Measuring The Quality Of Pennsylvania's Commercial HMOs

CALENDAR YEAR 2001

TECHNICAL REPORT

THE PENNSYLVANIA HEALTH CARE COST CONTAINMENT COUNCIL

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TECHNICAL REPORT

MEASURING THE QUALITY OF PENNSYLVANIA'S COMMERCIAL HMOS CALENDAR YEAR 2001

OVERVIEW

This technical supplement accompanies the calendar year 2001 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 fourteen 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 fourteen 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 *acute care* or *specialty acute care* hospital (or received care in an inpatient or ambulatory surgical setting for breast cancer procedures) between January 1, 2001 and December 31, 2001.

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

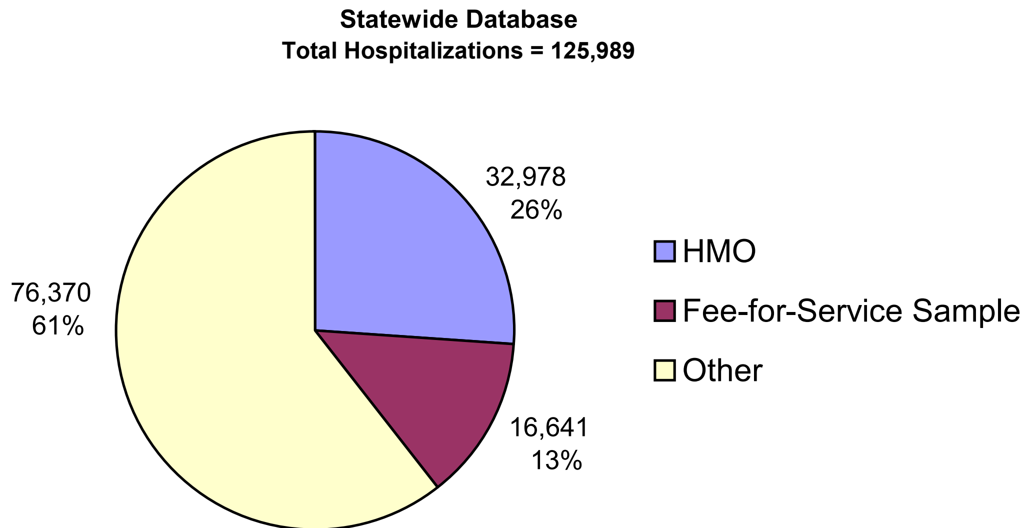
- aggregate hospitalizations for members of all commercial HMOs licensed by the Pennsylvania Department of Health.

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 (members 18 - 64 years)
Percent Rehospitalized—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 Complications	
▪ Hysterectomy ▪ Breast Cancer Procedures ▪ Neck and Back procedures ▪ Prostatectomy	Statewide Hospitalizations (members 18 - 64 years)
In-Hospital Mortality—30 days	
▪ Heart Attack	Statewide Hospitalizations (age 18 - 64 years)

*The Average 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 fourteen 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 the National Association of Insurance Commissioners (NAIC) code in the discharge record. The NAIC code is used by the hospital to identify the primary payor of a patient's care and provides a coded name for the specific HMO. All records that clearly identified an HMO plan as the principal payor by the NAIC code 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. Duplicate and problematic records (e.g., gender discrepancies, unresolvable dates, or invalid social security numbers) were removed prior to forwarding data to the HMO plans for verification.

The verification process presented three options to HMO plans: 1) verify and return a record for inclusion in the analyses, 2) reject and flag those records for which the plan was not the primary payor, or 3) add records that PHC4 did not include in the initial data file. Additions were possible if: 1) the record was based upon correct ICD.9.CM codes, 2) PHC4 was able to match the added record to a hospital discharge record, and 3) no other HMO plan in the statewide database claimed the same record.

Rejection of records by HMOs occurred for 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.

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. According to the NCQA Web site (www.ncqa.org), "NCQA's mission is to provide information that enables purchasers and consumers of managed health care to distinguish among plans based on quality, thereby allowing them to make more informed health care purchasing decisions." 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 *2002 Quality Compass* (2001 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:

<u>Comprehensive Diabetes Care</u> 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 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 HbA1c control (i.e., the most recent HbA1c test level within the calendar year 2001 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*: Hemoglobin A1c (HbA1c) tested (i.e., at least one HbA1c test conducted during the calendar year 2001).
- *Eye Exams Performed for Members with Diabetes*: Eye exam performed (i.e., an eye screening for diabetic retinal disease conducted during the calendar year 2001 or, in certain circumstances, the calendar year 2000).
- *Monitoring Kidney Disease for Members with Diabetes*: Kidney disease monitored (i.e., a microalbuminuria screening performed during the calendar year 2001, 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 (i.e., a low-density lipoprotein cholesterol test conducted during the calendar year 2000 or 2001).
- *"Bad" Cholesterol Controlled for Members with Diabetes*: LDL-C controlled (i.e., the most recent low-density lipoprotein cholesterol test performed during the calendar year 2000 or 2001 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.

<u>Childhood Immunizations</u> is reported as the percent of enrolled children who turned two years old during the calendar year 2001, 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.

<u>Timely Initiation of Prenatal Care</u> is reported as the percent of women who delivered a live birth between November 6th of the calendar year 2000 and November 5th of the calendar year 2001, 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.

<u>Screening for Breast Cancer</u> is reported as the percent of women age 52 through 69 years, who were continuously enrolled during the calendar years 2000 and 2001 and 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 1999, 2000 and 2001, 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, 2001 who were discharged alive during the prior year for AMI, CABG or PTCA/Stent and had evidence of receiving an LDL-C screening 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 are 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 result 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 uses 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 Blocker After a Heart Attack is reported as the percent of commercial HMO members age 35 years and older who were hospitalized and discharged alive from January 1, 2001 through December 31, 2001 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 diagnosed with a new episode of depression 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 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 diagnosed with a new episode of depression who remained on their antidepressant prescription for six months.

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 7 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 CY2001.

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 LOS 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, and 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 13 of the 23 HEDIS measures that were included in this year's managed care report:

Table 2. *Repeat of CY2000 HEDIS Measures in the CY2001 Report, by HMO*

	CIGNA Healthcare of PA	First Priority	Health America	Health Assurance	Health Guard	KHP Central	KHP East	KHP West
Childhood Immunizations		✓	✓	✓			✓	✓
Follow-up after Hospitalization for Mental Illness (7 and 30 days)	✓		✓	✓			✓	✓
Screening for Breast Cancer							✓	✓
Screening for Cervical Cancer		✓			✓			✓
Controlling High Blood Pressure		✓	✓	✓		✓	✓	✓
Timely Initiation of Prenatal Care		✓	✓	✓	✓		✓	✓
Comprehensive Diabetes Care Measures		✓					✓[1]	✓[2]

[1]Eye Exams Only
[2]Except Eye Exams

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 2001 CAHPS scores for 11 Pennsylvania plans (12 lines of business).

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 (PID). 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

Episode Of Care

An episode of care is a string of contiguous acute care inpatient hospitalizations linked by date. The total medical event or episode may be composed of a single acute care hospitalization or several such hospitalizations (e.g., transfers) coupled by date. Single-hospitalization episodes are especially frequent for the preventable hospitalizations (see "Preventing Hospitalization through Primary Care" in this document). For a multiple-hospitalization episode, the discharge date of the preceding hospitalization (in a string of contiguous hospitalizations) must be the same as the admission date of the subsequent hospitalization (independent of discharge status coding).

Index Hospitalizations

For any single HMO member, the index hospitalization is the first hospitalization in the year that meets the study population inclusion criteria. Using COPD as an example, the index hospitalization for an HMO member with COPD would include the first hospitalization in which the principal diagnosis was COPD (see Appendix A for the ICD.9.CM codes used to define COPD). Additional hospitalizations during the year for the same patient would be identified as non-index hospitalizations for COPD.

Procedures Used For Linking Hospitalizations

Identification of a patient's hospitalization history was crucial for: 1) distinguishing unique members, and 2) determining the percent rehospitalized for adult members with asthma, diabetes or COPD. All hospitalizations and episodes in the study period were identified for each patient when possible. Hospitalizations within an episode with a principal diagnosis that was different from the index hospitalization were still considered in creating a patient's hospitalization history. Thus, additional acute care hospitalizations (for an individual patient) occurring after the index hospitalization were retained in the dataset as potential rehospitalization cases.

The patient Social Security Number (SSN), sex, and date of birth, as reported by the hospitals, were used to identify patients across encounters. In the vast majority of instances these values were identical for the same patient. Inconsistencies in essential data elements (e.g., transposed

dates) 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 were assigned to the same patient.

Hospitalizations and Measures

Utilization and clinical information used to evaluate particular measures may have been taken from all or only a portion of the hospitalizations within a multiple-hospitalization episode, depending on the measure and clinical condition being investigated. Accordingly, all hospitalizations (in a multiple-hospitalization episode) or all episodes 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 was the basis of the hospitalization rate, not the number of hospitalizations.

- The percent rehospitalized for diabetes was also derived from the index hospitalization. While the main unit of analysis was the index hospitalization, the last acute care hospitalization in the diabetes episode was used as the reference in order to accurately determine a rehospitalization beginning within six months. It was necessary to use the discharge date of the last hospitalization in the episode as the reference; using only the index hospitalization as the reference would not have portrayed an accurate assessment of the percent rehospitalized across all patients hospitalized for diabetes.

Table 3 lists all the measures reported for each clinical condition in the calendar year 2001 *Measuring the Quality of Pennsylvania's Commercial HMOs* report. Detail is provided regarding the hospitalizations that were used to extract utilization and/or clinical information for each applicable measure in the PHC4-calculated analyses. The events used were different for each measure within a clinical condition grouping because the clinical management and delivery of health care varies for each condition. Refer to subsequent sections of this report that pertain to each clinical condition for detailed descriptions of the particular records excluded for each relevant measure.

Table 3. *Measures and Hospitalizations Analyzed, by Clinical Condition*

Condition	Data Source	Measure	Hospitalizations[1] Analyzed by PHC4
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]
		• Percent Rehospitalized (risk-adjusted)	• 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: • Percent Rehospitalized (risk-adjusted)	• 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 the 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.
[5] 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.
[6]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. *Measures and Hospitalizations Analyzed, by Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1] Analyzed by PHC4
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]
		• Percent Rehospitalized (risk-adjusted)	• 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]
		• Average 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) • Actual In-Hospital Mortality—30 Day (risk-adjusted) • Statistical Rating for In-Hospital Mortality—30 Day	• 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	• 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	• 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
		  ○ Cholesterol Screening after Acute Cardiovascular Events (percent)
		  ○ Bad Cholesterol Controlled after Acute Cardiovascular Events" (percent)
		• Beta Blocker After a Heart Attack (percent)
			Not Applicable

[1]Identifies the hospitalizations that were used to extract the 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.
[5] 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.
[6]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. *Measures and Hospitalizations Analyzed, by Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1] Analyzed by PHC4
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 (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 [5, 6]
		• Length of Stay (risk-adjusted) • Expected In-Hospital Complications (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) [6]
	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 (percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Single Hospitalizations [6]

[1]Identifies the hospitalizations that were used to extract the 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.
[5] 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.
[6]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. *Measures and Hospitalizations Analyzed, by Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1] Analyzed by PHC4
Prostatectomy	PHC4	• Total Prostatectomy Procedures • Procedure Rate per 10,000 Male Members (age-adjusted) • Length of Stay (risk-adjusted) • Expected In-Hospital Complications (percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Index hospitalization only (one per member)[2]
Mental Health	HEDIS	• Antidepressant Medication Management ○ Members with At Least 3 Follow-Up Visits (percent) ○ Effective Acute Phase Treatment (percent) ○ Effective Continuation Phase Treatment (percent) • Follow-Up After Hospitalization for a Mental Health Condition ○ 7—Days (percent) ○ 30—Days (percent) • Members Receiving any Mental Health Service (percent) • Inpatient Admission Rate • Inpatient Hospitalization Average Length of Stay	Not Applicable
Other Measures	HEDIS	• Childhood Immunizations • Timely Initiation of Prenatal Care	Not Applicable

[1]Identifies the hospitalizations that were used to extract the 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.
[5] 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.
[6]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.

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 gender 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. Gender 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. Appendix B describes the age cohorts used in the risk adjustment of hospitalization/procedure rates.

To standardize hospitalization/encounter data across plans and across age categories, only records for those patients age 64 or younger as of December 31, 2001 were included in the analysis. HMO members were excluded from an analysis if they turned 65 at any point during 2001, 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, 2001. 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, 2001 and excluded if the patient turned 76 at any time during the 2001 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, in-hospital mortality—30 day, in-hospital complications, and percent rehospitalized. These models were used to calculate expected, or predicted, results. HMO plans whose membership was characterized by a greater number of risk factors (e.g., severity of illness, comorbidity, demographic and/or socioeconomic factors) were given "credit" in the system; patients with significant risk factors were expected to have longer lengths of stay, and a greater probability of death, complications, and/or rehospitalization.

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. A bibliography of the literature reviewed is available on the PHC4 Website. The *Atlas Outcomes*™ Probability of Death and Predicted Length of Stay 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 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 probability of death or the predicted length of stay. The *Atlas Outcomes™* system utilizes 73 different disease-specific scoring algorithms to obtain the admission severity.

PHC4 Model Selection

Model selection identified those candidate variables that were statistically significant predictors of the relevant event (i.e., length of stay, in-hospital mortality—30 day, in-hospital complication, or rehospitalization—180 day). Linear regression models were used for length of stay, while binary logistic regression models were used for mortality, complication and rehospitalization 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 B for age cohorts in the risk adjustment models. See Appendix E for descriptions of the variables that were significant.)

