❖ Outlier[3]/Missing or Invalid[4] LOS	7	0.1	13.3	0	0.0	NA
Total exclusions	*5,399*	*89.7*	*6.9*	*332*	*13.9*	*1.9*
Total hospitalizations remaining in analysis	*617*	*10.3*	*1.2*	*2,055*	*86.1*	*2.4*

[1] Based on inpatient cases only.
[2]Includes inpatient and ambulatory cases.
[3]LOS > 7 days for lumpectomy and > 15 days for mastectomy procedures.
[4]LOS value < 0.
NA: Not Applicable

Neck and Back Procedures

Inclusion Criteria

Adult (18 through 64 years of age) HMO members were included in the analyses of neck and back procedures. Cases were included in the data analysis if they included a principal diagnosis and a procedure code (in any position) of one of the ICD-9-CM codes listed in Appendix A: "Description of Study Population." A total of 5,161 admissions (2,037 with fusion and 3,124 without fusion), after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age and sex-adjusted). The procedure rate is shown for each HMO using the total number of neck and back procedures (fusion and non-fusion combined) per 10,000 adult

HMO members. Of the 5,161 (2,037 with fusion and 3,124 without fusion) neck and back procedures submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 43 (23 with fusion and 20 without fusion) records were excluded. These hospitalizations are listed in Table 9G. The HMO database was used as the comparative reference.

Table 9G. *Exclusions from "Procedure Rate" Analyses for Neck and Back Procedures*

	Total HMO Hospitalizations					
	Total		*With Fusion*		*Without Fusion*	
	N	*% of Total*	*N*	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	*5,161*	*100.0*	*2,037*	*100.0*	*3,124*	*100.0*
Exclusions:						
❖ Refusion*	17	0.2	10	0.5	7	0.2
❖ Pathological Spinal Fracture*	8	0.2	6	0.3	2	0.1
❖ Spinal Nerve Root Injury*	4	0.1	2	0.1	2	0.1
❖ Paraplegia*	2	< 0.1	0	0.0	2	0.1
❖ Quadriplegia*	5	0.1	2	0.1	3	0.1
❖ Hemiplegia*	0	0.0	0	0.0	0	0.0
❖ Unspecified Paralysis*	0	0.0	0	0.0	0	0.0
❖ Spinal Fracture*	6	0.1	2	0.1	4	0.1
❖ HIV Infection; Infantile Cerebral Palsy*	1	< 0.1	1	< 0.1	0	0.0
Total exclusions	*43*	*0.8*	*23*	*1.1*	*20*	*0.6*
Total hospitalizations remaining in analysis	*5,118*	*99.2*	*2,014*	*98.9*	*3,104*	*99.4*

*See Appendix B for definitions of clinically complex exclusions.

In-Hospital Complications (risk-adjusted). In-hospital complications were reported separately for fusion and non-fusion procedures and were calculated for each HMO. In-hospital complications are any one of a particular set of ICD-9-CM codes in any procedure or secondary diagnosis position in a discharge record associated with the neck/back hospitalization (refer to Appendix C for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis are found in Table 9H. The statewide database was used as the comparative reference.

Table 9H. *Exclusions from "In-Hospital Complications" Analyses for Neck and Back Procedures*

	Total Statewide Hospitalizations			
	With Fusion		*Without Fusion*	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	*6,480*	*100.0*	*10,101*	*100.0*
Exclusions:				
❖ Procedure Rate Exclusions	93	1.4	74	0.7
❖ Missing *Atlas Outcomes*^{TM} Score	39	0.6	66	0.7
❖ Improper Coding of Fusion Technique*	11	0.2	NA	NA
Total exclusions	*143*	*2.2*	*140*	*1.4*
Total hospitalizations remaining in analysis	*6,337*	*97.8*	*9,961*	*98.6*

*Fusion technique was a significant risk factor for in-hospital complications. Therefore, if the ICD-9-CM procedure coding did not clearly indicate the fusion technique, the hospitalization(s) was excluded from the complications analysis.
NA: Not Applicable

Length of Stay (risk-adjusted). Length of stay was calculated from a single hospitalization only, beginning with the date of admission and ending with the date of discharge (length of stay was calculated as discharge date minus admit date). It is reported separately for fusion and non-fusion procedures and was calculated for each HMO. Hospitalizations that were excluded from the risk-adjusted length of stay analysis for neck and back procedures are listed in Table 9I. The statewide database was used as the comparative reference.

Table 9I. *Exclusions from "Length of Stay" (LOS) Analysis for Neck and Back Procedures*

	Total Statewide Procedures					
	With Fusion			*Without Fusion*		
	N	*% of Total*	*Avg. LOS*	*N*	*% of Total*	*Avg. LOS*
Total hospitalizations before exclusions	*6,480*	*100.0*	*2.5*	*10,101*	*100.0*	*1.8*
Exclusions:						
❖ In-Hospital Complications Exclusions	143	2.2	4.8	140	1.4	3.3
❖ Death in Hospital	1	< 0.1	11.0	2	< 0.1	5.5
❖ Outlier[1]/Missing or Invalid[2] LOS	23	0.4	25.9	20	0.2	23.6
Total exclusions	*167*	*2.6*	*7.7*	162	*1.6*	*5.8*
Total hospitalizations remaining in analysis	*6,313*	*97.4*	*2.3*	*9,939*	*98.4*	*1.7*

[1]LOS > 16 days for neck and back procedures with and without fusion.
[2]LOS value < 0.

Prostatectomy

Inclusion Criteria

Only adult (18 through 64 years of age) male HMO members were included in this analysis. Cases were included in the data analysis for prostatectomy if they included one of the procedure ICD-9-CM codes (in any position) for radical prostatectomy listed in Appendix A: "Description of Study Population." Prostatectomies done by a different surgical approach (i.e., transurethral prostatectomy) were not included. Radical prostatectomy is most often done when cancer is present or assumed to be present. The clinical indications for choosing one surgical approach over another for prostatectomy are very different. If a record included codes for both radical and transurethral prostatectomies it was included in the analysis as a radical prostatectomy. A total of 786 admissions, after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age-adjusted). The procedure rate is shown for each HMO using the total number of procedures per 10,000 male HMO members. Of the 780 prostatectomy procedures submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 5 records were excluded. These exclusions are listed in Table 9J. The HMO database was used as the comparative reference.

Table 9J. *Exclusions from "Procedure Rate" Analysis for Prostatectomy*

	Total HMO Hospitalizations	
	N	*% of Total*
Total hospitalizations before exclusions	*780*	*100.0*
Exclusions:		
❖ Multiple Prostatectomy Procedures for One Patient	0	0.0
❖ HIV Infection*	0	0.0
❖ Cases in DRGs Unrelated to Prostatectomy*	5	0.6
Total exclusions	*5*	*0.6*
Total hospitalizations remaining in analysis	*775*	*99.4*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define prostatectomy.

In-Hospital Complications (risk-adjusted). This measure was calculated for each HMO. In-hospital complications are any one of a particular set of ICD-9-CM codes in any procedure or secondary diagnosis position in the index prostatectomy hospitalization (refer to Appendix C for a detailed description of the complications). The exclusions to the in-hospital complications analysis are found in Table 9K. The statewide database was used as the comparative reference.

Table 9K. *Exclusions from "In-Hospital Complications" Analysis for Prostatectomy*

	Total Statewide Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*2,057*	*100.0*
Exclusions:		
❖ Procedure Rate Exclusions	10	0.5
❖ Cases not requiring abstraction of Atlas Outcome data (DRGs 338, 339, 341):	0	0.0
❖ Missing *Atlas Outcomes™* Score	25	1.2
Total exclusions	*35*	*1.7*
Total hospitalizations remaining in analysis	*2,022*	*98.3*

Length of Stay (risk-adjusted). Length of stay was calculated from a single hospitalization only, beginning with the date of admission and ending with the date of discharge (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for prostatectomy procedures are listed in Table 9L. The statewide database was used as the comparative reference.

Table 9L. *Exclusions from "Length of Stay" (LOS) Analysis for Prostatectomy*

	Total Statewide Hospitalizations		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*2,057*	*100.0*	*3.1*
Exclusions:			
❖ In-Hospital Complications Exclusion	35	1.7	4.3
❖ Death in Hospital	1	< 0.1	17.0
❖ Outlier[1]/Missing or Invalid[2] LOS	7	0.3	21.6
Total exclusions	*43*	*2.1*	*7.4*
Total hospitalizations remaining in analysis	*2,014*	*97.9*	*3.0*

[1]LOS > 15 days for prostatectomy.
[2]LOS value < 0.

MEMBER SATISFACTION

Satisfaction Measures

The following CAHPS Survey Questions are included in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report for calendar year 2003:

- Question 10 "In the last 12 months, how much of a problem, if any, was it to see a specialist that you needed to see?"
- Question 17 "In the last 12 months, when you needed care right away for an illness, injury or condition, how long did you usually have to wait between trying to get care and actually seeing a provider?"
- Question 18 "In the last 12 months, did you make any appointments with a doctor or other health provider for regular or routine health care?"
- Question 20 "In the last 12 months, not counting the times you needed health care right away, how many days did you usually have to wait between making an appointment and actually seeing a provider?"
- Question 24 "In the last 12 months, how much of a problem, if any, was it to get the care, tests or treatment you or a doctor believed necessary?"
- Question 26 "In the last 12 months, how much of a problem, if any, were delays in health care while you waited for approval from your health plan?"
- Question 42 "In the last 12 months, how much of a problem, if any, was it to get the help you needed when you called your health plan's customer service?"
- Question 43 "In the last 12 months, have you called or written your health plan with a complaint or problem?"
- Question 45 "Was your complaint or problem settled to your satisfaction?"
- Question 49 "How would you rate your health plan?"

All reported CAHPS measures include an average for the group of Pennsylvania HMO plans. These averages were calculated by PHC4 by weighting each plan's score by its CY2003 total commercial enrollment. National averages were also included when available from NCQA. The national averages (provided in the NCQA *Quality Compass*® database) include all lines of business across all reporting managed care organizations in the United States.

FINANCIAL INDICATORS

Financial information on the HMO plans is reported on the PHC4 Web site only. Each HMO submitted all data used in the financial section of the report as part of their 2000 – 2003 *Annual Statements* filed with the Pennsylvania Insurance Department. The data elements that pertain to commercial members (e.g., Commercial Premium Revenue) do not include government-funded HMO members, such as Medicare or Medical Assistance, but do include federal employee benefit programs. The following table outlines the locations of the data elements in the *Annual Statements.*

Table 10. *Location of Data Elements in the Annual Statement*

Financial Measures	Location in Annual Statement*
2003 Total HMO Premium Revenue	Page 4, Line 2, Column 2
2000 Total HMO Premium Revenue	Page 4, Line 1, Column 3 (CY2000)
2003 Commercial Premium Revenue	Page 7, Line 1, Columns 2, 7, and 13 (if applicable)
2003 Commercial Medical Expenses	Page 7, Line 16, Columns 2, 7, and 13 (if applicable)
2003 Commercial Underwriting Gain/Loss	Page 7, Line 21, Columns 2, 7, and 13 (if applicable)
2003 Total HMO Revenue	Page 4, Lines 7, 25, and 27, Column 2
2003 HMO Net Income	Page 4, Line 30, Column 2
2002 Total HMO Revenue	Page 4, Line 7, 25 and 27, Column 3
2001 Total HMO Revenue	Page 4, Line 7, 24 and 26, Column 3 (CY2001)
2002 HMO Net Income	Page 4, Line 30, Column 3
2001 HMO Net Income	Page 4, Line 29, Column 3 (CY2001)
2003 Cash and Short-term Investments	Page 2, Line 5, Column 3
2003 Claims Payable	Page 3, Line 1, Column 3

*Refers to each plan's CY2003 *Annual Statement* unless noted otherwise.

Definitions and formulas for the specific financial indicators are listed below:

Total HMO Premium Revenue reflects total premium revenue from the HMO line of business, including Medicare and Medical Assistance. There is no fee-for-service revenue included for the HMOs.

3-year Change in Total HMO Premium Revenue reflects the change in total HMO premium revenues from the end of CY2000 to the end of CY2003. This measure reflects the extent to which the corporation's HMO line of business is growing or declining.

$$\frac{\textit{Total HMO Premium Revenue}_{2003} - \textit{Total HMO Premium Revenue}_{2000}}{\textit{Total Revenue}_{2000}}$$

Commercial Premium Revenue as a Percent of Total Premium Revenue reflects the commercial portion of the HMO's total line of business. For those HMOs where commercial revenue was less than 100 percent of total HMO premium revenue, the balance of premium revenue was derived from Medicare and Medical Assistance plans and administrative service contracts.

$$\frac{\textit{Commercial Premium Revenue}_{2003}}{\textit{Total Premium Revenue}_{2003}}$$

Commercial Medical Loss Ratio reflects the portion of each commercial premium dollar spent on health care during CY2003. If an HMO has a Medical Loss Ratio above 100 percent, it is spending more for healthcare services than it receives in commercial premiums.

$$\frac{\textit{Commercial Medical Expenses}_{2003}}{\textit{Commercial Premium Revenue}_{2003}}$$

Commercial Net (pre-tax) Underwriting Margin shows the portion of commercial premium revenue that remained as income or profit after all expenses (except income taxes) related to commercial members had been paid. A negative margin indicates that revenues were not sufficient to cover expenses and the HMO's commercial line of business operated at a loss for the calendar year.

$$\frac{\textit{Commercial Underwriting Gain/Loss}_{2003}}{\textit{Commercial Premium Revenue}_{2003}}$$

Total HMO Net (after-tax) Margin shows the portion of Total HMO Revenue that remained as income or profit after all expenses (including taxes) had been paid. A negative margin indicates that revenues were not sufficient to cover expenses and the HMO operated at a loss.

$$\frac{\textit{Total HMO Net Income}_{2003}}{\textit{Total HMO Revenue}_{2003}}$$

3-year Average Total Net Margin reflects the average after tax net income over the past three calendar years (CY2001 – CY2003) for the Total HMO.

$$\frac{\Sigma_{2001,2002,2003}\,\textit{Total HMO Net Income}}{\Sigma_{2001,2002,2003}\,\textit{Total HMO Revenues}}$$

Cash to Claims Payable is the ratio between cash and short-term investments to claims payable. Claims payable includes both known and estimated unreported claims. This measure reflects the ability of the insurer to pay outstanding claims out of its liquid assets in the event that premium revenue was to fall short of health care reimbursements.

$$\frac{\textit{Cash \& Short-term Investments}_{2003}}{\textit{Claims Payable}_{2003}}$$

HMO PLAN PROFILE

The HMO "Plan Profile" is found on the PHC4 Web site only. The specific source of data and the determination of the information in the HMO profile is as follows:

Number of Commercial Members. The number of commercial members, as of December 31, 2003, is found in section III.A. columns 1 through 4 of the *Annual Report* submitted to the Pennsylvania Department of Health. Enrollment numbers reported on the PHC4 Web site, identified as the "Number of Commercial Members," reflect the sum of these columns. Only HMO members enrolled in the Pennsylvania operations of HMOs were included in this total. Some HMOs operate health care plans regionally or nationally; however, only those members that belong to an HMO licensed to operate in Pennsylvania were counted.

Change in Commercial Enrollment. The procedure outlined above was also followed for the December 31, 2002 *Annual Report*. The 2002 totals were then subtracted from the 2003 totals and the percent change is reported and is identified as the "Change in Commercial Enrollment" variable on the PHC4 Web site.

NCQA Accreditation Status. The "NCQA Accreditation Status" variable was obtained from the NCQA Web site and was current as of the publication date of the *CY2003 Measuring the Quality of Pennsylvania's Commercial HMOs*.

APPENDICES

Preventing Hospitalization Through Primary Care

Ear, Nose and Throat Infections *(Pediatric and Adult)*	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 017.4x (x = 0-6), 034.0, 055.2, 112.82, 380.10, 380.11, 380.12, 380.14, 380.16, 381.00, 381.01, 381.02, 381.03, 381.04, 381.05, 381.06, 381.10, 381.19, 381.20, 381.29, 381.3, 381.4, 382.00, 382.01, 382.1, 382.2, 382.3, 382.4, 382.9, 461.0, 461.1, 461.2, 461.3, 461.8, 461.9, 462, 463, 464.00, 464.01, 464.20, 464.21, 464.30, 464.31, 464.4, 464.50, 464.51, 465.0, 465.8, 465.9, 472.0, 472.1, 472.2, 473.0, 473.1, 473.2, 473.3, 473.8, 473.9, 474.00, 474.01, 474.02, 476.0, 476.1, 487.1
High Blood Pressure	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 401.0, 401.1, 401.9, 402.00, 402.10, 402.90, 403.00, 403.10, 403.90, 404.00, 404.10, 404.90
Gastrointestinal Infections	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 003.0, 006.2, 009.0, 009.1, 558.2, 558.9
Kidney/Urinary Tract Infections	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 590.00, 590.01, 590.10, 590.11, 590.2, 590.3, 590.80, 590.9, 599.0

Managing On-Going Illness

Chronic Obstructive Pulmonary Disease	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 491.20, 491.21, 492.0, 492.8, 496, 506.4
Asthma *(Pediatric and Adult)*	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 493.00, 493.01, 493.02, 493.10, 493.11, 493.12, 493.20, 493.21, 493.22, 493.81**, 493.82**, 493.90, 493.91, 493.92
Diabetes	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 250.xy (x = 0-9, y = 0-3)

Heart Attack

Heart Attack	*Any one of the following ICD-9-CM diagnosis codes in the principle position:* 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91

Surgical Procedures

Hysterectomy *(Abdominal and Vaginal)*	*Any one of the following ICD-9-CM procedure codes in the any position:* 68.3*, 68.31**, 68.39**, 68.4, 68.51, 68.59, 68.6, 68.7, 68.9
Breast Cancer Procedures *(Lumpectomy and Mastectomy)*	*Any one of the following ICD-9-CM or CPT procedure codes in any position:* 85.20, 85.21, 85.22, 85.23, 85.41, 85.42, 85.43, 85.44, 85.45, 85.46, 85.47, 85.48, 19112, 19120, 19125, 19126, 19160, 19162, 19180, 19200, 19220, 19240 *AND* *Any one of the following ICD-9-CM diagnosis codes in the principle position:* 174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.8, 174.9, 196.3, 198.2, 198.81, 233.0, 238.3, 239.3
Neck and Back Procedures *(With Fusion and Without Fusion)*	*Any one of the following ICD-9-CM procedure codes in any position:* 03.09, 80.50, 80.51, 80.59 *AND* *Any one of the following ICD-9-CM diagnosis codes in the principle position:* 720.0, 721.0, 721.1, 721.2, 721.3, 721.41, 721.42, 721.90, 721.91, 722.0, 722.10, 722.11, 722.2, 722.4, 722.51, 722.52, 722.6, 722.70, 722.71, 722.72, 722.73, 722.90, 722.91, 722.92, 722.93, 723.0, 723.1, 724.00, 724.01, 724.02, 724.09, 724.1, 724.2, 724.3, 724.5, 738.4, 756.11, 756.12
Prostatectomy	*Any one of the following ICD-9-CM procedure codes in any position:* 60.3, 60.4, 60.5, 60.62, 60.69