Table 4. *Coefficients of Significant Predictors*

Significant Predictors	Coefficient	p-value
Chronic Obstructive Pulmonary Disease		
Length of Stay		
• Intercept	-0.1399	
• MqPredLOS[1]	0.6539	<0.0001
• Psychological Disorder†	0.4691	0.0013
• Age	0.0187	0.0189
Percent Rehospitalized		
• Intercept	-9.6741	
• MqPredLOS[1]	0.2822	0.0005
• Psychological Disorder†	0.5110	0.0011
• Poverty Rate	1.5251	0.0660
• Age	0.2427	0.0293
• Age-squared	-0.0022	0.0449
Pediatric Asthma		
Length of Stay		
• Intercept	0.2454	
• MqPredLOS[1]	0.8814	<0.0001
• Median Household Income	-0.0057	0.0033
• Asthma Type†	0.1774	0.0148
Adult Asthma		
Length of Stay		
• Intercept	1.1400	
• MqPredLOS[1]	0.4388	<0.0001
• Diabetes†	0.4372	0.0003
• Psychological Disorder†	0.2879	0.0065
• Female†	0.1854	0.0358
• Age	0.0068	0.0951
Percent Rehospitalized		
• Intercept	-2.3658	
• MqPredLOS[1]	0.2582	0.0006
• Alcohol & Drug Abuse†	1.0259	0.0075
• Median Household Income	-0.0119	0.0126
• Asthma Type†	0.2224	0.0924
Diabetes		
Length of Stay		
• Intercept	3.1968	
• MqPredLOS[1]	0.7499	<0.0001
• Medical DRG†	-2.4822	<0.0001
• Lower Extremity Amputation†	1.7097	<0.0001
• Heart Failure†	1.1238	<0.0001
• Cardiomyopathy†	2.1101	<0.0001
• Renal Failure†	0.8157	0.0004
• Diabetes Complications—Long Term	-0.4741	
• Diabetes Complications—None	-0.1827	0.0204
• Diabetes Complications—Short Term	0.0000	
• Female†	0.3525	0.0101
• Malignant Cancer†	1.4084	0.0165
• Median Household Income	-0.0120	0.0295

Significant Predictors	Coefficient	p-value
***Diabetes* continued**		
Percent Rehospitalized		
• Intercept	-1.4511	
• MqPredLOS[1]	0.1873	<0.0001
• Age	-0.0334	<0.0001
• Renal Dialysis†	0.5010	0.0989
• Diabetes Complications—Long Term†	0.3989	0.0094
• Psychological Disorder†	0.5155	0.0091
• Renal Failure†	0.3743	0.0937
Heart Attack		
Average Number of Days Hospitalized		
• Intercept	0.5213	
• MqPredLOS[1]	1.0749	<0.0001
• Heart Failure†	2.1368	<0.0001
• Renal Failure†	1.4744	<0.0001
• Race—Black	-0.6578	
• Race—Other	-0.5920	<0.0001
• Race—White	0.0000	
• AMI Type II (anterior)†	0.4210	0.0013
• Age	0.0187	0.0067
• Diabetes†	0.2932	0.0144
In-Hospital Mortality		
• Intercept	3.3820	
• MqPredDeath[2]	1.0154	<0.0001
• Renal Failure†	0.9643	<0.0001
• AMI Type I (Q-Wave)†	0.7413	<0.0001
• Cardiomyopathy†	1.2391	<0.0001
• Female†	0.3915	0.0023
• Diabetes†	0.3485	0.0093
• Race—Black	-0.7018	
• Race—Other	0.1351	0.0064
• Race—White	0.0000	
• Alcohol & Drug Abuse†	0.5261	0.0372
• Age	-0.1799	0.0750
• Age-squared	0.0019	0.0547
Hysterectomy—Abdominal		
Length of Stay		
• Intercept	2.0311	
• MqPredLOS[1]	0.8306	<0.0001
• Race—Black	0.4227	
• Race—Other	0.1648	<0.0001
• Race—White	0.0000	
• Renal Failure†	1.6863	<0.0001
• Age	-0.0555	<0.0001
• Age-squared	0.0005	<0.0001
• Poverty Rate	0.5568	<0.0001
• Heart Failure†	0.5956	0.0003
• Obesity†	0.1325	0.0050
• Radical Hysterectomy†	0.6646	0.0093
• PDxGrp[3]—Bleeding/Other PDx	0.0407	0.0268
• PDxGrp[3]—Fibroids/Hyperplasia/etc.	0.0000	
• Alcohol & Drug Abuse†	0.2265	0.0848

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

Table 4. *Coefficients of Significant Predictors* continued

Significant Predictors	Coefficient	p-value
***Hysterectomy—Abdominal* continued**		
In-Hospital Complications		
• Intercept	-3.2220	
• MqPredLOS[1]	0.5457	<0.0001
• Race—Black	0.4957	
• Race—Other	0.1502	<0.0001
• Race—White	0.0000	
• Age	-0.0096	0.0163
• Heart Failure[†]	0.9471	0.0046
• Poverty Rate	0.6876	0.0495
Hysterectomy—Vaginal		
Length of Stay		
• Intercept	2.2692	
• Age	-0.0374	0.0002
• Laparoscopic Procedure[†]	-0.2125	<0.0001
• PDxGrp[3]—Bleeding/Other PDx	-0.1108	<0.0001
• PDxGrp[3]—Fibroids/Hyperplasia/etc.	0.0000	
• Age-squared	0.0005	<0.0001
• Race—Black	0.1642	
• Race—Other	0.0179	0.0005
• Race—White	0.0000	
• MqPredLOS[1]	0.1156	0.0017
• Hypertensive Disease[†]	0.0670	0.0475
In-Hospital Complications		
• Intercept	-3.7744	
• Poverty Rate	2.0300	0.0051
• PDxGrp[3]—Bleeding/Other PDx	-0.3694	0.0009
• PDxGrp[3]—Fibroids/Hyperplasia/etc.	0.0000	
• MqPredLOS[1]	0.4424	0.0038
• Race—Black	0.2375	
• Race—Other	-0.2785	0.0944
• Race—White	0.0000	
Breast Cancer Procedures—Lumpectomy		
Length of Stay		
• Intercept	0.7990	
• Reconstruction—Concurrent[†]	1.2475	<0.0001
• MqPredLOS[1]	0.1886	<0.0001
• Median Household Income	-0.0046	0.0003
• Subtotal Mastectomy[†]	-0.0874	0.0279
• Age	0.0047	0.0630
In-Hospital Complications		
• Intercept	-4.5338	
• MqPredLOS[1]	0.5191	0.0077
• Cancer—In situ	1.2265	
• Cancer—Malignant neoplasm	-0.6159	0.0245
• Cancer—Metastatic	0.0000	
• Reconstruction—Concurrent[†]	2.3331	0.0227

Significant Predictors	Coefficient	p-value
Breast Cancer Procedures—Mastectomy		
Length of Stay		
• Intercept	0.1648	
• Reconstruction—Concurrent[†]	2.0434	<0.0001
• MqPredLOS[1]	0.6026	<0.0001
• Race—Black	0.4082	
• Race—Other	0.0892	0.0004
• Race—White	0.0000	
• Age	0.0094	0.0091
• Family History of Breast Cancer[†]	0.3031	0.0252
• Cancer—In Situ	-0.2289	
• Cancer—Malignant Neoplasm	-0.0812	0.0376
• Cancer—Metastatic Cancer	0.0000	
In-Hospital Complications		
• Intercept	-4.0673	
• Reconstruction—Concurrent[†]	1.0373	<0.0001
• Age	0.0277	0.0222
• Median Household Income	-0.0124	0.0606
Neck and Back Procedures With Fusion		
Length of Stay		
• Intercept	2.0232	
• Location—Cervical/Atlas-axis	-1.6229	
• Location—Dorsal & Dorsolumbar	1.1938	<0.0001
• Location—Lumbar & Lumbosacral	0.0000	
• MqPredLOS[1]	0.7392	<0.0001
• Poverty Rate	1.7660	<0.0001
• Technique Anterior	-0.4678	
• Technique Multiple	0.0167	<0.0001
• Technique Posterior/Lateral	0.0000	
• Race—Black	0.5033	
• Race—Other	0.2070	<0.0001
• Race—White	0.0000	
• Psychological Disorder[†]	0.2265	0.0003
• PxGroup[4]—Both	0.4978	
• PxGroup[4]—Discectomy	0.0601	0.0005
• PxGroup[4]—Laminectomy	0.0000	
• Diabetes[†]	0.1953	0.0057
• Alcohol & Drug Abuse[†]	0.4185	0.0098
• PDxGroup[3]—Disc Degeneration	-0.1446	
• PDxGroup[3]—Disc Displacement	-0.1677	0.0978
• PDxGroup[3]—Narrow Spinal Canal	-0.1522	
• PDxGroup[3]—Other Disk Disorders	0.0000	
In-Hospital Complications		
• Intercept	-1.3976	
• Location—Cervical/Atlas-axis	-1.7152	
• Location—Dorsal & Dorsolumbar	0.4459	<0.0001
• Location—Lumbar & Lumbosacral	0.0000	
• Age	-0.0663	0.1418
• Poverty Rate	2.3674	0.0012
• MqPredLOS[1]	0.2060	0.0252
• COPD[†]	0.6161	0.0271
• Age-squared	0.0009	0.0793

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

Table 4. *Coefficients of Significant Predictors* continued

Significant Predictors	Coefficient	p-value
Neck and Back Procedures Without Fusion		
Length of Stay		
• Intercept	-0.1963	
• MqPredLOS[1]	1.4643	<0.0001
• Age	-0.0168	<0.0001
• Race—Black	0.4586	<0.0001
• Race—Other	0.0233	
• Race—White	0.0000	
• Female†	-0.2276	<0.0001
• PxGroup[4]—Both	0.4027	<0.0001
• PxGroup[4]—Discectomy	0.1395	
• PxGroup[4]—Laminectomy	0.0000	
• Psychological Disorder†	0.3140	<0.0001
• PdxGroup[3]—Disc Degeneration	-0.3400	<0.0001
• PdxGroup[3]—Disc Displacement	-0.4919	
• PdxGroup[3]—Narrow Spinal Canal	-0.5313	
• PdxGroup[3]—Other Disk Disorder	0.0000	
• Poverty Rate	0.8517	<0.0001
• Diabetes†	0.1882	<0.0001
• Muscular Skeletal Disorder†	0.1315	0.0346
In-Hospital Complications		
• Intercept	-3.7060	
• MqPredLOS[1]	0.4542	<0.0001
• Median Household Income	-0.0157	<0.0001
• PxGroup[4]—Both	0.1257	0.0008
• PxGroup[4]—Discectomy	-0.3681	
• PxGroup[4]—Laminectomy	0.0000	
• Age	0.0109	0.0418

Significant Predictors	Coefficient	p-value
Prostatectomy		
Length of Stay		
• Intercept	1.3479	
• MqPredLOS[1]	0.7646	<0.0001
• Median Household Income	-0.0050	0.0158
• Race—Black	0.3062	0.0227
• Race—Other	-0.0245	
• Race—White	0.0000	
• Diabetes†	0.1882	0.0866
In-Hospital Complications		
• Intercept	-1.7855	
• Median Household Income	-0.0086	0.0812

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

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, in-hospital mortality—30 day, in-hospital complications, and/or percent rehospitalized 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

Average Length of Stay	This value was determined as the arithmetic mean length of stay for the hospitalizations included for a particular condition.
In-Hospital Mortality Rate *(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 Rate	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.
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 by the total number of members hospitalized for that particular principal diagnoses.

Determining Expected Rates

The models for each outcome used the risk factor values and corresponding coefficients to provide a predicted value (predicted probability of death, predicted length of stay, probability of complication, or probability of rehospitalization) 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:

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

where e ≈ 2.7182818285

Linear Example—Calculations Used in COPD Length of Stay

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):

$$\begin{aligned} PLOS &= ßX \\ &= ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 \\ &= -0.1399 + (0.6539)(x_1) + (0.4691)(x_2) + (0.0187)(x_3) \end{aligned}$$

where
x_1 = MediQual PredLOS value
x_2 = Psychological Disorder (yes = 1, no = 0)
x_3 = Patient Age in years
(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:

$$\frac{\text{Mean Actual LOS}}{\text{Mean PLOS}}(\text{Statewide Mean Actual LOS})$$

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):

$$\begin{aligned} ßX &= ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 + ß_4x_4 + ß_5x_5 \\ &= -9.6741 + (0.2822)(x_1) + (0.5110)(x_2) + (1.5251)(x_3) + (0.2427)(x_4) + \\ &\quad (-0.0022)(x_5) \end{aligned}$$

where
x_1 = MediQual PredLOS
x_2 = Psychological Disorder (yes = 1, no = 0)
x_3 = Poverty Rate of patient's zip code
x_4 = Patient Age
x_5 = Patient Age^2
(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:

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

Risk-Adjusted Percent Rehospitalized:

$$\frac{\text{Mean Actual Percent Rehospitalized}}{\text{Mean Predicted Percent Rehospitalized}}(\text{Statewide Mean Actual Percent Rehospitalized})$$

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 Complications (Complication vs. No Complication)	Hysterectomy, Breast Cancer Procedures, Neck and Back Procedures, Prostatectomy
In-Hospital Mortality (Death vs. No Death)	Heart Attack

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 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 or equal to 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 less 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 less 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 greater 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).

DESCRIPTION OF MISSING INPATIENT DATA

The utilization and outcome data presented in this report were derived from the PHC4 database. Table 6A lists the number and percent of acute care facilities that submitted incomplete data. Table 6B lists specific acute care facilities that did not submit data. The data presented in these tables was based on *all inpatient* discharges—before exclusions and before payor verification of the data.

Table 6A. *Records Submitted by Facilities, by Quarter*

Time Period	Total Facilities	Facilities Not Reporting[1]	% Facilities Not Reporting
Quarter 1, 2001	189	1	0.5
Quarter 2, 2001	189	1	0.5
Quarter 3, 2001	189	0	0.0
Quarter 4, 2001	189	1	0.5

[1] Two different facilities did not report data over the course of CY2001 (see table below).

Table 6B. *Facilities that Submitted Incomplete Data During Study Period*

Facility Name	*N*[1], Quarter 1, 2001	*N*[1], Quarter 2, 2001	*N*[1], Quarter 3, 2001	*N*[1], Quarter 4, 2001	Total *N*[1]
• Ashland Regional	659	565	565	0	1,789
• Brownsville General	0	0	1,110	1,202	2,312

[1] Refers to the number of records submitted.

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 661 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 692 hospitalizations for pediatric ear, nose and throat infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 31 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 Pediatric Ear, Nose and Throat Infections***

	HMO Total Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	692	100.0%
Exclusions:		
❖ Neonates (age<28 days)	12	1.7%
❖ Subsequent hospitalizations (non-index) for the same person	13	1.9%
❖ HIV Infection*	1	0.1%
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	1	0.1%
❖ Mechanical Ventilation*	4	0.6%
❖ Metastatic Cancer; Ear, Nose or Throat Cancer; Lung Cancer; Tracheostomy; Cleft Lip and Palate Repair; Tracheitis*	0	0.0%
Total exclusions	31	4.5%
Total members remaining in analysis	661	95.5%

*See Appendix C 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 515 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 534 hospitalizations for adult ear, nose and throat infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 19 records were excluded.

These hospitalizations are listed in Table 7B. The HMO database was used as the comparative reference.

Table 7B. *Exclusions from "Hospitalization Rate" Analysis for Adult Ear, Nose and Throat Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	534	100.0%
Exclusions:		
❖ Subsequent hospitalizations (non-index) for the same person	6	1.1%
❖ Ear, Nose or Throat Cancer*	1	0.2%
❖ HIV Infection*	1	0.2%
❖ Mechanical Ventilation*	8	1.5%
❖ Tracheostomy*	3	0.6%
❖ Metastatic Cancer; Lung Cancer; Extensive OR Procedures Unrelated to Principal Diagnosis; Cleft Lip and Palate Repair, Tracheitis*	0	0.0%
Total exclusions	19	3.6%
Total members remaining in analysis	515	96.4%

*See Appendix C 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 477 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 502 hospitalizations for hypertension submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 25 records were excluded. These hospitalizations are listed in Table 7C. The HMO database was used as the comparative reference.

Table 7C. *Exclusions from "Hospitalization Rate" Analysis for High Blood Pressure*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	502	100.0%
Exclusions:		
❖ Subsequent hospitalizations (non-index) for the same person	18	3.6%
❖ Metastatic Cancer*	1	0.2%
❖ Renal Dialysis*	2	0.4%
❖ Open Heart Surgery*	1	0.2%
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	1	0.2%
❖ PTCA/Stent*	1	0.2%
❖ Mechanical Ventilation*	1	0.2%
❖ HIV Infection; Tracheostomy*	0	0.0%
Total exclusions	25	5.0%
Total members remaining in analysis	477	95.0%

*See Appendix C 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 1,184 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 1,229 hospitalizations for gastrointestinal infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 45 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" Analysis for Gastrointestinal Infections***

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	1,229	100.0%
Exclusions:		
❖ Neonates (age<28 days)	3	0.2%
❖ Subsequent hospitalizations (non-index) for the same person	9	0.7%
❖ Gastrointestinal Cancer*	15	1.2%
❖ Metastatic Cancer*	7	0.6%
❖ HIV Infection*	1	0.1%
❖ Extensive OR Procedures Unrelated to Diagnosis*	3	0.2%
❖ Major Large and Small Bowel Procedures*	4	0.3%
❖ Other Digestive System OR Procedures with Complications*	3	0.2%
Total exclusions	45	3.7%
Total members remaining in analysis	1,184	96.3%

*See Appendix C 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 1,460 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 1,567 hospitalizations for kidney/urinary tract infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 107 records were excluded. These hospitalizations are listed in Table 7E. The HMO database was used as the comparative reference.