**** Invalid Q4, 2003*** ***** Valid Q4, 2003***

Clinically Complex Exclusions

Exclusion	Definition[1]
Cancer	Dx: 140.0-208.9, 230.0-239.9
Chronic Renal Failure	Dx: 585
Cleft Lip and Palate Repair	DRG: 052
Ear, Nose, or Throat Cancer	Dx: 146.0-146.9, 147.0-147.3, 147.8, 147.9, 148.0-148.3, 148.8, 148.9, 149.0, 149.1, 149.8, 149.9, 160.0-160.5, 160.8, 160.9, 161.0-161.3, 161.8, 161.9, 162.0, 231.0, 231.1, 231.8, 231.9, 235.1, 235.6, 235.9
Extensive OR Procedures Unrelated to Principal Diagnosis	DRG: 468
Gastrointestinal Cancer	Dx: 150.0-150.5, 150.8, 150.9, 151.0-151.6, 151.8, 151.9, 152.0-152.3, 152.8, 152.9, 153.0-153.9, 154.0-154.3, 154.8, 155.0-155.2, 156.0-156.2, 156.8, 156.9, 157.0-157.4, 157.8, 157.9, 158.0, 158.8, 158.9, 159.0, 159.8, 159.9, 195.2, 197.4-197.8, 230.1-230.9, 235.2-235.5, 239.0
Heart or Heart and Lung Transplant	Px: 33.6, 37.5*, 37.51**, 37.52**
Hemiplegia	Dx: 342.00-342.02, 342.10-342.12, 342.80-342.82, 342.90-342.92
Hemorrhage	Dx: 998.11
HIV Infection	Dx: 042
Infantile Cerebral Palsy	Dx: 343.0-343.3
Kidney, Ureter and Major Bladder Procedures for Nonneoplasms with CC‡	DRG: 304
Kidney, Ureter and Major Bladder Procedures for Nonneoplasms without CC‡	DRG: 305
Kidney/Urinary Tract Cancer	Dx: 188.0-188.9, 189.0-189.4, 189.8, 189.9, 233.7, 233.9, 236.7, 236.90, 236.91, 236.99, 239.4
Lung Cancer	Dx: 162.2-162.5, 162.8, 162.9, 197.0, 231.2, 235.7, 239.1
Major Large and Small Bowel Procedures with CC‡	DRG: 148
Major Large and Small Bowel Procedures without CC‡	DRG: 149
Major Organ Transplant	Px: 33.50-33.52, 33.6, 37.5*, 37.51**, 37.52**, 41.00-41.09, 41.94, 46.97, 50.51, 50.59, 52.80-52.86, 55.61, 55.69
Mechanical Ventilation	Px: 96.70, 96.71, 96.72
Metastatic Cancer	Dx: 196.0-196.3, 196.5, 196.6, 196.8, 196.9, 197.0-197.8, 198.0-198.7, 198.81, 198.82, 198.89, 199.0, 199.1
Open Heart Surgery	Dx: 35.00-35.04, 35.10-35.14, 35.20-35.28, 35.31-35.35, 35.39, 35.42, 35.50-35.54, 35.60-35.63, 35.70-35.73, 35.81-35.84, 35.91-35.95, 35.98, 35.99, 36.10-36.17, 36.19, 36.2, 36.31, 36.32, 36.39, 36.91, 36.99, 37.10-37.12, 37.31-37.33, 37.4, 37.5*, 37.51**, 37.52**, 37.53**
Other Digestive System OR Procedures with CC‡	DRG: 170
Paraplegia	Dx: 344.1
Pathological Spinal Fracture	Dx: 733.13
PTCA/Stent	Px: 36.01, 36.02, 36.05, 36.06, 36.07
Quadriplegia	Dx: 344.00-344.04, 344.09
Refusion	Px: 81.30-81.39 in any position
Renal Dialysis	Dx: V45.1, V56.0, V56.8 Px: 39.95, 54.98
Spinal Fracture	Dx: 805.0x, 805.1x, x=0-8; 805.2-805.9; 806.0x, x=0-9; 806.1x, x=0-9; 806.2x, x=0-9; 806.3x, x=0-9; 806.4; 806.5; 806.6x, x=0-2, 9; 806.7x, x=0-2, 9; 806.8; 806.9
Spinal Nerve Root Injury	Dx: 952.0x, x=0-9; 952.1x, x=0-9; 952.2; 952.3; 952.4; 952.8; 952.9; 953.0-953.5; 953.8; 953.9; 954.0; 954.1; 954.8; 954.9
Tracheitis	Dx: 464.10, 464.11, 464.20, 464.21
Tracheostomy	Px: 31.1, 31.21, 31.29
Unspecified Paralysis	Dx: 344.9

[1]Cases are defined by ICD-9-CM Diagnosis (Dx)/ Procedure (Px) Codes or Diagnostic Related Group (DRG).
*Invalid effective Q4-2003 **Valid effective Q4, 2003
‡Comorbidity(s) and/or Complication(s)

DRGs Used to Define Conditions

Listed below are the DRGs used to define cases related to kidney/urinary tract infections, COPD, diabetes, hysterectomy, and prostatectomy. For each condition, cases in DRGs other than those below are considered clinically complex and are excluded.

Kidney/Urinary Tract Infection cases are restricted to the following DRGs:

320 Kidney and Urinary Tract Infections, Age Greater than 17 with CC‡
321 Kidney and Urinary Tract Infections, Age Greater than 17 without CC‡
322 Kidney and Urinary Tract Infections, Age 0 – 17

COPD cases are restricted to the following DRG:

88 Chronic Obstructive Pulmonary Disease

Diabetes cases are restricted to the following DRGs:

018 Cranial and Peripheral Nerve Disorders with CC‡
019 Cranial and Peripheral Nerve Disorders without CC‡
113 Amputation for Circulatory System Disorders Except Upper Limb and Toe
114 Upper Limb and Toe Amputation for Circulatory System Disorders
130 Peripheral Vascular Disorders with CC‡
131 Peripheral Vascular Disorders without CC‡
285 Amputation of Lower Limb for Endocrine, Nutritional and Metabolic Disorders
294 Diabetes, Age Greater than 35
295 Diabetes, Age 0 – 35
331 Other Kidney and Urinary Tract Diagnoses, Age Greater than 17 with CC‡
332 Other Kidney and Urinary Tract Diagnoses, Age Greater than 17 without CC‡

Hysterectomy (abdominal and vaginal) cases are restricted to the following DRGs:

353 Pelvic Evisceration, Radical Hysterectomy and Radical Vulvectomy
354 Uterine and Adnexa Procedures for Nonovarian/Adnexal Malignancy with CC‡
355 Uterine and Adnexa Procedures for Nonovarian/Adnexal Malignancy without CC‡
357 Uterine and Adnexa Procedures for Ovarian or Adnexal Malignancy
358 Uterine and Adnexa Procedures for Nonmalignancy with CC‡
359 Uterine and Adnexa Procedures for Nonmalignancy without CC‡

Prostatectomy cases are restricted to the following DRGs:

306 Prostatectomy with CC‡
307 Prostatectomy without CC‡
334 Major Male Pelvic Procedures with CC‡
335 Major Male Pelvic Procedures without CC‡
338 Testes Procedures for Malignancy
339 Testes Procedures for Nonmalignancy, Age Greater than 17
341 Penis Procedures

‡CC: Complication(s) and/or Comorbidity(s)

Statewide In-Hospital Complications for Hysterectomy

Total Abdominal Cases†				***Total Vaginal Cases†***			
Complication Type	**#**	**%**	**Avg. LOS**	**Complication Type**	**#**	**%**	**Avg. LOS**
• Procedure/Medical Care Related Events	526	3.9	3.9	• Procedure/Medical Care Related Events	186	3.1	2.6
• Postoperative Hemorrhage	283	2.1	4.2	• Postoperative Hemorrhage	121	2.0	3.3
• Postoperative Pulmonary Compromise	253	1.9	4.1	• Postoperative Pulmonary Compromise	54	0.9	3.1
• Digestive System Complications	251	1.8	5.8	• Digestive System Complications	44	0.7	2.8
• Postoperative Infection	109	0.8	6.6	• Postoperative Infection	21	0.3	5.4
• Postoperative Pneumonia	52	0.4	6.3	• Postoperative Cardiac Complications	15	0.2	1.9
• Hypo/Hypertension	37	0.3	3.3	• Hypo/Hypertension	14	0.2	2.9
• Postoperative Cardiac Complications	27	0.2	3.4	• Postoperative Pneumonia	13	0.2	6.4
• Postoperative Venous Thrombosis/Pulmonary Embolism	25	0.2	7.9	• Postoperative Stroke/Anoxic Brain Damage	7	0.1	3.6
• Device, Implant or Graft Complications	5	<0.1	5.8	• Postoperative Venous Thrombosis/Pulmonary Embolism	3	<0.1	9.3
• Postoperative Stroke/Anoxic Brain Damage	4	<0.1	4.8	• Device, Implant or Graft Complications	3	<0.1	2.0
• Gastric/Intestinal Hemorrhage or Ulceration	1	<0.1	5.0	• Death	1	<0.1	1.0
• Death	0	0.0	.	• Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA
Any Complication Above	***1,346***	***9.9***	***4.2***	***Any Complication Above***	***430***	***7.1***	***2.8***
Without Any Complication Above	***12,316***	***90.1***	***2.6***	***Without Any Complication Above***	***5,617***	***92.9***	***1.7***