Table 7E. ***Exclusions from "Hospitalization Rate" Analysis for Kidney/Urinary Tract Infections***

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	1,567	100.0%
Exclusions:		
❖ Neonates (age<28 days)	11	0.7%
❖ Subsequent hospitalizations (non-index) for the same person	31	2.0%
❖ Metastatic Cancer*	23	1.5%
❖ Kidney/Urinary Tract Cancer*	4	0.3%
❖ Chronic Renal Failure*	10	0.6%
❖ Renal Dialysis*	4	0.3%
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	3	0.2%
❖ Kidney, Ureter, and Major Bladder Procedures*	21	1.3%
❖ HIV Infection*	0	0.0%
Total exclusions	107	6.8%
Total members remaining in analysis	1,460	93.2%

*See Appendix C for definitions of clinically complex exclusions.

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 1,077 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 1,398 hospitalizations for COPD submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 321 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 COPD***

	HMO Total Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	1,398	100.0%
Exclusions:		
❖ Subsequent hospitalizations (non-index) for the same person	223	16.0%
❖ Non-COPD DRG (not DRG 088)	64	4.6%
❖ Metastatic Cancer*	18	1.3%
❖ Lung Cancer*	15	1.1%
❖ HIV Infection*	1	0.1%
❖ Mechanical Ventilation; Tracheostomy*	0	0.0%
Total exclusions	321	23.0%
Total members remaining in analysis	1,077	77.0%

*See Appendix C for definitions of clinically complex exclusions.

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 is 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 8B. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 8B. *Exclusions from "Length of Stay" (LOS) Analysis for COPD*

	Combined HMO and Fee-for-Service Total		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	2,119	100.0%	4.5
Exclusions:			
❖ Hospitalization Rate Exclusions	488	23.0%	6.3
❖ Death in hospital	2	0.1%	5.5
❖ Missing *Atlas Outcomes*™ scores	36	1.7%	3.6
❖ Outlier[1]/Invalid[2] or Missing LOS	9	0.4%	19.1
Total exclusions	535	25.2%	6.3
Total members remaining in analysis	1,584	74.8%	3.9

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

Percent Rehospitalized (risk-adjusted). For 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 8C. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 8C. *Exclusions from "Percent Rehospitalized" Analysis for COPD*

	Combined HMO and Fee-for-Service Total	
	N	***% of Total***
Total hospitalizations before exclusions	2,119	100.0%
Exclusions:		
❖ Length of Stay Exclusions	535	25.2%
❖ Non-PA Resident	27	1.3%
❖ Invalid SSN	9	0.4%
❖ Invalid admit/discharge/DOB/sex	1	0.1%
Total Exclusions	572	27.0%
Total members remaining in analysis	1,547	73.0%

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 1,582 pediatric admissions and 1,823 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 1,680 pediatric hospitalizations for asthma submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 98 records were excluded. Of the 2,135 adult hospitalizations submitted, 312 records were excluded. These hospitalizations are listed in Table 8B. The HMO database was used as the comparative reference.

Table 8D. *Exclusions from "Hospitalization Rate" Analyses for Asthma*

	HMO Total Hospitalizations			
	Pediatric		*Adult*	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	1,680	100.0%	2,135	100.0%
Exclusions:				
❖ Subsequent hospitalizations (non-index) for the same person	93	5.5%	264	12.4%
❖ Neonates (age < 28 days)	0	0.0%	NA	NA
❖ HIV Infection*	0	0.0%	1	< 0.1%
❖ Metastatic Cancer*	0	0.0%	7	0.3%
❖ Lung Cancer*	0	0.0%	2	0.1%
❖ Tracheostomy*	0	0.0%	1	< 0.1%
❖ Mechanical Ventilation*	5	0.3%	37	1.7%
Total exclusions	98	5.8%	312	14.6%
Total members remaining in analysis	1,582	94.2%	1,823	85.4%

*See Appendix C 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 is 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 8E. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 8E. *Exclusions from "Length of Stay" (LOS) Analyses for Asthma*

	Combined HMO and Fee-for-Service Total					
	Pediatric			*Adult*		
	N	*% of Total*	*Avg. LOS*	*N*	*% of Total*	*Avg. LOS*
Total hospitalizations before exclusions	2,206	100.0%	2.1	2,927	100.0	3.4
Exclusions:						
❖ Hospitalization Rate Exclusions	125	5.7%	2.8	412	14.1%	4.3
❖ Death in hospital	0	0.0%	NA	0	0.0%	NA
❖ Missing *Atlas Outcomes*™ scores	25	1.1%	2.2	66	2.3%	2.8
❖ Outlier[1]/Invalid[2] or Missing LOS	4	0.2%	11.3	34	1.2%	15.4
Total exclusions	154	7.0%	3.0	512	17.5%	4.8
Total members remaining in analysis	2,052	93.0%	2.0	2,415	82.5%	3.1

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

Percent Rehospitalized (risk-adjusted) was calculated for adult asthma only. Because pediatric cases frequently lack SSN identification, potential rehospitalizations cannot be linked to previous hospitalizations. Thus, the percent rehospitalized analysis was not reported for pediatric asthma cases.

For 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 percent rehospitalized are listed in Table 8F. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 8F. *Exclusions from "Percent Rehospitalized" Analysis for Adult Asthma*

	Combined HMO and Fee-for-Service Total	
	N	***% of Total***
Total hospitalizations before exclusions	2,927	100.0%
Exclusions:		
❖ Length of Stay Exclusions	512	17.5%
❖ Non-PA Resident	33	1.1%
❖ Invalid SSN	34	1.2%
❖ Invalid admit/discharge/DOB/sex	2	0.1%
Total Exclusions	581	19.8%
Total members remaining in analysis	2,346	80.2%

Diabetes

Inclusion Criteria

Hospitalizations for HMO members (18 through 75 years of age) were included in this analysis only if: the member was identified as having diabetes, according to HEDIS NCQA guidelines and met continuous enrollment requirements set by NCQA; and 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 1,397 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 1,800 hospitalizations for diabetes submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 357 records were excluded. These hospitalizations are listed in Table 8G. The HMO combined database was used as the comparative reference.

Table 8G. ***Exclusions from "Hospitalization Rate" Analysis for Diabetes***

	HMO Total Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	1,800	100.0%
Exclusions:		
❖ Subsequent hospitalizations (non-index) for the same person	305	16.9%
❖ Metastatic Cancer[1]	10	0.6%
❖ HIV Infection[1]	4	0.2%
❖ Major Organ Transplant[1]	25	1.4%
❖ Major Cardiovascular Procedures with Complications and Comorbidities[1]	1	0.1%
❖ Extensive OR procedures unrelated to principal diagnosis[1]	12	0.7%
❖ Spinal Procedures; Coronary Bypass with PTCA; Coronary Bypass with Cardiac Catheterization; Other Permanent Cardiac Pacemaker Implant or PTCA with Coronary Artery Stent Implant; OR Procedures for Obesity; Kidney, Ureter and Major Bladder Procedures for Nonneoplasms with Complications and Comorbidities; Kidney, Ureter and Major Bladder Procedures for Nonneoplasms without Complications and Comorbidities; Transurethral Procedures with Complications and Comorbidities; Prostatic OR Procedures Unrelated to Principal Diagnosis[1]	0	0.0%
Total exclusions	357	19.8%
Cases that could not be identified as "members with diabetes." [2]	46	2.7%
Total members remaining in analysis	1,397	77.6%

[1]See Appendix C for definitions of clinically complex exclusions.
[2]These cases met the diabetes inclusion criteria, but because the HMO plan claiming the records did not provide data for total members with diabetes, the corresponding hospitalization rate could not be calculated and these 46 records were removed from the analysis. These cases were included in the length of stay and rehospitalization analyses.

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. Hospitalizations that were excluded from the risk-adjusted length of stay analysis for diabetes are listed in the Table 8H. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 8H*.* ***Exclusions from " Length of Stay" (LOS) Analysis for Diabetes***

	Combined HMO and Fee-for-Service Total		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	2,962	100.0%	4.8
Exclusions:			
❖ Hospitalization Rate Exclusions	563	19.0%	5.7
❖ Death in hospital	9	0.3%	5.5
❖ Missing *Atlas Outcomes*™ scores	56	1.9%	3.6
❖ Outlier[1]/Invalid[2] or Missing LOS	6	0.2%	19.1
Total exclusions	634	21.4%	6.0
Total members remaining in analysis	2,328	78.6%	4.5

[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 (for a description of these codes see Appendix A: "Description of Study Population").

Percent Rehospitalized (risk-adjusted). For 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 percent rehospitalized are listed in Table 8I. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 8I. ***Exclusions from "Percent Rehospitalized" Analysis for Diabetes***

	Combined HMO and Fee-for-Service Total	
	N	***% of Total***
Total hospitalizations before exclusions	2,962	100.0%
Exclusions:		
❖ Length of Stay Exclusions	634	21.4%
❖ Non-PA Resident	0	0.0%
❖ Invalid SSN	46	1.6%
❖ Invalid admit/discharge/DOB/sex	19	0.6%
Total Exclusions	699	23.6%
Total members remaining in analysis	2,263	76.4%

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 3,215 admissions, after exclusions, matched these criteria.

The care received by a patient following a heart attack is comprehensive and typically involves several additional intricately-related hospitalizations. Therefore, for this report, the main data component analyzed consists of 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 or were linked by date to a hospitalization beginning within 30 days of the admit date of the index heart attack hospitalization. This unique methodology was meant to provide a complete depiction of an individual patient's hospitalization experience for a single heart attack. For any one patient, only hospitalizations associated with the first heart attack hospitalization were included in the analyses. That is, if a patient encounters two or more heart attack hospitalizations within the one-year study period, only the hospitalizations associated with the first index hospitalization were analyzed. Those AMI hospitalizations occurring after the 30-day period that were not contiguous with any other hospitalization beginning within the 30-day period were excluded (see Table 9A).

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 members hospitalized per 10,000 members. Table 9A illustrates that the total number of hospitalizations for AMI is different from the number of index hospitalizations studied, since, for a single AMI patient, several related hospitalizations occurring within 30 days of the index heart attack hospitalization were studied as a unit in the analyses.

Therefore, all MDC 5 hospitalizations associated with an individual patient were collectively referred to as a single data unit for hospitalization rate analysis. Table 9A also notes the number of non-index hospitalizations that were embedded into a single unit (to represent individual

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

patients). Of the 3,960 hospitalizations for heart attack submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 745 records were excluded. These hospitalizations are listed in Table 9A. The HMO database was used as the comparative reference.

Table 9A. *Exclusions from "Hospitalization Rate" Analysis for Heart Attack*

	HMO Total Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	3,960	100.0%
Exclusions:		
❖ Cases in which patient returned to the hospital after identified as having died	1	< 0.1%
❖ Hospitalizations occurring beyond 30 days from the index hospitalization[1]	57	1.4%
❖ Non-index AMI hospitalizations that were embedded in a 30-day episode.	676	17.1%
❖ HIV Infection[2]	1	< 0.1%
❖ Metastatic Cancer[2]	8	0.2%
❖ Heart or Lung Transplant[2]	2	0.1%
Total exclusions	745	18.8%
Total members remaining in analysis	3,215	81.2%

[1] Includes AMI or MDC 5 hospitalizations that occurred after the 30-day period *and* were not contiguous with any other hospitalization beginning within the 30-day period.
[2]See Appendix C for definitions of clinically complex exclusions.

In-Hospital Mortality (risk-adjusted). All acute care MDC 5 hospitalizations ending in death (regardless of principal diagnosis), where the death (discharge status "20" listed in the record) occurred no more than 30 days from the admit date of the index heart attack hospitalization, were included in the in-hospital mortality analysis. The exclusions to the analysis of in-hospital mortality for heart attack are listed below in Table 9B. The statewide database was used as the comparative reference.

Table 9B. *Exclusions from "In-Hospital Mortality Rate" Analysis for Heart Attack*

	Statewide Total Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	14,424	100.0%
Exclusions:		
❖ Hospitalization Rate Exclusions	2,703	18.7%
❖ Missing *Atlas Outcomes*™ scores	179	1.2%
❖ Invalid SSN[1]	248	1.7%
❖ Invalid admit/discharge/DOB/sex[1]	8	0.1%
Total exclusions	3,138	21.8%
Total members remaining in analysis	11,286	78.2%

[1]Patients were excluded since it was indeterminable (due to invalid SSN, dates, gender, etc.) whether these patients were hospitalized at another time following the index AMI hospitalization and therefore could not be linked.

Average Number of Days Hospitalized (risk-adjusted). Rather than reporting length of stay, the average 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 average 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 of the admit date of the index heart attack hospitalization. The exclusions to the average number of days hospitalized analysis for heart attack are listed in Table 9C. The statewide database was used as the comparative reference.

Table 9C. ***Exclusions from "Average Number of Days Hospitalized" Analysis for Heart Attack***

	Statewide Total Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	14,424	100.0%
Exclusions:		
❖ In-Hospital Mortality Exclusions	3,138	21.8%
❖ Death in hospital within 30 days[1]	432	3.0%
❖ Death in hospital after 30 days but within an episode[2]	12	0.1%
❖ Outliers[3]/missing or invalid[4] length of stay	103	0.7%
Total Exclusions	3,685	25.5%
Total hospitalizations remaining in analysis	10,739	74.5%

[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 > 30.
[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 admission date for a heart attack. Calculation of the catheterization percent incorporated the frequency of catheterization procedures (occurring for a single heart attack patient), 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, and 36.06. To be included in the analyses, these procedures must have been performed in any MDC 5 hospitalization within 30 days of the index hospital admission for a heart attack. Calculation of this percent incorporated the frequency of the procedures (occurring in any individual patient) 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 admission date for a heart attack. Calculation of the bypass surgery percent incorporated the frequency of CABG procedures occurring within 30 days of the index hospital admission for individual AMI patients 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, vaginal and total hysterectomies. 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 (i.e., cases that were not in MDC 13—Diseases and Disorders of the Female Reproductive System) were excluded. Thus, only non-traumatic and non-female reproductive malignant hysterectomies were analyzed. A total of 8,412 admissions (5,919 abdominal and 2,493 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 8,556 hospitalizations for hysterectomy submitted to PHC4 for inclusion in the report, 144 records were excluded; of the 6,041 hospitalizations for abdominal hysterectomy, and 2,515 hospitalizations for vaginal hysterectomy, 122 and 22 records were excluded, respectively. These hospitalizations are listed in Table 10A. The HMO database was used as the comparative reference.

Table 10A. ***Exclusions from "Procedure Rate" Analysis for Hysterectomy***

	HMO Total Hospitalizations					
	Total		***Abdominal***		***Vaginal***	
	N	***% of Total***	***N***	***% of Total***	***N***	***% of Total***
Total hospitalizations before exclusions	8,556	100.0%	6,041	100.0%	2,515	100.0%
Exclusions:						
❖ Multiple hysterectomies for one patient	0	0.0%	0	0.0%	0	0.0%
❖ Cancer[1,2]	53	0.6%	45	0.7%	8	0.3%
❖ Hemorrhage on Admission[2]	0	0.0%	0	0.0%	0	0.0%
❖ Non-MDC 13	90	1.1%	77	1.3%	13	0.5%
❖ HIV Infection[2]	1	< 0.1%	0	0.0%	1	< 0.1%
Total exclusions	144	1.7%	122	2.0%	22	0.9%
Total members remaining in analysis	8,412	98.3%	5,919	98.0%	2,493	99.1%

[1]Subsequent to data verification, these hospitalizations were deemed necessary exclusions due to cancer status of all other body sites.
[2]See Appendix C for definitions of clinically complex exclusions.