Statewide In-Hospital Complications for Breast Cancer Procedures

Total Lumpectomy Cases†				***Total Mastectomy Cases†***			
Complication Type	**#**	**%**	**Avg. LOS**		**#**	**%**	**Avg. LOS**
• Postoperative Hemorrhage	7	1.1	3.7	• Postoperative Hemorrhage	30	1.5	4.7
• Procedure/Medical Care Related Events	3	0.5	1.7	• Procedure/Medical Care Related Events	27	1.3	4.5
• Postoperative Infection	2	0.3	4.0	• Digestive System Complications	13	0.6	2.8
• Postoperative Pneumonia	2	0.3	10.0	• Postoperative Pulmonary Compromise	13	0.6	4.1
• Postoperative Cardiac Complications	2	0.3	3.5	• Device, Implant or Graft Complications	10	0.5	6.5
• Postoperative Venous Thrombosis/Pulmonary Embolism	2	0.3	12.0	• Postoperative Cardiac Complications	9	0.4	3.6
• Device, Implant or Graft Complications	2	0.3	3.0	• Postoperative Venous Thrombosis/Pulmonary Embolism	7	0.3	6.1
• Digestive System Complications	1	0.2	1.0	• Postoperative Infection	5	0.2	4.4
• Postoperative Pulmonary Compromise	1	0.2	1.0	• Hypo/Hypertension	5	0.2	3.4
• Hypo/Hypertension	0	0.0	NA	• Postoperative Pneumonia	3	0.1	3.0
• Postoperative Stroke/Anoxic Brain Damage	0	0.0	NA	• Postoperative Stroke/Anoxic Brain Damage	0	0.0	NA
• Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA	• Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA
• Death	0	0.0	NA	• Death	0	0.0	NA
• Lymphedema	0	0.0	NA	• Lymphedema	0	0.0	NA
Any Complication Above	***21***	***3.4***	***4.4***	***Any Complication Above***	***110***	***5.4***	***4.3***
Without Any Complication Above	***603***	***96.6***	***1.2***	***Without Any Complication Above***	***1,945***	***94.6***	***2.3***

†The term "cases" refers to hospitalizations after exclusions.
NA: Not Applicable

Statewide In-Hospital Complications for Neck and Back Procedures

Total Cases† With Fusion				*Total Cases† Without Fusion*			
Complication Type	**#**	**%**	**Avg. LOS**	**Complication Type**	**#**	**%**	**Avg. LOS**
▪ Procedure/Medical Care Related Events	148	2.3	5.8	▪ Procedure/Medical Care Related Events	292	2.9	3.2
▪ Postoperative Pulmonary Compromise	74	1.2	8.3	▪ Postoperative Stroke/Anoxic Brain Damage	61	0.6	4.0
▪ Digestive System Complications	70	1.1	5.4	▪ Digestive System Complications	39	0.4	4.3
▪ Postoperative Hemorrhage	43	0.7	6.9	▪ Postoperative Pulmonary Compromise	33	0.3	5.0
▪ Postoperative Stroke/Anoxic Brain Damage	26	0.4	6.1	▪ Postoperative Hemorrhage	26	0.3	5.0
▪ Device, Implant or Graft Complications	26	0.4	5.3	▪ Postoperative Cardiac Complications	12	0.1	3.8
▪ Postoperative Cardiac Complications	25	0.4	5.0	▪ Hypo/Hypertension	12	0.1	2.8
▪ Postoperative Pneumonia	17	0.3	11.2	▪ Device, Implant or Graft Complications	11	0.1	2.4
▪ Hypo/Hypertension	14	0.2	5.0	▪ Postoperative Venous Thrombosis/Pulmonary Embolism	10	0.1	7.8
▪ Postoperative Infection	13	0.2	17.8	▪ Postoperative Infection	8	0.1	11.0
▪ Postoperative Venous Thrombosis/Pulmonary Embolism	9	0.1	8.3	▪ Postoperative Pneumonia	8	0.1	7.9
▪ Gastric/Intestinal Hemorrhage or Ulceration	4	0.1	10.8	▪ Gastric/Intestinal Hemorrhage or Ulceration	2	<0.1	2.0
▪ Death	1	<0.1	11.0	▪ Death	2	<0.1	5.5
Any Complication Above	***402***	***6.3***	***5.7***	***Any Complication Above***	***469***	***4.7***	***3.6***
Without Any Complication Above	***5,935***	***93.7***	***2.2***	***Without Any Complication Above***	***9,492***	***95.3***	***1.7***

Statewide In-Hospital Complications for Prostatectomy

Total Cases†			
Complication Type	**#**	**%**	**Avg. LOS**
▪ Procedure/Medical Care Related Events	54	2.7	4.1
▪ Digestive System Complications	50	2.5	6.4
▪ Postoperative Hemorrhage	30	1.5	6.6
▪ Postoperative Pulmonary Compromise	27	1.3	5.4
▪ Postoperative Venous Thrombosis/Pulmonary Embolism	13	0.6	11.5
▪ Postoperative Cardiac Complications	12	0.6	6.6
▪ Hypo/Hypertension	10	0.5	4.1
▪ Postoperative Pneumonia	7	0.3	6.7
▪ Device, Implant or Graft Complications	4	0.2	4.0
▪ Postoperative Infection	2	0.1	19.0
▪ Gastric/Intestinal Hemorrhage or Ulceration	1	<0.1	7.0
▪ Death	1	<0.1	17.0
▪ Postoperative Stroke/Anoxic Brain Damage	0	0.0	NA
Any Complication Above	***179***	***8.9***	***5.2***
Without Any Complication Above	***1,843***	***91.1***	***2.9***

†The term "cases" refers to hospitalizations after exclusions.
NA: Not Applicable

Definition of In-Hospital Complications for Surgical Procedures

The following ICD-9-CM codes were used to define in-hospital complications for Hysterectomy (Abdominal and Vaginal), Breast Cancer Procedures (Lumpectomy and Mastectomy), Neck and Back Procedures (With Fusion and Without Fusion) and Prostatectomy. Exceptions are noted.

Procedure/Medical Care Related Events *The following codes were analyzed for all surgical procedures.*

995.4	998.2	998.32	998.7	998.9	999.7
995.86		998.4	998.83	999.2	999.8
995.89	998.31	998.6	998.89	999.6	999.9
998.0					

Digestive System Complications *The following code was analyzed for all surgical procedures.*

997.4

Postoperative Pulmonary Compromise *The following codes were analyzed for all surgical procedures.*

31.1 (Procedure)	512.1	518.4	518.6	518.82	997.3
31.21 (Procedure)	514	518.5	518.81	518.84	998.81
31.29 (Procedure)					

Lymphedema *The following code was analyzed for Breast Cancer Procedures only.*

457.0

Postoperative Hemorrhage *The following codes were analyzed for all surgical procedures.*

39.98 (Procedure)	57.93 (Procedure)	998.11	998.12	998.13

Postoperative Infection

The following codes were analyzed for all surgical procedures.

038.0	038.2	038.42	038.8	995.92	996.64
038.10	038.3	038.43	038.9	995.93	998.51
038.11	038.40	038.44	995.90	995.94	998.59
038.19	038.41	038.49	995.91	996.62	999.3

The following code was analyzed for Hysterectomy, Breast Cancer Procedures, and Prostatectomy only.

996.60

The following code was analyzed for Hysterectomy and Prostatectomy only.

996.65

The following code was analyzed for Breast Cancer Procedures only.

996.69

The following codes were analyzed for Neck and Back Procedures only.

996.63	996.66	996.67

Postoperative Pneumonia *Coded by causative organism. The following codes were analyzed for all surgical procedures.*

481	482.30	482.40	482.82	482.9	485
482.0	482.31	482.41	482.83	483.0	486
482.1	482.32	482.49	482.84	483.1	
482.2	482.39	482.81	482.89	483.8	

Postoperative Cardiac Complications *The following codes were analyzed for all surgical procedures.*

410.01	410.21	410.41	410.61	410.81	997.1
410.11	410.31	410.51	410.71	410.91	

Postoperative Venous and Arterial Thrombosis/Pulmonary Embolism *The following codes were analyzed for all surgical procedures.*

415.11	451.11	451.81	997.2	997.72	999.1
415.19	451.19	453.8	997.71	997.79	

Hypotension/Hypertension *The following codes were analyzed for all surgical procedures.*

458.2*	458.29**	997.91

Postoperative Stroke/Anoxic Brain Damage *The following codes were analyzed for all surgical procedures.*

348.1	432.1	433.21	433.91	434.91	997.01
430	432.9	433.31	434.01	436	997.02
431	433.01	433.81	434.11	997.00	997.09
432.0	433.11				

Device, Implant, or Graft Complications

The following codes were analyzed for all surgical procedures.