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 a discharge record associated with the hysterectomy hospitalization (refer to Appendix D for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis for hysterectomy are outlined in Table 10B. The statewide database was used as the comparative reference.

Table 10B. ***Exclusions from "In-Hospital Complications" Analysis for Hysterectomy***

	Statewide Total Hospitalizations			
	Abdominal		***Vaginal***	
	N	***% of Total***	***N***	***% of Total***
Total hospitalizations before exclusions	15,098	100.0%	6,442	100.0%
Exclusions:				
❖ Procedure Rate Exclusions	422	2.8%	56	0.9%
❖ Missing *Atlas Outcomes*™ scores	153	1.0%	49	0.8%
Total exclusions	575	3.8%	105	1.6%
Total members remaining in analysis	14,523	96.2%	6,337	98.4%

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 is 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 10C. The statewide database was used as the comparative reference.

Table 10C. *Exclusions from "Length of Stay" (LOS) Analysis for Hysterectomy*

	Statewide Total Hospitalizations					
	Abdominal			***Vaginal***		
	N	***% of Total***	***Avg. LOS***	***N***	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	15,098	100.0%		6,442	100.0%	
Exclusions:						
❖ In-Hospital Complications Exclusions	575	3.8%	5.2	105	1.6%	3.4
❖ Death in hospital	3	< 0.1%	6.3	0	0.0%	NA
❖ Outlier[1]/Invalid[2] or Missing LOS	46	0.3%	16.2	6	0.1%	17.0
Total exclusions	624	4.1%	6.0	111	1.7%	4.2
Total members remaining in analysis	14,474	95.9%	2.9	6,331	98.3%	1.9

[1]LOS > 11 days for abdominal or vaginal hysterectomy hospitalizations.
[2]LOS value < 0.
NA: Not Applicable

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 2,832 admissions (2,049 lumpectomy cases and 783 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 were performed at the same time (e.g., lumpectomy and mastectomy) only the most invasive procedure (mastectomy) was included in the analysis. That is, 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 2,832 breast cancer procedures (2,049 lumpectomy cases and 783 mastectomy cases) submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, none were excluded (see Table 10D). The HMO database served as the comparative reference.

Table 10D. ***Exclusions from "Procedure Rate" Analysis for Breast Cancer Procedures—Inpatient and Ambulatory***

	HMO Total Procedures					
	Total		*Lumpectomy*		*Mastectomy*	
	N	*% of Total*	*N*	*% of Total*	*N*	*% of Total*
Total procedures before exclusions	2,832	100.0%	2,049	100.0%	783	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	2,832	100.0%	2,049	100.0%	783	100.0%

*See Appendix C 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 D for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis are found in Table 10E. The statewide database was used as the comparative reference.

Table 10E. ***Exclusions from "In-Hospital Complications" Analysis for Breast Cancer Procedures—Inpatient Only***

	Statewide Total Procedures			
	Lumpectomy		*Mastectomy*	
	N	*% of Total*	*N*	*% of Total*
Total procedures[1] before exclusions	6,211	100.0%	2,450	100.0%
Exclusions:				
❖ Hospitalization Rate Exclusions	0	0.0%	0	0.0%
❖ Ambulatory Cases[2]	5,240	84.4%	279	11.4%
❖ Missing *Atlas Outcomes*™ scores	20	0.3%	44	1.8%
Total exclusions	5,260	84.7%	323	13.2%
Total hospitalizations remaining in analysis	951	15.3%	2,127	86.8%

[1]Includes inpatient and ambulatory cases. [2]5,240 lumpectomy and 279 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 hospitalization (length of stay is calculated as discharge date minus admit date). Hospitalizations that were excluded from the analysis are listed in Table 10F. The statewide database was used as the comparative reference.

Table 10F. ***Exclusions from "Length of Stay" (LOS) Analysis for Breast Cancer Procedures—Inpatient Only***

	Statewide Total Procedures					
	Lumpectomy			*Mastectomy*		
	N	*% of Total*	*Avg. LOS[4]*	*N*	*% of Total*	*Avg. LOS[4]*
Total procedures[1] before exclusions	6,211	100.0%	1.2	2,450	100.0%	2.5
Exclusions:						
❖ In-Hospital Complications Exclusions	5,260	84.7%	1.1	323	13.2%	2.7
❖ Death in hospital	0	0.0%	NA	2	0.1%	1.0
❖ Outlier[2]/Invalid[3] or Missing LOS	6	0.1%	13.3	5	0.2%	20.8
Total exclusions	5,266	84.8%	3.9	330	13.5%	4.4
Total hospitalizations remaining in analysis	945	15.2%	1.2	2,120	86.5%	2.4

[1]Includes inpatient and ambulatory cases. [2]LOS > 7 days for lumpectomy and > 15 days for mastectomy procedures.
[3]LOS value < 0. [4] Based on inpatient cases only. 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 or CPT codes listed in Appendix A: "Description of Study Population." A total of 5,322 admissions (1,810 with fusion and 3,512 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 5,364 (1,829 with fusion 3,535 without fusion) neck and back procedures submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 42 (19 with fusion and 23 without fusion) records were excluded. These hospitalizations are listed in Table 10G. The HMO database was used as the comparative reference.

Table 10G. ***Exclusions from "Procedure Rate" Analysis for Neck and Back Procedures***

	HMO Total Hospitalizations					
	Total		***With Fusion***		***Without Fusion***	
	N	***% of Total***	***N***	***% of Total***	***N***	***% of Total***
Total hospitalizations before exclusions	5,364	100.0%	1,829	100.0%	3,535	100.0%
Exclusions:						
❖ Refusion*	23	0.4%	6	0.3%	17	0.5%
❖ Pathological Spinal Fracture*	2	<0.1%	2	0.1%	0	0.0%
❖ Spinal Nerve Root Injury*	1	<0.1%	1	0.1%	0	0.0%
❖ Paraplegia*	1	<0.1%	0	0.0%	1	<0.1%
❖ Quadriplegia*	9	0.2%	9	0.5%	0	0.0%
❖ Unspecified Paralysis*	1	<0.1%	0	0.0%	1	<0.1%
❖ Spinal Fracture*	5	0.1%	1	0.1%	4	0.1%
❖ Hemiplegia; HIV Infection; Infantile Cerebral Palsy*	0	0.0%	0	0.0%	0	0.0%
Total exclusions	42	0.8%	19	1.0%	23	0.7%
Total hospitalizations remaining in analysis	5,322	99.2%	1,810	99.0%	3,512	99.3%

*See Appendix C 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 D for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis are found in Table 10H. The statewide database was used as the comparative reference.

Table 10H. ***Exclusions from "In-Hospital Complications" Analysis for Neck and Back Procedures***

	Statewide Total Hospitalizations			
	With Fusion		***Without Fusion***	
	N	***% of Total***	***N***	***% of Total***
Total hospitalizations before exclusions	6,302	100.0%	11,444	100.0%
Exclusions:				
❖ Procedure Rate Exclusions	88	1.4%	96	0.8%
❖ Missing *Atlas Outcomes*™ scores	123	2.0%	251	2.2%
Total exclusions	211	3.3%	347	3.0%
Total hospitalizations remaining in analysis	6,091	96.7%	11,097	97.0%

Length of Stay (risk-adjusted). The inpatient length of stay for neck and back procedures is the period of hospitalization beginning with the date of admission in which the procedure was performed and ending with the date of discharge of the same hospitalization (length of stay is 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 10I. The statewide database was used as the comparative reference.

Table 10I. *Exclusions from "Length of Stay" (LOS) Analysis for Neck and Back Procedures*

	Statewide Total Hospitalizations					
	With Fusion			Without Fusion		
	N	% of Total	Avg. LOS	N	% of Total	Avg. LOS
Total hospitalizations before exclusions	6,302	100.0%	2.5	11,444	100.0%	1.8
Exclusions:						
❖ In-Hospital Complications Exclusions	211	3.3%	4.5	347	3.0%	2.3
❖ Death in hospital	3	<0.1%	4.7	3	<0.1%	7.0
❖ Outlier[1]/Invalid[2] or Missing LOS	24	0.4%	21.9	14	0.1%	23.8
Total exclusions	238	3.8%	6.3	364	3.2%	3.2
Total hospitalizations remaining in analysis	6,064	96.2%	2.4	11,080	96.8%	1.7

[1]LOS > 15 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. Only radical prostatectomies in DRGs 334 or 335 were analyzed. If a record included codes for both radical and transurethral prostatectomies it was included in the analysis as a radical prostatectomy. A total of 855 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 865 prostatectomy procedures submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 10 records were excluded. These exclusions are listed in Table 10J. The HMO database was used as the comparative reference.

Table 10J. *Exclusions from "Procedure Rate" Analysis for Prostatectomy*

	HMO Total Hospitalizations	
	N	% of Total
Total hospitalizations before exclusions	865	100.0%
Exclusions:		
❖ HIV Infection*	0	0.0%
❖ Multiple prostatectomy procedures for one patient	0	0.0%
❖ DRG other than 334 or 335	10	1.2%
Total exclusions	10	1.2%
Total hospitalizations remaining in analysis	855	98.8%

*See Appendix C for definitions of clinically complex exclusions.

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 a discharge record associated with the prostatectomy hospitalization (refer to Appendix D for a detailed description of the complications). The exclusions to the in-hospital complications analysis are found in Table 10K. The statewide database was used as the comparative reference.

Table 10K. *Exclusions from "In-Hospital Complications" Analysis for Prostatectomy*

	Statewide Total Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	2,238	100.0%
Exclusions:		
❖ Procedure Rate Exclusions	20	0.9%
❖ Missing *Atlas Outcomes*™ scores	51	2.3%
Total exclusions	71	3.2%
Total hospitalizations remaining in analysis	2,167	96.8%

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 is 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 10L. The statewide database was used as the comparative reference.

Table 10L. *Exclusions from "Length of Stay" (LOS) Analysis for Prostatectomy*

	Statewide Total Hospitalizations		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	2,238	100.0%	3.3
Exclusions:			
❖ In-Hospital Complications Exclusions	71	3.2%	4.7
❖ Death in hospital	3	0.1%	5.0
❖ Outlier[1]/Invalid[2] or Missing LOS	1	< 0.1%	27.0
Total exclusions	75	3.4%	5.1
Total hospitalizations remaining in analysis	2,163	97.0%	3.3

[1]LOS > 15 days for neck and back procedures with or without fusion.
[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 2001:

- Question 10 — "In the last 12 months, how much of a problem, if any, was it to get a referral to a specialist that you needed to see?"
- Question 16 — "In the last 12 months, did you make any appointments with a doctor or other health provider for regular or routine health care?"
- Question 18 — "In the last 12 months, how many days did you usually have to wait between making an appointment for regular or routine care and actually seeing a provider?"
- Question 21 — "In the last 12 months, how many days did you usually have to wait between making an appointment and actually seeing a provider for an illness or injury?"
- Question 24 — "In the last 12 months, how much of a problem, if any, was it to get the care you or a doctor believed necessary?"
- Question 25 — "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 41 — "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 42 — "In the last 12 months, have you called or written your health plan with a complaint or problem?"
- Question 44 — "Was your complaint or problem settled to your satisfaction?"
- Question 47 — "How would you rate your health plan now?"

All reported CAHPS measures include an average for the group of Pennsylvania HMO plans. These were calculated by PHC4 by weighting each plan's score by its CY2001 total commercial enrollment. Also included, when available from NCQA, are national averages. 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. All data utilized in the financial section of the report were submitted by each HMO as part of its 1998 - 2001 *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 does include federal employee benefit programs. The following table outlines the locations of the data elements in the *Annual Statements.*

Table 11. ***Location of Data Elements in the Annual Statement***

Financial Measures	Location in Annual Statement*
2001 Total HMO Premium Revenue	Page 4, Line 2, Column 2
1998 Total HMO Premium Revenue	Page 4, Line 1, Column 2 (CY1998)
2001 Commercial Premium Revenue	Page 7, Line 1, Columns 2, 7, & 13 (if applicable)
2001 Commercial Medical Expenses	Page 7, Line 15, Columns 2, 7, & 13 (if applicable)
2001 Commercial Underwriting Gain/Loss	Page 7, Line 20, Columns 2, 7, & 13 (if applicable)
2001 Total HMO Revenue	Page 4, Lines 7, 24, & 26, Column 2
2001 HMO Net Income	Page 4, Line 29, Column 2
1999 & 2000 Total HMO Revenue	Page 4, Line 7, Column 2 & 3 (CY2000)
1999 & 2000 HMO Net Income	Page 4, Line 27, Column 2 & 3 (CY2000)
2001 Cash and Short-term Investments	Page 2, Line 5, Column 3
2001 Claims Payable	Page 3, Line 1, Column 3

*Refers to CY2001 *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 CY1998 to the end of CY2001. This measure reflects the extent to which the corporation's HMO line of business is growing or declining.

$$\frac{\text{Total Revenue}_{2001} - \text{Total Revenue}_{1998}}{\text{Total Revenue}_{1998}}$$

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 is less than 100 percent of total HMO premium revenue, the balance of premium revenue is derived from Medicare and Medical Assistance plans and administrative service contracts.

$$\frac{\text{Commercial Premium Revenue}_{2001}}{\text{Total Premium Revenue}_{2001}}$$

Commercial Medical Loss Ratio reflects the portion of each commercial premium dollar spent on health care during CY2001. If an HMO has a Medical Loss Ratio above 100 percent, it is spending more for healthcare services than it receives in commercial premiums.

$$\frac{\textit{Commercial Medical Expenses}_{2001}}{\textit{Commercial Premium Revenue}_{2001}}$$

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.

$$\frac{\textit{Commercial Underwriting Gain/Loss}_{2001}}{\textit{Commercial Premium Revenue}_{2001}}$$

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.

$$\frac{\textit{Total HMO Net Income}_{2001}}{\textit{Total HMO Revenue}_{2001}}$$

3-year Average Total Net Margin reflects the average after tax net income over the past three calendar years (CY1999 – CY2001) for the Total HMO.

$$\frac{\Sigma_{1999,2000,2001}\ \textit{Total HMO Net Income}}{\Sigma_{1999,2000,2001}\ \textit{Total HMO Revenues}}$$

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 were to fall short of health care reimbursements.

$$\frac{\textit{Cash \& Short-term Investments}_{2001}}{\textit{Claims Payable}_{2001}}$$

HMO PLAN PROFILE

The HMO "Plan Profile" is found on the PHC4 Web site only. Specific sources of data for the HMO profile include:

- The number of commercial members (as of December 31, 2001) 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.

The same procedure was followed for the December 31, 2000 *Annual Report*. The 2000 totals were then subtracted from the 2001 totals and the percent change is reported (identified as the "Change in Commercial Enrollment" variable on the PHC4 Web site).

- The "Number of General Acute Care (GAC) Hospitals in the Network" was taken from each HMO's most recent Provider Directory filed with the Department of Health. PHC4 tallied the number of GAC hospitals in those counties where, according to the Department of Health, each HMO was licensed to do business. The "Number of GAC Hospitals in the Network" was then divided by the total number of GAC hospitals within these counties (as defined by data submissions to PHC4) and is reported as the "Percentage of all GAC Hospitals in the Plan's Service Area." In addition, the number of GAC hospitals in the Provider Directory located outside the HMO's service area was determined and reported as "Additional GAC Hospitals in Network."

- The "NCQA Accreditation Status" variable was obtained from the NCQA Web site and was current as of the time of publication.

APPENDICES

APPENDIX A: DESCRIPTION OF STUDY POPULATION

Ear, Nose and Throat Infections (Pediatric and Adult)

- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
017.4x x = 0 - 6	Tuberculosis of ear
034.0	Streptococcal sore throat
055.2	Postmeasles otitis media
112.82	Candidal otitis externa
380.10	Infective otitis externa, unspecified
380.11	Acute infection of pinna
380.12	Acute swimmers' ear
380.14	Malignant otitis externa
380.16	Other chronic infective otitis externa
381.00	Acute nonsuppurative otitis media, unspecified
381.01	Acute serous otitis media
381.02	Acute mucoid otitis media
381.03	Acute sanguinous otitis media
381.04	Acute allergic serous otitis media
381.05	Acute allergic mucoid otitis media
381.06	Acute allergic sanguinous otitis media
381.10	Chronic serous otitis media, simple or unspecified
381.19	Other chronic serous otitis media
381.20	Chronic mucoid otitis media, simple or unspecified
381.29	Other chronic mucoid otitis media
381.3	Other and unspecified chronic nonsuppurative otitis media
381.4	Nonsuppurative otitis media, not specified as acute or chronic
382.00	Acute suppurative otitis media without spontaneous rupture of ear drum
382.01	Acute suppurative otitis media with spontaneous rupture of ear drum
382.1	Chronic tubotympanic suppurative otitis media
382.2	Chronic atticoantral suppurative otitis media
382.3	Unspecified chronic suppurative otitis media
382.4	Unspecified suppurative otitis media
382.9	Unspecified otitis media
461.0	Acute maxillary sinusitis
461.1	Acute frontal sinusitis
461.2	Acute ethmoidal sinusitis
461.3	Acute sphenoidal sinusitis

Ear, Nose and Throat Infections (Pediatric and Adult) **continued**

ICD.9.CM Diagnosis Codes	Description
461.8	Other acute sinusitis
461.9	Acute sinusitis, unspecified
462	Acute pharyngitis
463	Acute tonsillitis
464.0	Acute laryngitis
464.00	Acute laryngitis, without mention obstruction
464.01	Acute laryngitis with obstruction
464.20	Acute laryngotraceheitis without mention of obstruction
464.21	Acute laryngotracheitis with obstruction
464.30	Acute epiglottitis without mention of obstruction
464.31	Acute epiglottitis with obstruction
464.4	Croup
465.0	Acute laryngopharyngitis
465.8	Acute upper respiratory infections of other multiple sites
465.9	Acute upper respiratory infections of unspecified site
472.0	Chronic rhinitis
472.1	Chronic pharyngitis
472.2	Chronic nasopharyngitis
473.0	Chronic maxillary sinusitis
473.1	Chronic frontal sinusitis
473.2	Chronic ethmoidal sinusitis
473.3	Chronic sphenoidal sinusitis
473.8	Other chronic sinusitis
473.9	Unspecified sinusitis (chronic)
474.00	Chronic tonsillitis
474.01	Chronic adenoiditis
474.02	Chronic tonsillitis and adenoiditis
476.0	Chronic laryngitis
476.1	Chronic laryngotracheitis
487.1	Influenza with other respiratory manifestations

High Blood Pressure (Hypertension)

- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
401.0	Malignant essential hypertension
401.1	Benign essential hypertension
401.9	Unspecified essential hypertension
402.00	Malignant hypertensive heart disease without congestive heart failure
402.10	Benign hypertensive heart disease without congestive heart failure
402.90	Unspecified hypertensive heart disease without congestive heart failure
403.00	Malignant hypertensive renal disease without mention of renal failure
403.10	Benign hypertensive renal disease without mention of renal failure
403.90	Unspecified hypertensive renal disease without mention of renal failure
404.00	Malignant hypertensive heart and renal disease without mention of congestive heart failure or renal failure
404.10	Benign hypertensive heart and renal disease without mention of congestive heart failure or renal failure
404.90	Unspecified hypertensive heart and renal disease without mention of congestive heart failure or renal failure

Gastrointestinal Infections (Enteritis/Colitis/Gastroenteritis)

- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
003.0	Salmonella gastroenteritis
006.2	Amebic nondysenteric colitis
009.0	Infectious colitis, enteritis, and gastroenteritis
009.1	Colitis, enteritis, and gastroenteritis of presumed infectious origin
558.2	Toxic gastroenteritis and colitis
558.9	Other and unspecified noninfectious gastroenteritis and colitis

Kidney/Urinary Tract Infections

- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
590.00	Chronic pyelonephritis without lesion of renal medullary necrosis
590.01	Chronic pyelonephritis with lesion of renal medullary necrosis
590.10	Acute pyelonephritis without lesion of renal medullary necrosis
590.11	Acute pyelonephritis with lesion of renal medullary necrosis
590.2	Renal and perinephric abscess
590.3	Pyeloureteritis cystica
590.80	Pyelonephritis, unspecified
590.9	Infection of kidney, unspecified
599.0	Urinary tract infection, site not specified

Chronic Obstructive Pulmonary Disease (COPD)

- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
491.20	Obstructive chronic bronchitis without mention of acute exacerbation
491.21	Obstructive chronic bronchitis with acute exacerbation
492.0	Emphysematous bleb
492.8	Other emphysema
496.0	Chronic airway obstruction, not elsewhere classified
506.4	Chronic respiratory conditions due to fumes and vapors

Asthma (Pediatric and Adult)

- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
493.00	Extrinsic asthma without mention of status asthmaticus
493.01	Extrinsic asthma with status asthmaticus
493.02	Extrinsic asthma with acute exacerbation
493.10	Intrinsic asthma without mention of status asthmaticus
493.11	Intrinsic asthma with status asthmaticus
493.12	Intrinsic asthma with acute exacerbation
493.20	Chronic obstructive asthma without mention of status asthmaticus
493.21	Chronic obstructive asthma with status asthmaticus
493.22	Chronic obstructive asthma with acute exacerbation
493.90	Asthma, unspecified without mention of status asthmaticus
493.91	Asthma, unspecified with status asthmaticus
493.92	Unspecified Asthma, with acute exacerbation

Diabetes

- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
250.00	Uncomplicated – Non-insulin dependent, controlled
250.01	Uncomplicated – Insulin dependent, controlled
250.02	Uncomplicated – Non-insulin dependent, uncontrolled
250.03	Uncomplicated – Insulin dependent, uncontrolled
250.1x	With Ketoacidosis, where x = 0,1,2,3
250.2x	With Hyperosmolarity, where x = 0,1,2,3
250.3x	With Other Coma, where x = 0,1,2,3
250.4x	With Renal Manifestations, where x = 0,1,2,3
250.5x	With Ophthalmic Manifestations, where x = 0,1,2,3
250.6x	With Neurological Manifestations, where x = 0,1,2,3
250.7x	With Peripheral Circulatory Disorders, where x = 0,1,2,3
250.8x	With Other Specified Manifestations, where x = 0,1,2,3
250.9x	With Unspecified Complication, where x = 0,1,2,3

Heart Attack (AMI)

- The diagnosis codes below were analyzed only when listed as the principal diagnosis.

ICD.9.CM Diagnosis Codes	Description
410.01	Acute myocardial infarction of anterolateral wall
410.11	Acute myocardial infarction of other anterior wall
410.21	Acute myocardial infarction of inferolateral wall
410.31	Acute myocardial infarction of inferoposterior wall
410.41	Acute myocardial infarction of other inferior wall
410.51	Acute myocardial infarction of other lateral wall
410.61	Acute myocardial infarction, true posterior wall
410.71	Acute myocardial infarction, subendocardial
410.81	Acute myocardial infarction of other specified sites
410.91	Acute myocardial infarction, unspecified site

Hysterectomy (non-malignant and non-traumatic)

- The procedure codes below were analyzed when listed as a principal or secondary procedure.

ICD.9.CM Procedure Codes	Description
68.3	Subtotal abdominal hysterectomy
68.4	Total abdominal hysterectomy
68.51	Laparoscopically assisted vaginal hysterectomy
68.59	Other vaginal hysterectomy
68.6	Radical abdominal hysterectomy
68.7	Radical vaginal hysterectomy
68.9	Other and unspecified hysterectomy

Breast Cancer Procedures

- The procedure codes were included in the analyses when listed as the principal or secondary procedure.
- The diagnosis codes were analyzed when listed as the principal diagnosis.

ICD.9.CM/CPT Procedure Codes	Description
85.20	Excision or destruction of breast tissue, not otherwise specified
85.21	Local excision of lesion of breast
85.22	Resection of quadrant of breast
85.23	Subtotal mastectomy
85.41	Unilateral simple mastectomy
85.42	Bilateral simple mastectomy
85.43	Unilateral extended simple mastectomy
85.44	Bilateral extended simple mastectomy
85.45	Unilateral radical mastectomy
85.46	Bilateral radical mastectomy
85.47	Unilateral extended radical mastectomy
85.48	Bilateral extended radical mastectomy
19112	Excision of lactiferous duct fistula
19120	Excision of cyst, fibroadenoma, or other benign or malignant tumor aberrant breast tissue, duct lesion, nipple or areolar lesion, male or female, one or more lesions
19125	Excision of breast lesion identified by preoperative placement of radiological marker; single lesion
19126	Each additional lesion separately identified by a radiological marker
19160	Mastectomy, partial
19162	Mastectomy, partial with axillary lymphadenectomy

***Breast Cancer Procedures* continued**

ICD.9.CM/CPT Procedure Codes	**Description**
19180	Mastectomy, simple, complete
19200	Mastectomy, radical, including pectoral muscles, axillary lymph nodes
19220	Mastectomy, radical, including pectoral muscles, axillary and internal mammary lymph nodes
19240	Mastectomy, modified radical, including axillary lymph nodes, with or without pectoralis minor muscle, but excluding pectoralis major muscle

ICD.9.CM Diagnosis Codes	**Description**
174.0	Malignant neoplasm of nipple and areola
174.1	Malignant neoplasm of central portion of female breast
174.2	Malignant neoplasm of upper-inner quadrant of female breast
174.3	Malignant neoplasm of lower-inner quadrant of female breast
174.4	Malignant neoplasm of upper-outer quadrant of female breast
174.5	Malignant neoplasm of lower-outer quadrant of female breast
174.6	Malignant neoplasm of axillary tail of female breast
174.8	Malignant neoplasm of other specified sites of female breast
174.9	Malignant neoplasm of breast (female), unspecified
196.3	Secondary and unspecified malignant neoplasm of lymph nodes of axilla and upper limb
198.2	Secondary malignant neoplasm of skin (skin of breast listed as example)
198.81	Secondary malignant neoplasm of breast
233.0	Carcinoma in situ of breast
238.3	Neoplasm of uncertain behavior of breast
239.3	Neoplasm of unspecified nature of breast

Neck and Back Procedures

- The procedure codes were included in the analyses when listed as the principal or secondary procedure.
- The diagnosis codes were analyzed only when listed as the principal diagnosis.

ICD.9.CM Procedure Codes	**Description**
03.09	Other exploration and decompression of spinal canal
80.50	Excision or destruction of intervertebral disc, unspecified
80.51	Excision of intervertebral disc
80.59	Other destruction of intervertebral disc

Neck and Back Procedures **continued**

ICD.9.CM Diagnosis Codes	**Description**
720.0	Ankylosing spondylitis
721.0	Cervical spondylosis without myelopathy
721.1	Cervical spondylosis with myelopathy
721.2	Thoracic spondylosis without myelopathy
721.3	Lumbosacral spondylosis without myelopathy
721.41	Thoracic region spondylosis with myelopathy
721.42	Lumbar region spondylosis with myelopathy
721.90	Spondylosis of unspecified site without mention of myelopathy
721.91	Spondylosis of unspecified site with myelopathy
722.0	Displacement of cervical intervertebral disc without myelopathy
722.10	Displacement of lumbar intervertebral disc without myelopathy
722.11	Displacement of thoracic intervertebral disc without myelopathy
722.2	Displacement of intervertebral disc, site unspecified, without myelopathy
722.4	Degeneration of cervical intervertebral disc
722.51	Degeneration of thoracic or thoracolumbar intervertebral disc
722.52	Degeneration of lumbar or lumbosacral intervertebral disc
722.6	Degeneration of intervertebral disc, site unspecified
722.70	Intervertebral disc disorder with myelopathy of unspecified region
722.71	Intervertebral disc disorder with myelopathy of cervical region
722.72	Intervertebral disc disorder with myelopathy of thoracic region
722.73	Intervertebral disc disorder with myelopathy of lumbar region
722.90	Other and unspecified disc disorder of unspecified region
722.91	Other and unspecified disc disorder of cervical region
722.92	Other and unspecified disc disorder of thoracic region
722.93	Other and unspecified disc disorder of lumbar region
723.0	Spinal stenosis in cervical region
723.1	Cervicalgia
724.00	Spinal stenosis, unspecified region
724.01	Spinal stenosis, thoracic region
724.02	Spinal stenosis, lumbar region
724.09	Spinal stenosis, other
724.1	Pain in thoracic spine
724.2	Lumbago
724.3	Sciatica
724.5	Backache, unspecified
738.4	Acquired spondylolisthesis
756.11	Spondylolysis, lumbosacral region
756.12	Spondylolisthesis

Prostatectomy

- The procedure codes below were analyzed when listed in any procedure position.

ICD.9.CM Procedure Codes	Description
60.3	Suprapubic prostatectomy
60.4	Retropubic prostatectomy
60.5	Radical prostatectomy
60.62	Perineal prostatectomy
60.69	Other prostatectomy

Appendix B: Age Cohorts for Risk Adjustment

Note: Age cohorts are inclusive of endpoints.