996.31	996.74

The following codes were analyzed for Hysterectomy and Prostatectomy only.

996.30	996.39	996.76

The following code was analyzed for Breast Cancer Procedures and Neck and Back Procedures only.

996.52

The following codes were analyzed for Breast Cancer Procedures only.

996.54	996.55	996.70	996.79

The following codes were analyzed for Neck and Back Procedures only.

996.4	996.75	996.77	996.78

Gastric/Intestinal Hemorrhage or Ulceration

The following codes were analyzed for all surgical procedures.

531.00	531.41	532.20	533.01	533.60	534.21
531.01	531.60	532.21	533.10	533.61	534.40
531.10	531.61	532.40	533.11	534.00	534.41
531.11	532.00	532.41	533.20	534.01	534.60
531.20	532.01	532.60	533.21	534.10	534.61
531.21	532.10	532.61	533.40	534.11	537.84
531.40	532.11	533.00	533.41	534.20	578.9

The following code was analyzed for Hysterectomy and Prostatectomy only.

49.95 (Procedure)

Death Discharge Status Code 20 was included as a complication for all surgical procedures.

*Invalid Q4, 2003
**Valid Q4, 2003

Pediatric Ear, Nose and Throat Infections

Cases age 0 through 17

Hospitalization Rate	**HMO Inpatient Cases* (N = 701)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	424	60.5
5 –17 years	277	39.5
• Sex		
Female	302	43.1
Male	399	56.9

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Adult Ear, Nose and Throat Infections

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 533)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	352	66.0
45 – 64 years	181	34.0
• Sex		
Female	304	57.0
Male	229	43.0

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

High Blood Pressure (Hypertension)

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 569)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	156	27.4
45 – 64 years	413	72.6
• Sex		
Female	313	55.0
Male	256	45.0

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Gastrointestinal Infections

Cases age 0 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,166)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	136	11.7
5 – 17 years	150	12.9
18 – 44 years	453	38.9
45 – 64 years	427	36.6
• Sex		
Female	710	60.9
Male	456	39.1

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Kidney/Urinary Tract Infections

Cases age 0 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,449)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	158	10.9
5 – 17 years	187	12.9
18 – 44 years	548	37.8
45 – 64 years	556	38.4
• Sex		
Female	1,145	79.0
Male	304	21.0

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Chronic Obstructive Pulmonary Disease

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,150)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	71	6.2
45 – 64 years	1,079	93.8
• Sex		
Female	658	57.2
Male	492	42.8
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,728)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* MQPredLOS			
0 – 3.704 days	345	20.0	3.2
3.705 – 4.121 days	346	20.0	3.4
4.122 – 4.574 days	346	20.0	3.8
4.575 – 5.239 days	346	20.0	3.9
5.240 + days	345	20.0	5.0
• Median Household Income			
$ 0 – 29,989	338	19.6	3.5
$ 29,990 – 34,829	355	20.5	3.8
$ 34,830 – 39,940	351	20.3	3.9
$ 39,941 – 47,920	339	19.6	4.0
$ 47,921 +	345	20.0	4.0
• Female			
No	750	43.4	3.6
Yes	978	56.6	4.1
• Age			
0 – 50	308	17.8	3.6
51 – 55	348	20.1	3.6
56 – 59	410	23.7	3.8
60 – 62	396	22.9	4.1
63 +	266	15.4	4.1
• Psychological Disorder			
No	1,377	79.7	3.7
Yes	351	20.3	4.3
**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

Rehospitalizations (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,696)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes™* MQPredDeath			
0 – 0.002	241	14.2	16.2%
0.003 – 0.003	271	16.0	18.1%
0.004 – 0.006	599	35.3	19.5%
0.007 – 0.010	292	17.2	21.6%
0.011 +	293	17.3	34.5%
• Psychological Disorder			
No	1,351	79.7	20.3%
Yes	345	20.3	27.5%
• Poverty Rate			
0 - 5.3565%	350	20.6	20.3%
5.3566 - 8.1500%	318	18.8	20.4%
8.1501 - 10.8093%	350	20.6	22.3%
10.8094 - 15.1123%	336	19.8	22.3%
15.1124% +	342	20.2	23.4%
**Cases after rehospitalization exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

Chronic Obstructive Pulmonary Disease *continued*

LOS	***Rehosp***	***Significant Risk Factors Used for Length of Stay and Rehospitalizations***
✓		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓		• *Atlas Outcomes*™ Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
✓		• Female (no, yes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• High Poverty (high, average, very high; based on zip code)
✓		• Median Household Income (based on zip code)
	✓	• Poverty Rate (based on zip code)
	✓	• Predicted Death (logit of *Atlas Outcomes*™ Predicted Probability of Death [MQPredDeath])
✓	✓	• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Pediatric Asthma

Cases age 0 through 17

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,597)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	732	45.8
5 – 17 years	865	54.2
• Sex		
Female	609	38.1
Male	988	61.9
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,007)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Age			
0 – 1 year	293	14.6	1.9
2 – 3 years	457	22.8	1.7
4 – 6 years	565	28.2	1.9
7 – 11 years	356	17.7	2.2
12 – 17 years	336	16.7	2.4
• *Atlas Outcomes™* PredLOS			
0 – 2.004 days	192	9.6	1.8
2.005 – 2.079 days	1,098	54.7	1.9
2.080 – 2.393 days	318	15.8	2.1
2.394 +	399	19.9	2.4
• Asthmaticus			
No	226	11.3	1.7
Yes	1,781	88.7	2.0
• Female			
No	1,257	62.6	1.9
Yes	750	37.4	2.1
**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

LOS	***Significant Risk Factors Used for Length of Stay***
✓	• Age
	• Age-Squared
✓	• Asthma with Status Asthmaticus/Acute Exacerbation (no, yes: 493.01, 493.02, 493.11, 493.12, 493.21, 493.22, 493.91, 493.92)
✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
✓	• Female (no, yes)
	• Median Household Income (based on zip code)
	• Poverty Rate (based on zip code)
	• Race (Black, Other, White)

Adult Asthma

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 2,268)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	1,028	45.3
45 – 64 years	1,240	54.7
• Sex		
Female	1,707	75.3
Male	561	24.7
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Adult Asthma *continued*

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 3,052)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.715 days	610	20.0	2.4
2.716 – 3.170 days	610	20.0	2.9
3.171 – 3.640 days	613	20.1	3.2
3.641 – 4.199 days	609	20.0	3.7
4.200 + days	610	20.0	4.2
• Chronic Obstructive Asthma			
No	2,318	76.0	3.1
Yes	734	24.0	4.0
• Psychological Disorder			
No	2,506	82.1	3.2
Yes	546	17.9	3.7
• Asthma with Status Asthmaticus/Acute Exacerbation			
No	412	13.5	3.0
Yes	2,640	86.5	3.3
• *Diabetes*			
No	2,612	85.6	3.2
Yes	440	14.4	4.0
**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

Rehospitalizations (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,974)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes™* PredLOS			
0 - 2.726 days	594	20.0	10.8
2.727 - 3.176 days	595	20.0	11.1
3.177 - 3.650 days	598	20.1	12.4
3.651 - 4.199 days	593	19.9	12.5
4.200 + days	594	20.0	20.5
• Chronic Obstructive Asthma			
No	2,257	75.9	11.8
Yes	717	24.1	18.7
• Poverty Rate			
0 - 5.2768%	595	20.0	10.8
5.2769 - 8.2715%	599	20.1	13.4
8.2716 - 11.2262%	591	19.9	14.9
11.2263 - 17.0105%	589	19.8	12.2
17.0106% +	600	20.2	16.0
• Asthma with Status Asthmaticus/Acute Exacerbation			
No	404	13.6	8.4
Yes	2,570	86.4	14.2
• Psychological Disorder			
No	2,433	81.8	12.6
Yes	541	18.2	17.4
• Age			
17 – 35	593	19.9	10.1
36 – 42	527	17.7	13.9
43 – 50	710	23.9	13.7
51 – 56	568	19.1	14.4
57 +	576	19.4	15.3
**Cases after rehospitalization exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

LOS	***Rehosp***	***Significant Risk Factors Used for Length of Stay and Rehospitalizations***
	✓	• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
✓	✓	• Asthma with Status Asthmaticus/Acute Exacerbation (no, yes: 493.01, 493.02, 493.11, 493.12, 493.21, 493.22, 493.91, 493.92)
✓	✓	• Chronic Obstructive Asthma (no, yes: 493.20-493.22)
✓		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Female (no, yes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• Median Household Income (based on zip code)
	✓	• Poverty Rate (based on zip code)
■		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✓	✓	• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Diabetes

Cases age 18 through 75

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,425)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 25 years	124	8.7
26 – 35 years	164	11.5
36 – 45 years	271	19.1
46 – 55 years	442	31.0
56 – 65 years	376	26.4
66 – 75 years	48	3.4
• Sex		
Female	624	43.8
Male	801	56.2