	Hospitalization/ Procedure Rate	Length of Stay/ Avg. # of Days Hospitalized	Percent Rehospitalized	In Hospital Mortality—30 Day	In-Hospital Complications
Ear, Nose & Throat Infections					
Pediatric	0 - 4 5 - 17	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Adult	18 - 44 45 - 64	Not Applicable	Not Applicable	Not Applicable	Not Applicable
High Blood Pressure	18 - 44 45 - 64	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Gastrointestinal Infections	0 - 4 5 - 17 18 - 44 45 - 64	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Kidney/Urinary Tract Infections	0 - 4 5 - 17 18 - 44 45 - 64	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Chronic Obstructive Pulmonary Disease	18 - 44 45 - 64	18 – 49 50 - 54 55 - 58 59 - 61 62 – 64	18 - 49 50 - 54 55 - 58 59 - 61 62 – 64	Not Applicable	Not Applicable
Asthma					
Pediatric	0 - 4 5 - 17	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Adult	18 – 44 45 - 64	18 - 32 33 - 40 41 - 48 49 - 54 55 – 64	Not Applicable	Not Applicable	Not Applicable
Diabetes	18 - 25 26 - 35 36 - 45 46 - 55 56 - 65 66 - 75	Not Applicable	19 - 35 36 - 46 47 - 53 54 - 59 60 – 64	Not Applicable	Not Applicable
Heart Attack	18 - 44 45 - 64	18 – 46 47 - 51 52 - 56 57 - 60 61 – 64	Not Applicable	18 - 46 47 - 51 52 - 57 58 - 60 61 – 64	Not Applicable
Hysterectomy					
Abdominal	18 - 44 45 - 64	18 – 37 38 - 41 42 - 46 47 - 50 51 – 64	Not Applicable	Not Applicable	18 - 37 38 - 41 42 - 46 47 - 50 51 - 64
Vaginal	18 - 44 45 - 64	18 – 36 37 - 40 41 - 45 46 - 51 52 – 64	Not Applicable	Not Applicable	Not Applicable
Breast Cancer Procedures					
Lumpectomy	18 - 44 45 - 64	18 – 43 44 - 48 49 - 54 55 - 59 60 – 64	Not Applicable	Not Applicable	Not Applicable
Mastectomy	18 - 44 45 - 64	18 – 42 43 - 48 49 - 53 54 - 58 59 – 64	Not Applicable	Not Applicable	18 - 42 43 - 48 49 - 53 54 - 58 59 – 64
Neck and Back Procedures					
With Fusion	18 - 44 45 - 64	Not Applicable	Not Applicable	Not Applicable	18 - 37 38 - 42 43 - 48 49 - 54 55 – 64
Without Fusion	18 - 44 45 - 64	18 – 35 36 - 41 42 - 48 49 - 55 56 – 64	Not Applicable	Not Applicable	18 - 35 36 - 41 42 - 48 49 - 55 56 – 64
Prostatectomy	18 - 44 45 - 64	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Exclusion	Definition: Cases are defined by ICD.9.CM Diagnosis (Dx)/ Procedure (Px) Codes or Diagnostic Related Group (DRG)
Cancer	Dx: 140.0-208.9, 230.0-239.9
Chronic renal failure	Dx: 585
Cleft lip and palate repair	DRG: 052
Coronary bypass with cardiac catheterization	DRG: 107
Coronary bypass with PTCA	DRG: 106
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 lung transplant	Px: 33.6, 37.5
Hemiplegia	Dx: 342.00-342.02, 342.10-342.12, 342.80-342.82, 342.90-342.92
Hemorrhage on admission	Dx: 998.11
HIV infection	Dx: 042
Infantile cerebral palsy	Dx: 343.0-343.3
Kidney, ureter and major bladder procedures for nonneoplasms with complications and comorbidities	DRG: 304
Kidney, ureter and major bladder procedures for nonneoplasms without complication and comorbidities	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 cardiovascular procedures with complications and comorbidities	DRG: 110
Major large and small bowel procedures	DRG: 148, 149
Major organ transplant	Px: 33.50-33.52, 33.6, 37.5, 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
OR procedures for obesity	DRG: 288
Other digestive system OR procedures with complications	DRG: 170
Other permanent cardiac pacemaker implant or PTCA with coronary artery stent implant	DRG: 116
Paraplegia	Dx: 344.1
Pathological spinal fracture	Dx: 733.13
Prostatic OR procedure unrelated to principal diagnosis	DRG: 476
PTCA/Stent	Px: 36.01, 36.02, 36.05, 36.06
Quadriplegia	Dx: 344.00 – 344.04, 344.09
Refusion	Px: 81.09 in any position (Q1-3), 81.30-81.39 (Q4)
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, 806.1x, 806.2x, 806.3x, x = 0-9; 806.4; 806.5; 806.6x, 806.7x, x = 0-2; 9, 806.8, 806.9
Spinal nerve root injury	Dx: 952.0x; 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
Spinal procedures	DRG: 004
Tracheitis	Dx: 464.10, 464.11
Tracheostomy	Px: 31.1, 31.21, 31.29
Transurethral procedures with complications and comorbidities	DRG: 310
Unspecified paralysis	Dx: 344.9

APPENDIX D: IN-HOSPITAL COMPLICATIONS FOR SURGICAL PROCEDURES

Hysterectomy

	Total Cases†			Abdominal			Vaginal		
Type of In-Hospital Complication	**#**	**%**	**Avg. LOS**	**#**	**%**	**Avg. LOS**	**#**	**%**	**Avg. LOS**
• Procedure/Medical Care Related Events	809	3.9	3.6	616	4.2	3.9	193	3.0	2.7
• Postoperative Hemorrhage	395	1.9	4.1	285	2.0	4.4	110	1.7	3.3
• Digestive System Complication	386	1.9	4.8	329	2.3	5.2	57	0.9	2.7
• Postoperative Pulmonary Compromise	360	1.7	4.1	315	2.2	4.2	45	0.7	3.1
• Postoperative Infection	133	0.6	5.7	120	0.8	5.7	13	0.2	5.8
• Postoperative Pneumonia	61	0.3	6.0	53	0.4	6.2	8	0.1	4.4
• Hypo/hypertension	51	0.2	2.8	41	0.3	3.0	10	0.2	1.8
• Postoperative Cardiac Complications	51	0.2	3.5	36	0.2	3.9	15	0.2	2.3
• Postoperative Venous Thrombosis/ Pulmonary Embolism	42	0.2	9.6	37	0.3	10.3	5	< 0.1	4.6
• Device, Implant or Graft Complication	11	< 0.1	5.7	7	< 0.1	7.6	4	< 0.1	2.5
• Postoperative Stroke/Anoxic Brain Damage	7	< 0.1	5.4	5	< 0.1	6.2	2	< 0.1	3.5
• Death	3	< 0.1	6.3	3	< 0.1	6.3	0	0.0	NA
• Gastric/Intestinal Hemorrhage or Ulceration	1	< 0.1	2.0	0	0.0	NA	1	< 0.1	2.0
With any Complication Above	***2,031***	***9.7***	***4.0***	***1,607***	***11.1***	***4.3***	***424***	***6.7***	***2.9***
Without any Complication Above	***18,829***	***90.3***	***2.4***	***12,916***	***88.9***	***2.7***	***5,913***	***93.3***	***1.8***

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

Breast Cancer Procedures

	Total Cases†			Lumpectomy			Mastectomy		
Type of In-Hospital Complication	**#**	**%**	**Avg. LOS**	**#**	**%**	**Avg. LOS**	**#**	**%**	**Avg. LOS**
• Postoperative Hemorrhage	36	1.2	4.3	11	1.2	3.1	25	1.2	4.8
• Digestive System Complication	25	0.8	3.5	5	0.5	2.0	20	0.9	3.9
• Procedure/Medical Care Related Events	25	0.8	4.7	3	0.3	2.0	22	1.0	5.0
• Postoperative Pulmonary Compromise	24	0.8	4.8	4	0.4	2.8	20	0.9	5.2
• Postoperative Infection	14	0.5	12.5	1	0.1	35.0	13	0.6	10.8
• Hypo/hypertension	13	0.4	3.5	1	0.1	1.0	12	0.6	3.8
• Postoperative Pneumonia	8	0.3	6.4	0	0.0	NA	8	0.4	6.4
• Device, Implant or Graft Complication	8	0.3	6.5	1	0.1	12.0	7	0.3	5.7
• Postoperative Cardiac Complications	8	0.3	7.3	0	0.0	NA	8	0.4	7.3
• Postoperative Venous Thrombosis/ Pulmonary Embolism	5	0.2	6.8	2	0.2	4.5	3	0.1	8.3
• Death	2	< 0.1	1.0	0	0.0	NA	2	< 0.1	1.0
• Postoperative Stroke/Anoxic Brain Damage	1	< 0.1	9.0	0	0.0	NA	1	< 0.1	9.0
• Lymphedema	0	0.0	NA	0	0.0	NA	0	0.0	NA
• Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA	0	0.0	NA	0	0.0	NA
With any Complication Above	***147***	***4.8***	***4.9***	***26***	***2.7***	***4.2***	***121***	***5.7***	***5.0***
Without any Complication Above	***2,931***	***95.2***	***2.0***	***925***	***97.3***	***1.2***	***2,006***	***94.3***	***2.3***

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

Neck and Back Procedures

Type of In-Hospital Complication	Total Cases[†]			With Fusion			Without Fusion		
	#	%	Avg. LOS	#	%	Avg. LOS	#	%	Avg. LOS
• Procedure/Medical Care Related Events	427	2.5	4.0	167	2.7	4.8	260	2.3	3.5
• Digestive System Complication	129	0.8	4.6	72	1.2	5.2	57	0.5	3.7
• Postoperative Stroke/Anoxic Brain Damage	99	0.6	5.3	38	0.6	7.5	61	0.5	4.0
• Postoperative Pulmonary Compromise	97	0.6	7.3	61	1.0	7.8	36	0.3	6.5
• Postoperative Hemorrhage	73	0.4	5.6	39	0.6	6.0	34	0.3	5.1
• Postoperative Cardiac Complications	38	0.2	5.1	18	0.3	5.8	20	0.2	4.5
• Device, Implant or Graft Complication	33	0.2	4.3	25	0.4	4.6	8	< 0.1	3.3
• Hypo/hypertension	31	0.2	3.6	15	0.2	4.7	16	0.1	2.6
• Postoperative Infection	24	0.1	11.0	16	0.3	10.9	8	< 0.1	11.4
• Postoperative Pneumonia	21	0.1	7.7	13	0.2	8.0	8	< 0.1	7.3
• Postoperative Venous Thrombosis/ Pulmonary Embolism	13	< 0.1	12.2	7	0.1	9.4	6	< 0.1	15.5
• Death	6	< 0.1	5.8	3	< 0.1	4.7	3	< 0.1	7.0
• Gastric/Intestinal Hemorrhage or Ulceration	2	< 0.1	23.5	2	< 0.1	23.5	0	0.0	NA
With any Complication Above	***881***	***5.1***	***4.6***	***408***	***6.7***	***5.5***	***473***	***4.3***	***3.8***
Without any Complication Above	***16,307***	***94.9***	***1.9***	***5,683***	***93.3***	***2.3***	***10,62***	***95.7***	***1.7***

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

Prostatectomy

Type of In-Hospital Complication	Total Cases[†]		
	#	%	Avg. LOS
• Digestive System Complication	67	3.1	5.4
• Procedure/Medical Care Related Events	60	2.8	4.8
• Postoperative Hemorrhage	38	1.8	3.9
• Postoperative Pulmonary Compromise	26	1.2	5.7
• Postoperative Cardiac Complications	23	1.1	5.6
• Hypo/hypertension	10	0.5	3.4
• Postoperative Venous Thrombosis/ Pulmonary Embolism	9	0.4	6.7
• Postoperative Pneumonia	8	0.4	9.5
• Device, Implant or Graft Complication	5	0.2	6.2
• Postoperative Infection	4	0.2	8.5
• Death	3	0.1	5.0
• Gastric/Intestinal Hemorrhage or Ulceration	2	< 0.1	5.5
• Postoperative Stroke/Anoxic Brain Damage	2	< 0.1	6.0
With any Complication Above	***223***	***10.3***	***4.8***
Without any Complication Above	***1,944***	***89.7***	***3.1***

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

Definition of In-Hospital Complication for Hysterectomy

Type of Complication	ICD.9.CM Code
Procedure/Medical Care Related Events	
ABO incompatibility reaction	999.6
accidental puncture or laceration during a procedure	998.2
acute reaction to foreign substance accidentally left during a procedure	998.7
disruption of operation wound	998.3
foreign body accidentally left during a procedure	998.4
malignant hyperthermia (e.g. due to anesthesia)	995.86
non-healing surgical wound	998.83
other and unspecified complications of medical care, not elsewhere classified	999.9
other specified adverse effects, not elsewhere classified (e.g. hypothermia due to anesthesia).	995.89
other specified complications of procedures	998.89
other transfusion reaction	999.8
other vascular complications (e.g. following infusion, perfusion, or transfusion)	999.2
persistent postoperative fistula	998.6
postoperative shock	998.0
Rh incompatibility reaction	999.7
shock due to anesthesia	995.4
unspecified complication of procedure, not elsewhere classified	998.9
Digestive System Complications	
digestive system complications (e.g. hepatic failure, intestinal obstruction)	997.4
Postoperative Pulmonary Compromise	
acute and chronic respiratory failure	518.84
acute edema of lung, unspecified	518.4
acute respiratory failure	518.81
allergic bronchopulmonary aspergillosis	518.6
emphysema (subcutaneous) (surgical) resulting from a procedure	998.81
iatrogenic pneumothorax	512.1
mediastinal tracheostomy	31.21 (procedure)
other permanent tracheostomy	31.29 (procedure)
other pulmonary insufficiency, not elsewhere classified	518.82
pulmonary congestion and hypostasis	514
pulmonary insufficiency following trauma & surgery	518.5
respiratory complications (e.g. aspiration pneumonia, Mendelson's syndrome)	997.3
temporary tracheostomy	31.1 (procedure)
Postoperative Hemorrhage	
control of hemorrhage, not otherwise specified	39.98 (procedure)
control of (postoperative) hemorrhage of bladder	57.93 (procedure)
hemorrhage complicating a procedure	998.11
hematoma complicating a procedure	998.12
seroma complicating a procedure	998.13
In-Hospital Death	
discharge status of 20 (expired)	NA

Definition of In-Hospital Complication for Hysterectomy **continued**

Type of Complication	ICD.9.CM Code
Postoperative Infection	
infected postoperative seroma	998.51
infection and inflammatory reaction due to indwelling urinary catheter	996.64
infection and inflammatory reaction due to unspecified device, implant and graft	996.60
infection and inflammatory reaction due to vascular device, implant and graft	996.62
infection due to other genitourinary device, implant and graft	996.65
other infection	999.3
other postoperative infection	998.59
septicemia	038.0-038.9
Postoperative Pneumonia (coded by causative organism)	
Anaerobes	482.81
bacterial pneumonia unspecified	482.9
bronchopneumonia, organism unspecified	485
Chlamydia	483.1
Escherichia coli	482.82
Hemophilus influenzae	482.2
Klebsiella pneumoniae	482.0
Legionnaires' disease	482.84
Mycoplasma pneumoniae	483.0
other gram-negative bacteria	482.83
other specified bacteria	482.89
other specified organism	483.8
pneumonia, organism unspecified	486
Pneumococcal pneumonia (Streptococcus pneumoniae pneumonia)	481
Pseudomonas	482.1
Staphylococcus (aureus, unspecified, other)	482.40-482.49
Streptococcus (Group A, Group B, unspecified, other)	482.30-482.39
Postoperative Cardiac Complications	
acute myocardial infarction after surgery – initial episode of care only	410.x1, x = 0-9
cardiac complications (e.g. cardiac arrest, heart failure)	997.1
Postoperative Venous Thrombosis/Pulmonary Embolism	
air embolism	999.1
iatrogenic pulmonary embolism and infarction	415.11
other pulmonary embolism and infarction	415.19
other venous embolism and thrombosis of other specified veins	453.8
peripheral vascular complications	997.2
phlebitis and thrombophlebitis of femoral vein (deep) (superficial)	451.11
phlebitis and thrombophlebitis of iliac vein	451.81
phlebitis and thrombophlebitis of other deep vessels of lower extremities	451.19
vascular complications of mesenteric artery	997.71
vascular complications of other vessels	997.79
Hypo/Hypertension	
hypertension, not elsewhere classified	997.91
iatrogenic hypotension	458.2

Definition of In-Hospital Complication for Hysterectomy continued

Type of Complication	**ICD.9.CM Code**
Postoperative Stroke/Anoxic Brain Damage	
acute, but ill-defined cerebrovascular disease	436
anoxic brain damage	348.1
central nervous system complications (e.g. anoxic brain damage, cerebral hypoxia)	997.01
iatrogenic cerebrovascular infarction or hemorrhage	997.02
intracerebral hemorrhage	431
nervous system complication, unspecified	997.00
occlusion and stenosis of precerebral arteries	433.x1, x = 0-3, 8, 9
occlusion of cerebral arteries	434.x1, x = 0, 1, 9
other and unspecified intracranial hemorrhage	432.0 – 432.9
other nervous system complications	997.09
subarachnoid hemorrhage	430
Device, Implant or Graft Complications	
mechanical complication due to urethral (indwelling) catheter	996.31
mechanical complication of other genitourinary device, implant, and graft	996.39
mechanical complication of unspecified genitourinary device, implant, and graft	996.30
other complications due to genitourinary device, implant and graft	996.76
other complications due to vascular device, implant and graft	996.74
Gastric/Intestinal Hemorrhage or Ulceration	
control of (postoperative) hemorrhage of anus	49.95 (procedure)
duodenal ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	532.00-532.21
duodenal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	532.60-532.61
duodenal ulcer chronic or unspecified with hemorrhage with or without obstruction	532.40-532.41
gastric ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	531.00-531.21
gastric ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	531.60-531.61
gastric ulcer chronic or unspecified with hemorrhage with or without obstruction	531.40-531.41
gastrojejunal ulcer acute with hemorrhage, perforation or hemorrhage and perforation with or without obstruction	534.00-534.21
gastrojejunal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	534.60-534.61
gastrojejunal ulcer chronic or unspecified with hemorrhage with or without obstruction	534.40-534.41
hemorrhage of gastrointestinal tract, unspecified	578.9
peptic ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	533.00-533.21
peptic ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	533.60-533.61
peptic ulcer chronic or unspecified with hemorrhage with or without obstruction	533.40-533.41

Definition of In-Hospital Complication for Breast Cancer Procedures

Type of Complication	ICD.9.CM Code
Procedure/Medical Care Related Events	
ABO incompatibility reaction	999.6
accidental puncture or laceration during a procedure	998.2
acute reaction to foreign substance accidentally left during a procedure	998.7
disruption of operation wound	998.3
foreign body accidentally left during a procedure	998.4
malignant hyperthermia (e.g. due to anesthesia)	995.86
non-healing surgical wound	998.83
other and unspecified complications of medical care, not elsewhere classified	999.9
other specified adverse effects, not elsewhere classified (e.g. hypothermia due to anesthesia).	995.89
other specified complications of procedures	998.89
other transfusion reaction	999.8
other vascular complications (e.g. following infusion, perfusion, or transfusion)	999.2
persistent postoperative fistula	998.6
postoperative shock	998.0
Rh incompatibility reaction	999.7
shock due to anesthesia	995.4
unspecified complication of procedure, not elsewhere classified	998.9
Digestive System Complications	
digestive system complications (e.g. hepatic failure, intestinal obstruction)	997.4
Postoperative Pulmonary Compromise	
acute and chronic respiratory failure	518.84
acute edema of lung, unspecified	518.4
acute respiratory failure	518.81
allergic bronchopulmonary aspergillosis	518.6
emphysema (subcutaneous) (surgical) resulting from a procedure	998.81
iatrogenic pneumothorax	512.1
other permanent tracheostomy	31.29 (procedure)
other pulmonary insufficiency, not elsewhere classified	518.82
mediastinal tracheostomy	31.21 (procedure)
pulmonary congestion and hypostasis	514
pulmonary insufficiency following trauma & surgery	518.5
respiratory complications (e.g. aspiration pneumonia, Mendelson's syndrome)	997.3
temporary tracheostomy	31.1 (procedure)
Lymphedema	
postmastectomy lymphedema syndrome	457.0
Postoperative Hemorrhage	
control of hemorrhage, not otherwise specified	39.98 (procedure)
hemorrhage complicating a procedure	998.11
hematoma complicating a procedure	998.12
seroma complicating a procedure	998.13
In-Hospital Death	
discharge status of 20 (expired)	NA

Definition of In-Hospital Complication for Breast Cancer Procedures continued

Type of Complication	ICD.9.CM Code
Postoperative Infection	
infected postoperative seroma	998.51
infection and inflammatory reaction due to indwelling urinary catheter	996.64
infection and inflammatory reaction due to unspecified device, implant and graft	996.60
infection and inflammatory reaction due to vascular device, implant and graft	996.62
infection due to other internal prosthetic device, implant and graft	996.69
other infection	999.3
other postoperative infection	998.59
septicemia	038.0–038.9
Postoperative Pneumonia (coded by causative organism)	
anaerobes	482.81
bacterial pneumonia unspecified	482.9
bronchopneumonia, organism unspecified	485
Chlamydia	483.1
Escherichia coli	482.82
Hemophilus influenzae	482.2
Klebsiella pneumoniae	482.0
Legionnaires' disease	482.84
Mycoplasma pneumoniae	483.0
other gram-negative bacteria	482.83
other specified bacteria	482.89
other specified organism	483.8
pneumonia, organism unspecified	486
Pneumococcal pneumonia (Streptococcus pneumoniae pneumonia)	481
Pseudomonas	482.1
Staphylococcus (aureus, unspecified, other)	482.40-482.49
Streptococcus (Group A, Group B, unspecified, other)	482.30-482.39
Postoperative Cardiac Complications	
acute myocardial infarction after surgery – initial episode of care only	410.x1, x = 0 - 9
cardiac complications (e.g. cardiac arrest, heart failure)	997.1
Postoperative Venous Thrombosis/Pulmonary Embolism	
air embolism	999.1
iatrogenic pulmonary embolism and infarction	415.11
other pulmonary embolism and infarction	415.19
other venous embolism and thrombosis of other specified veins	453.8
peripheral vascular complications	997.2
phlebitis and thrombophlebitis of femoral vein (deep) (superficial)	451.11
phlebitis and thrombophlebitis of iliac vein	451.81
phlebitis and thrombophlebitis of other deep vessels of lower extremities	451.19
vascular complications of mesenteric artery	997.71
vascular complications of other vessels	997.79
Hypo/Hypertension	
hypertension, not elsewhere classified	997.91
iatrogenic hypotension	458.2

Definition of In-Hospital Complication for Breast Cancer Procedures continued

Type of Complication	ICD.9.CM Code
Postoperative Stroke/Anoxic Brain Damage	
acute, but ill-defined cerebrovascular disease	436
anoxic brain damage	348.1
central nervous system complications (e.g. anoxic brain damage, cerebral hypoxia)	997.01
iatrogenic cerebrovascular infarction or hemorrhage	997.02
intracerebral hemorrhage	431
nervous system complication, unspecified	997.00
occlusion and stenosis of precerebral arteries	433.x1, x = 0-3, 8, 9
occlusion of cerebral arteries	434.x1, x = 0, 1, 9
other and unspecified intracranial hemorrhage	432.0 – 432.9
other nervous system complications	997.09
subarachnoid hemorrhage	430
Device, Implant or Graft Complications	
mechanical complication due to artificial skin graft and decellularized allodermis	996.55
mechanical complication due to breast prosthesis	996.54
mechanical complication due to graft of other tissue, not elsewhere classified	996.52
mechanical complication due to urethral (indwelling) catheter	996.31
other complication due to other internal prosthetic device, implant and graft	996.79
other complication due to unspecified device, implant and graft	996.70
other complication due to vascular device, implant and graft	996.74
Gastric/Intestinal Hemorrhage or Ulceration	
duodenal ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	532.00-532.21
duodenal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	532.60-532.61
duodenal ulcer chronic or unspecified with hemorrhage with or without obstruction	532.40-532.41
gastric ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	531.00-531.21
gastric ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	531.60-531.61
gastric ulcer chronic or unspecified with hemorrhage with or without obstruction	531.40-531.41
gastrojejunal ulcer acute with hemorrhage, perforation or hemorrhage and perforation with or without obstruction	534.00-534.21
gastrojejunal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	534.60-534.61
gastrojejunal ulcer chronic or unspecified with hemorrhage with or without obstruction	534.40-534.41
hemorrhage of gastrointestinal tract, unspecified	578.9
peptic ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	533.00-533.21
peptic ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	533.60-533.61
peptic ulcer chronic or unspecified with hemorrhage with or without obstruction	533.40-533.41

Definition of In-Hospital Complication for Neck and Back Procedures

Type of Complication	**ICD.9.CM Code**
Procedure/Medical Care Related Events	
ABO incompatibility reaction	999.6
accidental puncture or laceration during a procedure	998.2
acute reaction to foreign substance accidentally left during a procedure	998.7
disruption of operation wound	998.3
foreign body accidentally left during a procedure	998.4
malignant hyperthermia (e.g. due to anesthesia)	995.86
non-healing surgical wound	998.83
other and unspecified complications of medical care, not elsewhere classified	999.9
other specified adverse effects, not elsewhere classified (e.g. hypothermia due to anesthesia)	995.89
other specified complications of procedures	998.89
other transfusion reaction	999.8
other vascular complications (e.g. following infusion, perfusion, or transfusion)	999.2
persistent postoperative fistula	998.6
postoperative shock	998.0
Rh incompatibility reaction	999.7
shock due to anesthesia	995.4
unspecified complication of procedure, not elsewhere classified	998.9
Digestive System Complications	
digestive system complications (e.g. hepatic failure, intestinal obstruction)	997.4
Postoperative Pulmonary Compromise	
acute and chronic respiratory failure	518.84
acute edema of lung, unspecified	518.4
acute respiratory failure	518.81
allergic bronchopulmonary aspergillosis	518.6
emphysema (subcutaneous) (surgical) resulting from a procedure	998.81
iatrogenic pneumothorax	512.1
other permanent tracheostomy	31.29 (procedure)
other pulmonary insufficiency, not elsewhere classified	518.82
mediastinal tracheostomy	31.21 (procedure)
pulmonary congestion and hypostasis	514
pulmonary insufficiency following trauma & surgery	518.5
respiratory complications (e.g. aspiration pneumonia, Mendelson's syndrome)	997.3
temporary tracheostomy	31.1 (procedure)
Postoperative Hemorrhage	
control of hemorrhage, not otherwise specified	39.98 (procedure)
hemorrhage complicating a procedure	998.11
hematoma complicating a procedure	998.12
seroma complicating a procedure	998.13
In-Hospital Death	
discharge status of 20 (expired)	NA

Definition of In-Hospital Complication for Neck and Back Procedures continued

Type of Complication	ICD.9.CM Code
Postoperative Infection	
infected postoperative seroma	998.51
infection and inflammatory reaction due to indwelling urinary catheter	996.64
infection and inflammatory reaction due internal joint prosthesis	996.66
infection and inflammatory reaction due to nervous system device, implant and graft	996.63
infection and inflammatory reaction due to other internal orthopedic device, implant and graft	996.67
infection and inflammatory reaction due to vascular device, implant and graft	996.62
other infection	999.3
other postoperative infection	998.59
septicemia	038.0–038.9
Postoperative Pneumonia (coded by causative organism)	
anaerobes	482.81
bacterial pneumonia unspecified	482.9
bronchopneumonia, organism unspecified	485
Chlamydia	483.1
Escherichia coli	482.82
Hemophilus influenzae	482.2
Klebsiella pneumoniae	482.0
Legionnaires' disease	482.84
Mycoplasma pneumoniae	483.0
other gram-negative bacteria	482.83
other specified bacteria	482.89
other specified organism	483.8
pneumonia, organism unspecified	486
Pneumococcal pneumonia (Streptococcus pneumoniae pneumonia)	481
Pseudomonas	482.1
Staphylococcus (aureus, unspecified, other)	482.40-482.49
Streptococcus (Group A, Group B, unspecified, other)	482.30-482.39
Postoperative Cardiac Complications	
acute myocardial infarction after surgery – initial episode of care only	410.x1, x = 0 - 9
cardiac complications (e.g. cardiac arrest, heart failure)	997.1
Postoperative Venous Thrombosis/Pulmonary Embolism	
air embolism	999.1
iatrogenic pulmonary embolism and infarction	415.11
other pulmonary embolism and infarction	415.19
other venous embolism and thrombosis of other specified veins	453.8
peripheral vascular complications	997.2
phlebitis and thrombophlebitis of femoral vein (deep) (superficial)	451.11
phlebitis and thrombophlebitis of iliac vein	451.81
phlebitis and thrombophlebitis of other deep vessels of lower extremities	451.19
vascular complications of mesenteric artery	997.71
vascular complications of other vessels	997.79
Hypo/Hypertension	
hypertension, not elsewhere classified	997.91
iatrogenic hypotension	458.2

Definition of In-Hospital Complication for Neck and Back Procedures continued

Type of Complication	ICD.9.CM Code
Postoperative Stroke/Anoxic Brain Damage	
acute, but ill-defined cerebrovascular disease	436
anoxic brain damage	348.1
central nervous system complications (e.g. anoxic brain damage, cerebral hypoxia)	997.01
iatrogenic cerebrovascular infarction or hemorrhage	997.02
intracerebral hemorrhage	431
nervous system complication, unspecified	997.00
occlusion and stenosis of precerebral arteries	433.x1, x = 0-3, 8, 9
occlusion of cerebral arteries	434.x1, x = 0, 1, 9
other and unspecified intracranial hemorrhage	432.0–432.9
other nervous system complications	997.09
subarachnoid hemorrhage	430
Device, Implant or Graft Complications	
mechanical complication due to graft of other tissue, not elsewhere classified	996.52
mechanical complication due to urethral (indwelling) catheter	996.31
mechanical complication of internal orthopedic device, implant and graft	996.4
other complication due to internal joint prosthesis	996.77
other complication due to nervous system device, implant and graft	996.75
other complication due to other internal orthopedic device, implant and graft	996.78
other complication due to vascular device, implant and graft	996.74
Gastric/Intestinal Hemorrhage or Ulceration	
duodenal ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	532.00-532.21
duodenal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	532.60-532.61
duodenal ulcer chronic or unspecified with hemorrhage with or without obstruction	532.40-532.41
gastric ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	531.00-531.21
gastric ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	531.60-531.61
gastric ulcer chronic or unspecified with hemorrhage with or without obstruction	531.40-531.41
gastrojejunal ulcer acute with hemorrhage, perforation or hemorrhage and perforation with or without obstruction	534.00-534.21
gastrojejunal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	534.60-534.61
gastrojejunal ulcer chronic or unspecified with hemorrhage with or without obstruction	534.40-534.41
hemorrhage of gastrointestinal tract, unspecified	578.9
peptic ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	533.00-533.21
peptic ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	533.60-533.61
peptic ulcer chronic or unspecified with hemorrhage with or without obstruction	533.40-533.41

Definition of In-Hospital Complication for Prostatectomy

Type of Complication	ICD.9.CM Code
Procedure/Medical Care Related Events	
ABO incompatibility reaction	999.6
accidental puncture or laceration during a procedure	998.2
acute reaction to foreign substance accidentally left during a procedure	998.7
disruption of operation wound	998.3
foreign body accidentally left during a procedure	998.4
malignant hyperthermia (e.g. due to anesthesia)	995.86
non-healing surgical wound	998.83
other and unspecified complications of medical care, not elsewhere classified	999.9
other specified adverse effects, not elsewhere classified (e.g. hypothermia due to anesthesia)	995.89
other specified complications of procedures	998.89
other transfusion reaction	999.8
other vascular complications (e.g. following infusion, perfusion, or transfusion)	999.2
persistent postoperative fistula	998.6
postoperative shock	998.0
Rh incompatibility reaction	999.7
shock due to anesthesia	995.4
unspecified complication of procedure, not elsewhere classified	998.9
Digestive System Complications	
digestive system complications (e.g. hepatic failure, intestinal obstruction)	997.4
Postoperative Pulmonary Compromise	
acute and chronic respiratory failure	518.84
acute edema of lung, unspecified	518.4
acute respiratory failure	518.81
allergic bronchopulmonary aspergillosis	518.6
emphysema (subcutaneous) (surgical) resulting from a procedure	998.81
iatrogenic pneumothorax	512.1
mediastinal tracheostomy	31.21 (procedure)
other permanent tracheostomy	31.29 (procedure)
other pulmonary insufficiency, not elsewhere classified	518.82
pulmonary congestion and hypostasis	514
pulmonary insufficiency following trauma & surgery	518.5
respiratory complications (e.g. aspiration pneumonia, Mendelson's syndrome)	997.3
temporary tracheostomy	31.1 (procedure)
Postoperative Hemorrhage	
control of hemorrhage, not otherwise specified	39.98 (procedure)
control of (postoperative) hemorrhage of bladder	57.93 (procedure)
hemorrhage complicating a procedure	998.11
hematoma complicating a procedure	998.12
seroma complicating a procedure	998.13
In-Hospital Death	
discharge status of 20 (expired)	NA