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,143)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.656 days	428	20.0	2.3
2.657 – 3.363 days	428	20.0	2.5
3.364 – 4.432 days	430	20.1	3.2
4.433 – 6.301 days	429	20.0	4.4
6.302 + days	428	20.0	7.5
• Medical DRG			
No	235	11.0	9.1
Yes	1,908	89.0	3.4
• Heart Failure			
No	2,014	94.0	3.8
Yes	129	6.0	6.6
• Renal Failure			
No	1,905	88.9	3.7
Yes	238	11.1	6.3
• Female			
No	1,193	55.7	4.0
Yes	950	44.3	4.0
• Diabetic Complications			
Long Term	938	43.8	5.2
None	114	5.3	2.4
Short Term	1,091	50.9	3.1

**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*

Diabetes *continued*

Rehospitalizations (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,074)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes™* PredLOS			
0 - 2.656 days	414	20.0	8.2
2.657 - 3.363 days	414	20.0	8.9
3.364 - 4.441 days	417	20.1	10.8
4.442 - 6.301 days	416	20.1	15.4
6.302 days +	413	19.9	21.8
• Age			
18 – 35 years	407	19.6	18.2
36 – 45 years	384	18.5	12.2
46 – 53 years	491	23.7	11.8
54 – 59 years	398	19.2	12.1
60 – 75 years	394	19.0	10.9
• Medical DRG			
No	230	11.1	15.7
Yes	1,844	88.9	12.7
• Diabetes Complications			
Long Term	906	43.7	16.3
None	108	5.2	2.8
Short Term	1,060	51.1	11.2
• Renal Failure			
No	1,847	89.1	11.9
Yes	227	10.9	22.5

**Cases after rehospitalization exclusions; comparative reference = HMO and Fee-for-Service combined databases*

LOS	***Rehosp***	***Significant Risk Factors Used for Length of Stay and Rehospitalizations***
	✔	• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✔	✔	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Cardiomyopathy (no, yes: 425.3, 425.4, 425.8, 425.9)
		• COPD (no, yes: 491.20, 491.21, 492.0, 492.8, 496, 506.4, 518.2)
✔	✔	• Diabetes Complications (long-term: 250.4x-250.9x, x=0-3; none: 250.00, 250.01; short-term: 250.02, 250.03, 250.1x-250.3x, x=0-3)
✔		• Female (no, yes)
✔		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Ischemic Heart Disease (no, yes: 411.0, 411.1, 411.81, 411.89, 412, 413.0, 413.1, 413.9, 414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.10, 414.07**, 414.11, 414.12, 414.19, 414.8, 414.9)
		• Lower Extremity Amputation—non-traumatic (no, yes: procedure codes 84.10-84.17; exclude diagnosis codes 895.x, x=0,1; 896.x, x=0-3; 897.x, x=0-7)
		• Malignant Cancer (no, yes: 140.0-208.9, 230.0-239.9)
		• Median Household Income (based on zip code)
✔	✔	• Medical DRG (no, yes)
		• Obesity (no, yes: 278.00, 278.01)
		• Peripheral Vascular Disease (no, yes: 443.0, 443.1, 443.81, 443.89, 443.9)
		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Dialysis (no, yes: V45.1, V56.0, V56.8; procedure codes 39.95, 54.98)
✔	✔	• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

**valid Q4, 2003

Heart Attack (AMI)

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 3,131)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	395	12.6
45 – 64 years	2,736	87.4
• Sex		
Female	767	24.5
Male	2,364	75.5

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Number of Days Hospitalized (AvgDays)	**Statewide Inpatient Cases* (N = 11,251)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. # Days Hospitalized*
• *Atlas Outcomes™* PredLOS			
0 – 2.815 days	2,248	20.0	4.3
2.816 – 3.671 days	2,250	20.0	5.2
3.672 – 4.554 days	2,253	20.0	5.7
4.555 – 5.975 days	2,250	20.0	6.7
5.976 + days	2,250	20.0	9.8
• Heart Failure			
No	9,608	85.4	5.6
Yes	1,643	14.6	10.5
• Renal Failure			
No	10,670	94.8	6.1
Yes	581	5.2	11.3
• Age			
18 – 46	1,988	17.7	5.0
47 – 52	2,465	21.9	5.8
53 – 57	2,789	24.8	6.3
58 – 61	2,320	20.6	7.2
62 +	1,689	15.0	7.6
• Poverty Rate			
0 – 4.9038%	2,236	19.9	5.9
4.9039 – 7.7658%	2,285	20.3	6.2
7.7659 – 10.6181%	2,240	19.9	6.5
10.6182 – 15.4406%	2,231	19.8	6.5
15.4407% +	2,259	20.1	6.7
• AMI Type II (Anterior)			
No	9,311	82.8	6.3
Yes	1,940	17.2	6.8

**Cases after Number of Days hospitalized exclusions; comparative reference = Statewide database*

Heart Attack (AMI) *continued*

In-Hospital Mortality (Mort)	**Statewide Inpatient Cases* (N = 11,678)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Mortality*
• Predicted Death (Logit of MQPredDeath)			
0 – 0.005	1,914	16.4	0.3
0.006 – 0.008	2,445	20.9	0.4
0.009 – 0.014	2,886	24.7	0.4
0.015 – 0.025	2,106	18.0	1.7
0.026 +	2,327	19.9	11.0
• Renal Failure			
No	10,958	93.8	1.9
Yes	720	6.2	14.7
• AMI Type I (Q-wave)			
No	5,412	46.3	1.7
Yes	6,266	53.7	3.6
• Renal Dialysis			
No	11,483	98.3	2.5
Yes	195	1.7	15.9
• Median Household Income			
$0 - 30,539	2,362	20.2	3.3
$30,540 - 35,309	2,305	19.7	2.6
$35,310 - 41,030	2,340	20.0	3.3
$41,031 - 50,100	2,364	20.2	2.6
$50,101 +	2,307	19.8	1.7
**Cases after in-hospital mortality exclusions; comparative reference = Statewide database*			

AvgDays	***Mort***	***Significant Risk Factors Used for Average Number of Days and In-Hospital Mortality***
✓		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
	✓	• AMI Type I (Q-wave) (no, yes: 410.x1, x = 0-6, 8-9)
✓		• AMI Type II (Anterior) (no, yes: 410.01, 410.11)
✓		• *Atlas Outcomes*™ Predicted Length of Stay (MQPredLOS)
		• Cardiomyopathy (no, yes: 425.3, 425.4, 425.8, 425.9)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Female (no, yes)
✓		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of CABG (no, yes: V45.81, 414.02, 414.03, 414.04, 414.05, 996.03)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
	✓	• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
	✓	• Predicted Death (logit of *Atlas Outcomes*™ Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
	✓	• Renal Dialysis (no, yes: V45.1, V56.0, V56.8; procedure codes 39.95, 54.98)
✓	✓	• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Hysterectomy (Abdominal and Vaginal)

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 7,666)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	3,796	49.5
45 – 64 years	3,870	50.5
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Hysterectomy – Abdominal

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 5,300)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	2,590	48.9
45 – 64 years	2,710	51.1
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 13,654)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.603 days	2,707	19.8	2.6
2.604 – 2.710 days	2,750	20.1	2.5
2.711 – 2.867 days	2,756	20.2	2.7
2.868 – 3.100 days	2,715	19.9	2.7
3.101 + days	2,726	20.0	3.3
• Poverty Rate			
0 – 4.8347%	2,710	19.8	2.7
4.8348 – 7.6423%	2,757	20.2	2.7
7.6424 – 10.5245%	2,726	20.0	2.7
10.5246 – 15.2562%	2,733	20.0	2.7
15.2563% +	2,728	20.0	3.0
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 13,662)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complications*
• *Atlas Outcomes™* PredLOS			
0 – 2.603 days	2,708	19.8	7.2
2.604 – 2.710 days	2,750	20.1	6.2
2.711 – 2.867 days	2,757	20.2	8.1
2.868 – 3.100 days	2,716	19.9	9.3
3.101 + days	2,731	20.0	18.5
• Poverty Rate			
0 – 4.8347%	2,710	19.8	9.3
4.8348 – 7.6423%	2,760	20.2	9.9
7.6424 – 10.5245%	2,728	20.0	9.2
10.5246 – 15.2562%	2,734	20.0	8.0
15.2563% +	2,730	20.0	12.9
**Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

Hysterectomy – Abdominal *continued*

LOS	*Compl*	*Significant Risk Factors Used for Length of Stay and In-Hospital Complications*
		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Female Reproductive Cancer (no, yes: V10.40-V10.44)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
✓	✓	• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Principal Diagnosis Group (fibroids/hyperplasia/endometriosis/uterine prolapse: 218.x, x=0-9; 621.2; 621.3; 617.x, x=0-9; 618.1-618.4; bleeding abnormalities and other principal diagnoses: 626.2-626.9, 627.0, 627.1)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Radical Hysterectomy (no, yes: 68.6, 68.7)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)

Hysterectomy – Vaginal

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 2,366)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	1,206	51.0
45 – 64 years	1,160	49.0
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 6,042)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 1.716 days	1,154	19.1	1.5
1.717 – 1.844 days	1,242	20.6	1.7
1.845 – 1.968 days	1,234	20.4	1.7
1.969 – 2.181 days	1,204	19.9	1.8
2.182 + days	1,208	20.0	2.0
• Laparoscopic Procedure			
No	4,174	69.1	1.8
Yes	1,868	30.9	1.6
• Age			
18 – 36 years	1,015	16.8	1.6
37 – 41 years	1,193	19.7	1.7
42 – 46 years	1,491	24.7	1.7
47 – 52 years	1,276	21.1	1.8
53 – 64 years	1,067	17.7	2.0
• Poverty Rate			
0 – 4.9079%	1,207	20.0	1.8
4.9080 – 7.5381%	1,211	20.0	1.7
7.5382 – 10.2236%	1,211	20.0	1.7
10.2237 – 13.9488%	1,206	20.0	1.7
13.9489% +	1,207	20.0	1.9
• Principal Diagnosis Group			
Bleeding/Other	2,370	39.2	1.7
Fibroids/Hyperplasia/Endometriosis/ Uterine Prolapse	3,672	60.8	1.8
**Cases after LOS exclusions; comparative reference = Statewide database*			

Hysterectomy – Vaginal *continued*

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 6,047)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complications*
• *Atlas Outcomes™* PredLOS			
0 – 1.716 days	1,155	19.1	4.1
1.717 – 1.844 days	1,243	20.6	4.6
1.845 – 1.968 days	1,235	20.4	5.3
1.969 – 2.182 days	1,207	20.0	5.6
2.183 + days	1,207	20.0	16.0
• Age			
18 – 36 years	1,017	16.8	7.2
37 – 41 years	1,194	19.7	7.4
42 – 46 years	1,491	24.7	6.7
47 – 52 years	1,277	21.1	6.9
53 – 64 years	1,068	17.7	7.6
• Laparoscopic Procedure			
No	4,176	69.1	7.5
Yes	1,871	30.9	6.3
**Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
✔	✔	• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✔	✔	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Female Reproductive Cancer (no, yes: V10.40-V10.44)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
✔	✔	• Laparoscopic Procedure (no, yes: 68.51)
		• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
✔		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✔		• Principal Diagnosis Group (fibroids/hyperplasia/endometriosis/uterine prolapse: 218.x, x=0-9; 621.2; 621.3; 617.x, x=0-9; 618.1-618.4; bleeding abnormalities and other principal diagnoses: 626.2-626.9, 627.0, 627.1)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)

Breast Cancer Procedures (Lumpectomy and Mastectomy)

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 2,498)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	533	21.3
45 – 64 years	1,965	78.7
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Breast Cancer Procedures – Lumpectomy

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 617)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 1.679 days	195	31.6	1.1
1.680 – 1.798 days	196	31.8	1.1
1.799 – 1.982 days	103	16.7	1.1
1.983 + days	123	19.9	1.4
• Poverty Rate			
0 – 3.8525%	124	20.1	1.0
3.8526 – 6.4881%	123	19.9	1.1
6.4882 – 10.2333%	123	19.9	1.2
10.2334 – 16.8607%	124	20.1	1.2
16.8608% +	123	19.9	1.3
• Obesity			
No	590	95.6	1.1
Yes	27	4.4	1.5
• Breast Cancer Type			
In Situ	22	3.6	1.6
Malignant Neoplasm	356	57.7	1.1
Metastatic Cancer	239	38.7	1.2
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 624)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• *Atlas Outcomes™* PredLOS			
1.576 – 1.679 days	196	31.4	3.1
1.680 – 1.798 days	196	31.4	2.0
1.799 – 2.028 days	108	17.3	0.9
2.029 + days	124	19.9	8.1
• Obesity			
No	597	95.7	2.8
Yes	27	4.3	14.8
• Hypertension			
No	487	78.0	2.5
Yes	137	22.0	6.6
** Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
		• Age
		• Age-Squared
		• Alcohol & Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
✓		• Breast Cancer Type (malignant: 174.0-174.9, 238.3, 239.3; in situ: 233.0; metastatic: 196.3, 198.2, 198.81)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Family History of Breast Cancer (no, yes: V16.3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Breast Cancer (no, yes: V10.3)
	✓	• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
✓	✓	• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Reconstruction–Concurrent (no, yes: procedure codes 85.50-85.54, 85.7, 85.82-85.87, 85.93, 85.96)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Subtotal Mastectomy (no, yes: procedure codes 85.23, CPT 19160, CPT 19162)

Breast Cancer Procedures – Mastectomy

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 2,055)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Reconstruction–Concurrent			
No	1,526	74.3	1.9
Yes	529	25.7	3.7
• *Atlas Outcomes™* PredLOS			
1.576 – 1.712 days	788	38.3	2.3
1.713 – 1.816 days	461	22.4	2.2
1.817 – 2.122 days	401	19.5	2.3
2.123 + days	405	19.7	2.6
• Diabetes			
No	1,923	93.6	2.3
Yes	132	6.4	2.6
• Procedure Group - Radical			
No	2,001	97.4	2.3
Yes	54	2.6	2.9
• Breast Cancer Type			
In Situ	331	16.1	2.3
Malignant Neoplasm	1,098	53.4	2.4
Metastatic Cancer	626	30.5	2.3
• Poverty Rate			
0 – 3.8445%	411	20.0	2.5
3.8446 – 5.9152%	411	20.0	2.3
5.9153 – 9.5579%	410	20.0	2.3
9.5580 – 14.3027%	410	20.0	2.2
14.3028% +	413	20.1	2.5
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 2,055)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• Reconstruction–Concurrent			
No	1,526	74.3	4.2
Yes	529	25.7	8.7
• Diabetes			
No	1,923	93.6	5.0
Yes	132	6.4	9.8
• Obesity			
No	2,009	97.8	5.2
Yes	46	2.2	13.0
** Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-hospital Complications***
		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓		• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
✓		• Breast Cancer Type (malignant: 174.0-174.9, 238.3, 239.3; in situ: 233.0; metastatic: 196.3, 198.2, 198.81)
✓	✓	• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Family History of Breast Cancer (no, yes: V16.3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Breast Cancer (no, yes: V10.3)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
	✓	• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✓		• Procedure Group (simple mastectomy: procedure codes 85.41-85.44, CPT19180; radical mastectomy: procedure codes 85.45-85.48, CPT 19200, CPT 19220, CPT 19240)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
✓	✓	• Reconstruction–Concurrent (no, yes: procedure codes 85.50-85.54, 85.7, 85.82-85.87, 85.93, 85.96)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)

Neck and Back Procedures (With Fusion and Without Fusion)

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 5,118)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	2,078	40.6
45 – 64 years	3,040	59.4
• Sex		
Female	2,461	48.1
Male	2,657	51.9
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Neck and Back Procedures With Fusion

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 6,313)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Fusion Location			
Cervical/Atlas-Axis	4,341	68.8	1.6
Dorsal and Dorsolumbar	46	0.7	4.7
Lumbar and Lumbosacral	1,926	30.5	3.9
• *Atlas Outcomes™* PredLOS			
0 – 1.591 days	1,009	16.0	1.5
1.592 – 1.902 days	1,512	24.0	1.7
1.903 – 2.446 days	1,269	20.1	2.1
2.447 – 3.034 days	1,261	20.0	2.7
3.035 + days	1,262	20.0	3.6
• Principal Diagnosis Group			
Disc Degeneration	627	9.9	3.2
Disc Displacement	3,336	52.8	1.8
Narrowing of the Spinal Canal	1,767	28.0	2.8
Other Disc Disorders/Back Pain	583	9.2	2.6
• Fusion Technique			
Anterior	3,801	60.2	1.7
Multiple	1,345	21.3	2.9
Posterior/Lateral	1,167	18.5	3.7
• Poverty Rate			
0 – 4.5291%	1,272	20.1	2.3
4.5292 – 7.2657%	1,255	19.9	2.2
7.2658 – 10.0144%	1,260	20.0	2.2
10.0145 – 13.6333%	1,269	20.1	2.3
13.6334% +	1,257	19.9	2.5
• Procedure Group			
Both Discectomy and Laminectomy	150	2.4	3.7
Discectomy	5,711	90.5	2.2
Laminectomy	452	7.2	3.7
• Alcohol/Drug Abuse			
No	6,249	99.0	2.3
Yes	64	1.0	3.4
• Obesity			
No	6,039	95.7	2.3
Yes	274	4.3	3.0
• Age			
18 – 38	1,149	18.2	2.2
39 – 43	1,195	18.9	2.1
44 – 49	1,511	23.9	2.2
50 – 55	1,275	20.2	2.3
56 +	1,183	18.7	2.8
• Diabetes			
No	5,812	92.1	2.3
Yes	501	7.9	2.8
**Cases after LOS exclusions; comparative reference = Statewide database*			

Neck and Back Procedures With Fusion *continued*

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 6,337)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• Fusion Location			
Cervical/Atlas-Axis	4,352	68.7	3.0
Dorsal and Dorsolumbar	50	0.8	22.0
Lumbar and Lumbosacral	1,935	30.5	13.4
• *Atlas Outcomes™* PredLOS			
0 – 1.591 days	1,009	15.9	3.1
1.592 – 1.902 days	1,512	23.9	3.4
1.903 – 2.456 days	1,283	20.2	5.8
2.457 – 3.044 days	1,266	20.0	8.1
3.045 + days	1,267	20.0	11.4
• Age			
18 - 38	1,149	18.1	5.0
39 – 43	1,196	18.9	5.4
44 – 49	1,515	23.9	6.3
50 – 55	1,284	20.3	5.5
56 +	1,193	18.8	9.6
• Principal Diagnosis Group			
Disc Degeneration	631	10.0	11.7
Disc Displacement	3,341	52.7	4.1
Narrowing of the Spinal Canal	1,775	28.0	8.8
Other Disc Disorders/Back Pain	590	9.3	6.1
• Procedure Group			
Both Discectomy and Laminectomy	152	2.4	16.4
Discectomy	5,729	90.4	5.5
Laminectomy	456	7.2	13.4
• *Poverty Rate*			
0 – 4.5291%	1,274	20.1	6.2
4.5292 – 7.2722%	1,261	19.9	5.8
7.2723 – 10.0270%	1,268	20.0	5.7
10.0271 – 13.6333%	1,269	20.0	6.4
13.6334% +	1,265	20.0	7.7

** Cases after in-hospital complications exclusions; comparative reference = Statewide database*

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
✓	✓	• Age
		• Age-Squared
✓		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Cancer (malignant/in situ: 140.0-208.9, 230.0-239.9; history: V10.00-V10.9)
		• COPD (no, yes: 491.20, 491.21, 492.0, 492.8, 496, 506.4, 518.2)
✓		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Female (no, yes)
✓	✓	• Fusion Location (cervical/atlas-axis: procedure codes 81.00, 81.01, 81.02, 81.03; dorsal and dorsolumbar: procedure codes 81.04, 81.05; lumbar and lumbosacral: procedure codes 81.06, 81.07, 81.08)
✓		• Fusion Technique (anterior: procedure codes 81.00, 81.01, 81.02, 81.04, 81.06; posterior/lateral: procedure codes 81.03, 81.05, 81.07, 81.08; multiple: procedure code 81.61, 81.62**, 81.63**, 81.64**, 2 or more procedure codes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
		• Musculoskeletal Disorders (no, yes: 274.x, x=0-9; 710.0x, x=0-9; 712.x, x=0-9; 713.x, x=0-8; 714.x, x=0-9; 715.x x=0-9; 733.0x, x=0-9; V43.6x, x=0-9)
✓		• Obesity (no, yes: 278.00, 278.01)
✓	✓	• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✓	✓	• Principal Diagnoses Group (disc displacement: 722.0, 722.10, 722.11, 722.2; narrowing of spinal canal: 720.0, 721.0-721.42, 721.90, 721.91, 723.0, 724.00-724.09, 738.4, 756.11, 756.12; disc degeneration: 722.4, 722.51, 722.52, 722.6; other disc disorders/back pain: 722.70-722.73, 722.90-722.93, 723.1, 724.1-724.3, 724.5)
✓	✓	• Procedure Group (discectomy: procedure codes 80.50, 80.51, 80.59; laminectomy: procedure codes 03.09; discectomy and laminectomy: procedure codes 80.50, 80.51 or 80.59 and 03.09)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

**Valid Q4, 2003

Neck and Back Procedures Without Fusion

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 9,939)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 1.420 days	1,807	18.2	1.3
1.421 – 1.591 days	1,228	12.4	1.4
1.592 – 1.834 days	2,934	29.5	1.4
1.835 – 2.282 days	1,983	20.0	1.7
2.283 + days	1,987	20.0	2.9
• Principal Diagnosis Group			
Disc Degeneration	143	1.4	2.6
Disc Displacement	7,249	72.9	1.6
Narrowing of Spinal Canal	2,279	22.9	2.1
Other Disc Disorders/Back Pain	268	2.7	2.6
• Poverty Rate			
0 – 4.3938%	1,988	20.0	1.6
4.3939 – 7.1868%	1,988	20.0	1.7
7.1869 – 9.8612%	1,968	19.8	1.8
9.8613 – 13.6131%	1,994	20.1	1.6
13.6132% +	2,001	20.1	1.9
• Female			
No	5,748	57.8	1.6
Yes	4,191	42.2	1.9
• Procedure Group			
Both Discectomy and Laminectomy	560	5.6	2.1
Discectomy	7,069	71.1	1.6
Laminectomy	2,310	23.2	2.1
• Age			
18 – 35 years	1,868	18.8	1.5
36 – 42 years	2,075	20.9	1.6
43 – 49 years	2,179	21.9	1.7
50 – 56 years	1,997	20.1	1.8
57 – 64 years	1,820	18.3	2.1

**Cases after LOS exclusions; comparative reference = Statewide database*

In-Hospital Complications (comp)	**Statewide Inpatient Cases* (N = 9,961)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• Principal Diagnosis Group			
Disc Degeneration	144	1.4	11.8
Disc Displacement	7,257	72.9	3.8
Narrowing of Spinal Canal	2,286	22.9	7.3
Other Disc Disorders/Back Pain	274	2.8	4.7
• *Atlas Outcomes™* PredLOS			
0 – 1.420 days	1,807	18.1	3.3
1.421 – 1.591 days	1,228	12.3	3.6
1.592 – 1.837 days	2,943	29.5	3.7
1.838 – 2.286 days	1,995	20.0	4.9
2.287 + days	1,988	20.0	7.9
• Age			
18 – 35 years	1,872	18.8	3.2
36 – 42 years	2,078	20.9	3.3
43 – 49 years	2,181	21.9	4.8
50 – 56 years	2,005	20.1	5.2
57 – 64 years	1,825	18.3	7.2
• Obesity			
No	9,350	93.9	4.5
Yes	611	6.1	8.2
• Procedure Group			
Both Discectomy and Laminectomy	564	5.7	8.2
Discectomy	7,077	71.0	3.7
Laminectomy	2,320	23.3	6.8
• Median Household Income			
$0 – 31,909	1,993	20.0	5.1
$31,910 – 36,929	1,988	20.0	5.0
$36,930 – 43,840	2,000	20.1	4.7
$43,841 – 52,780	1,989	20.0	5.1
$52,781 +	1,991	20.0	3.7

** Cases after in-hospital complications exclusions; comparative reference = Statewide database*

Neck and Back Procedures Without Fusion *continued*

LOS	*Compl*	*Significant Risk Factors Used for Length of Stay and In-Hospital Complications*
✓	✓	• Age
✓		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes*™ Predicted Length of Stay (MQPredLOS)
		• Cancer (malignant/in situ: 140.0-208.9, 230.0-239.9; history: V10.00-V10.9)
		• COPD (no, yes: 491.20, 491.21, 492.0, 492.8, 496, 506.4, 518.2)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
✓		• Female (no, yes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
	✓	• Median Household Income (based on zip code)
		• Musculoskeletal Disorders (no, yes: 274.x, x=0-9; 710.0x, x=0-9; 712.x, x=0-9; 713.x, x=0-8; 714.x, x=0-9; 715.x x=0-9; 733.0x, x=0-9; V43.6x, x=0-9)
	✓	• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes*™ Predicted Probability of Death [MQPredDeath])
✓	✓	• Principal Diagnoses Group (disc displacement: 722.0, 722.10, 722.11, 722.2; narrowing of spinal canal: 720.0, 721.0-721.42, 721.90, 721.91, 723.0, 724.00-724.09, 738.4, 756.11, 756.12; disc degeneration: 722.4, 722.51, 722.52, 722.6; other disc disorders/back pain: 722.70-722.73, 722.90-722.93, 723.1, 724.1-724.3, 724.5)
✓	✓	• Procedure Group (discectomy: procedure codes 80.50, 80.51, 80.59; laminectomy: procedure code 03.09; discectomy and laminectomy: procedure codes 80.50, 80.51 or 80.59 and 03.09)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Prostatectomy

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 775)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	12	1.5
45 – 64 years	763	98.5
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 2,014)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes*™ PredLOS			
0 –2.954 days	400	19.9	2.9
2.955 – 3.056 days	378	18.8	2.9
3.057 – 3.262 days	433	21.5	3.0
3.263 – 3.641 days	401	19.9	3.0
3.642 + days	402	20.0	3.3
• Hypertension			
No	1,247	61.9	2.9
Yes	767	38.1	3.2
• Median Household Income			
$0 – 32,709	403	20.0	3.2
$32,710 – 38,959	403	20.0	3.0
$38,960 – 47,000	402	20.0	3.1
$47,001 – 56,580	404	20.1	2.9
$56,581 +	402	20.0	2.9
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 2,022)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• *Atlas Outcomes™* PredLOS			
0 –2.954 days	404	20.0	6.7
2.955 – 3.056 days	375	18.5	8.0
3.057 – 3.262 days	444	22.0	9.7
3.263 – 3.641 days	395	19.5	7.6
3.642 + days	404	20.0	12.1
• Age			
18 - 52	362	17.9	5.5
53 - 55	305	15.1	6.6
56 – 59	553	27.3	10.5
60 – 62	508	25.1	8.3
63 +	294	14.5	13.3
• Median Household Income			
$0 – 32,709	406	20.1	10.1
$32,710 – 38,959	403	19.9	7.2
$38,960 – 47,000	404	20.0	10.4
$47,001 – 56,580	406	20.1	10.6
$56,581 +	403	19.9	6.0

** Cases after in-hospital complications exclusions; comparative reference = Statewide database*

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
	✓	• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Family History of Prostate Cancer (no, yes: V16.42)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Prostate Cancer (no, yes: V10.46)
✓		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
✓	✓	• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
		• Other Cancer—Not Prostate (metastatic: 196.0-198.81, 198.89-199.1; primary: 140.0-184.9, 186.0-195.8, 200.0-208.9, 230.0-233.3, 233.5-236.4, 236.6-239.4, 239.6-239.9)
		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)