Definition of In-Hospital Complication for Prostatectomy continued

Type of Complication	**ICD.9.CM Code**
Postoperative Infection	
infected postoperative seroma	998.51
infection and inflammatory reaction due to indwelling urinary catheter	996.64
infection and inflammatory reaction due to unspecified device, implant and graft	996.60
infection and inflammatory reaction due to vascular device, implant and graft	996.62
infection due to other genitourinary device, implant and graft	996.65
other infection	999.3
other postoperative infection	998.59
septicemia	038.0-038.9
Postoperative Pneumonia (coded by causative organism)	
Anaerobes	482.81
bacterial pneumonia unspecified	482.9
bronchopneumonia, organism unspecified	485
Chlamydia	483.1
Escherichia coli	482.82
Hemophilus influenzae	482.2
Klebsiella pneumoniae	482.0
Legionnaires' disease	482.84
Mycoplasma pneumoniae	483.0
other gram-negative bacteria	482.83
other specified bacteria	482.89
other specified organism	483.8
pneumonia, organism unspecified	486
Pneumococcal pneumonia (Streptococcus pneumoniae pneumonia)	481
Pseudomonas	482.1
Staphylococcus (aureus, unspecified, other)	482.40-482.49
Streptococcus (Group A, Group B, unspecified, other)	482.30-482.39
Postoperative Cardiac Complications	
acute myocardial infarction after surgery – initial episode of care only	410.x1, x = 0-9
cardiac complications (e.g. cardiac arrest, heart failure)	997.1
Postoperative Venous Thrombosis/Pulmonary Embolism	
air embolism	999.1
iatrogenic pulmonary embolism and infarction	415.11
other pulmonary embolism and infarction	415.19
other venous embolism and thrombosis of other specified veins	453.8
peripheral vascular complications	997.2
phlebitis and thrombophlebitis of femoral vein (deep) (superficial)	451.11
phlebitis and thrombophlebitis of iliac vein	451.81
phlebitis and thrombophlebitis of other deep vessels of lower extremities	451.19
vascular complications of mesenteric artery	997.71
vascular complications of other vessels	997.79
Hypo/Hypertension	
hypertension, not elsewhere classified	997.91
iatrogenic hypotension	458.2

Definition of In-Hospital Complication for Prostatectomy continued

Type of Complication	ICD.9.CM Code
Postoperative Stroke/Anoxic Brain Damage	
acute, but ill-defined cerebrovascular disease	436
anoxic brain damage	348.1
central nervous system complications (e.g. anoxic brain damage, cerebral hypoxia)	997.01
iatrogenic cerebrovascular infarction or hemorrhage	997.02
intracerebral hemorrhage	431
nervous system complication, unspecified	997.00
occlusion and stenosis of precerebral arteries	433.x1, x = 0-3, 8, 9
occlusion of cerebral arteries	434.x1, x = 0, 1, 9
other and unspecified intracranial hemorrhage	432.0 – 432.9
other nervous system complications	997.09
subarachnoid hemorrhage	430
Device, Implant or Graft Complications	
mechanical complication due to urethral (indwelling) catheter	996.31
mechanical complication of other genitourinary device, implant, and graft	996.39
mechanical complication of unspecified genitourinary device, implant, and graft	996.30
other complications due to genitourinary device, implant and graft	996.76
other complications due to vascular device, implant and graft	996.74
Gastric/Intestinal Hemorrhage or Ulceration	
control of (postoperative) hemorrhage of anus	49.95 (procedure)
duodenal ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	532.00-532.21
duodenal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	532.60-532.61
duodenal ulcer chronic or unspecified with hemorrhage with or without obstruction	532.40-532.41
gastric ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	531.00-531.21
gastric ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	531.60-531.61
gastric ulcer chronic or unspecified with hemorrhage with or without obstruction	531.40-531.41
gastrojejunal ulcer acute with hemorrhage, perforation or hemorrhage and perforation with or without obstruction	534.00-534.21
gastrojejunal ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	534.60-534.61
gastrojejunal ulcer chronic or unspecified with hemorrhage with or without obstruction	534.40-534.41
hemorrhage of gastrointestinal tract, unspecified	578.9
peptic ulcer acute with hemorrhage, perforation, or hemorrhage and perforation with or without obstruction	533.00-533.21
peptic ulcer chronic or unspecified with hemorrhage and perforation with or without obstruction	533.60-533.61
peptic ulcer chronic or unspecified with hemorrhage with or without obstruction	533.40-533.41

APPENDIX E: RISK FACTORS

Pediatric Ear, Nose and Throat Infections Cases age 0 through 17		
Hospitalization Rate	**HMO Inpatient Cases* (N = 661)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	407	61.6%
5 –17 years	254	38.4%
• Sex		
Female	255	38.6%
Male	406	61.4%
**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 = 515)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	362	70.3%
45 – 64 years	153	29.7%
• Sex		
Female	290	56.3%
Male	225	43.7%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

High Blood Pressure (Hypertension) Cases age 18 through 64		
Hospitalization Rate	**HMO Inpatient Cases* (N = 477)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	125	26.2%
45 – 64 years	352	73.8%
• Sex		
Female	256	53.7%
Male	221	46.3%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Gastrointestinal Infections Cases age 0 through 64		
Hospitalization Rate	**HMO Inpatient Cases* (N = 1,184)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	181	15.3%
5 – 17 years	175	14.8%
18 – 44 years	454	38.3%
45 – 64 years	374	31.6%
• Sex		
Female	712	60.1%
Male	472	39.9%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Kidney/Urinary Tract Infections Cases age 0 through 64		
Hospitalization Rate	**HMO Inpatient Cases* (N = 1,460)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	192	13.2%
5 – 17 years	159	10.9%
18 – 44 years	599	41.0%
45 – 64 years	510	34.9%
• Sex		
Female	1,171	80.2%
Male	289	19.8%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Chronic Obstructive Pulmonary Disease

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,077)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	106	9.8%
45 – 64 years	971	90.2%
• Sex		
Female	620	57.6%
Male	457	42.4%
**Cases after hospitalization rate exclusions comparative reference = HMO database*		

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,584)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes*™ PredLOS			
0 - 3.816 days	316	19.9%	3.1
3.817 - 4.237 days	317	20.0%	3.6
4.238 - 4.621 days	318	20.1%	3.9
4.622 - 5.097 days	317	20.0%	4.2
5.098 + days	316	19.9%	4.7
• Psychological Disorder			
No	1,296	81.8%	3.8
Yes	288	18.2%	4.3
• Age			
18 – 49 years	310	19.6%	3.4
50 – 54 years	303	19.1%	3.7
55 – 58 years	344	21.7%	4.1
59 - 61 years	319	20.1%	4.2
62 - 64 years	308	19.4%	4.1
**Cases after LOS exclusions comparative reference = HMO and fee-for-service combined database*			

Percent Rehospitalized (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,547)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes*™ PredLOS			
0 - 3.816 days	307	19.8%	13.7%
3.817 - 4.233 days	311	20.1%	14.5%
4.234 - 4.625 days	311	20.1%	19.3%
4.626 - 5.097 days	309	20.0%	28.5%
5.098 + days	309	20.0%	25.2%
• Psychological Disorder			
No	1,264	81.7%	18.6%
Yes	283	18.3%	27.6%
• Poverty Rate			
0 - 5.2768%	311	20.1%	18.3%
5.2769 - 8.0680%	311	20.1%	18.6%
8.0681 - 11.1080%	306	19.8%	20.6%
11.1081 - 15.4494%	309	20.0%	21.4%
15.4495% +	310	20.0%	22.3%
• Age			
18 – 49 years	302	19.5%	15.9%
50 – 54 years	295	19.1%	20.7%
55 – 58 years	335	21.7%	20.0%
59 - 61 years	313	20.2%	21.7%
62 - 64 years	302	19.5%	22.8%
• *Age-squared*			
**Cases after rehospitalization exclusions; comparative reference = HMO and fee-for-service combined database.*			

LOS	**Rehosp**	***Risk Factors Tested for Length of Stay and % Rehospitalized*** *(S = Significant; NS = Not significant)*
S	S	• Age
NS	S	• Age-squared
NS	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes*™ Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	NS	• Diabetes (no, yes; 250.0x-250.9x)
NS	NS	• Female (no, yes)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• High poverty (high, average, very high; based on zip code)
NS	NS	• Low income (low, average, very low; based on zip code)
NS	NS	• Median household income (based on zip code)
NS	S	• Poverty rate (based on zip code)
S	S	• Psychological disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
NS	NS	• Race (Black, Other, White)
NS	NS	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)
NS	NS	• Tobacco use (no, yes; 305.1, V15.82)

Pediatric Asthma

Cases age 0 through 17

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,582)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	760	48.0%
5 – 17 years	822	52.0%
• Sex		
Female	588	37.2%
Male	994	62.8%

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

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,052)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes*™ PredLOS			
0 - 1.860 days	410	20.0%	1.7
1.861 - 1.981 days	401	19.5%	1.9
1.982 - 2.112 days	427	20.8%	1.8
2.113 - 2.280 days	406	19.8%	2.2
2.281 + days	408	19.9%	2.4
• Median Household Income			
$ 0 – 29,629	412	20.1%	2.1
$ 29,630 – 35,139	408	19.9%	2.0
$ 35,140 – 41,400	410	20.0%	2.0
$ 41,401 – 51,180	408	19.9%	2.0
$ 51,181 +	414	20.2%	1.9
• Asthma Type			
No	362	17.6%	1.8
Yes	1,690	82.4%	2.0

**Cases after LOS exclusions; comparative reference = HMO and fee-for-service combined database*

LOS	***Risk Factors Tested for LOS** (S = Significant; NS = Not significant)*
NS	• Age
NS	• Age-squared
S	• Asthma type (no, yes; w/ status asthmaticus/acute exacerbation – 493.0x-493.9x, x=1,2, w/out status asthmaticus – 493.0x-493.9x, x=0)
S	• *Atlas Outcomes*™ Predicted length of stay ((MqPredLOS)
NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	• Female (no, yes)
S	• Median household income (based on zip code)
NS	• Poverty rate (based on zip code)
NS	• Race (Black, Other, White)

Adult Asthma

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,823)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	899	49.3%
45 – 64 years	924	50.7%
• Sex		
Female	1,396	76.6%
Male	427	23.4%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,415)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes*™ PredLOS			
0 - 2.735 days	480	19.9%	2.5
2.736 - 3.063 days	486	20.1%	2.8
3.064 - 3.376 days	484	20.0%	3.1
3.377 - 3.823 days	483	20.0%	3.5
3.824 + days	482	20.0%	3.7
• Diabetes			
No	2,130	88.2%	3.0
Yes	285	11.8%	3.8
• Psychological Disorder			
No	2,055	85.1%	3.1
Yes	360	14.9%	3.5
• Female			
No	598	24.8%	2.9
Yes	1,817	75.2%	3.2
• Age			
18 – 32 years	466	19.3%	2.6
33 – 40 years	437	18.1%	2.9
41 – 48 years	607	25.1%	3.3
49 - 54 years	448	18.6%	3.3
55 - 64 years	457	18.9%	3.5
**Cases after LOS exclusions; comparative reference = HMO and fee-for-service combined database*			

Percent Rehospitalized (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,346)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes*™ PredLOS			
0 - 2.743 days	468	19.9%	12.2%
2.744 - 3.068 days	470	20.0%	11.9%
3.069 - 3.383 days	470	20.0%	14.7%
3.384 - 3.829 days	469	20.0%	15.4%
3.830 + days	469	20.0%	18.6%
• Alcohol and Drug Abuse			
No	2,308	98.4%	14.3%
Yes	38	1.6%	31.6%
• Median Household Income			
$0 - 29,549	466	19.9%	16.5%
$29,550 - 34,629	484	20.6%	15.3%
$34,630 - 39,770	450	19.2%	14.9%
$39,771 - 49,650	480	20.5%	11.7%
$49,651 +	466	19.9%	14.4%
• Asthma Type			
No	695	29.6%	12.8%
Yes	1,651	70.4%	15.3%
**Cases after rehospitalization exclusions; comparative reference = HMO and fee-for-service combined database*			

Adult Asthma **continued**

LOS	***Rehosp***	***Risk Factors Tested for Length of Stay and % Rehospitalized*** *(S = Significant; NS = Not significant)*
S	NS	• Age
NS	NS	• Age-squared
NS	S	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes™* Predicted length of stay ((MqPredLOS)
NS	NS	• *Atlas Outcomes™* Predicted probability of death (MqPredDeath)
NS	S	• Asthma type (no, yes; w/ status asthmaticus/acute exacerbation – 493.0x-493.9x, x=1,2, w/out status asthmaticus – 493.0x-493.9x, x=0)
NS	NS	• Chronic obstructive asthma (no, yes; 493.20-493.22)
S	NS	• Diabetes (no, yes; 250.0x-250.9x)
S	NS	• Female (no, yes)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	S	• Median household income (based on zip code)
NS	NS	• Poverty rate (based on zip code)
S	NS	• Psychological disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
NS	NS	• Race (Black, Other, White)
NS	NS	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)
NS	NS	• Tobacco use (no, yes; 305.1, V15.82)

Diabetes

Cases age 18 through 75

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,397)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 25 years	102	7.3%
26 – 35 years	145	10.4%
36 – 45 years	296	21.2%
46 – 55 years	431	30.9%
56 – 65 years	365	26.1%
66 – 75 years	58	4.2%
• Sex		
Female	593	42.4%
Male	804	57.6%

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

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,328)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes*™ PredLOS			
0 - 2.754 days	465	20.0%	2.3
2.755 - 3.545 days	464	19.9%	2.9
3.546 – 4.588 days	468	20.1%	3.8
4.589 – 6.194 days	466	20.0%	5.4
6.195 + days	465	20.0%	7.9
• Medical DRG			
No	532	22.9%	8.1
Yes	1,796	77.1%	3.4
• Lower extremity amputation—non-traumatic)			
No	2,083	89.5%	3.9
Yes	245	10.5%	9.2
• Heart Failure			
No	2,148	92.3%	4.3
Yes	180	7.7%	7.0
• Cardiomyopathy			
No	2,283	98.1%	4.4
Yes	45	1.9%	8.2
• Renal Failure			
No	2,091	89.8%	4.3
Yes	237	10.2%	6.3
• Diabetes Complications			
Long Term	1,212	52.1%	5.7
None	97	4.2%	2.4
Short Term	1,019	43.8%	3.2
• Female			
No	1,326	57.0%	4.5
Yes	1,002	43.0%	4.4
• Malignant Cancer			
No	2,297	98.7%	4.4
Yes	31	1.3%	5.8
• Median Household Income			
$0 - 29,989	457	19.6%	4.6
$29,990 – 35,079	475	20.4%	4.4
$35,080 - 39,940	471	20.2%	4.3
$39,941 – 48,580	454	19.5%	4.5
$48,581 +	471	20.2%	4.5

**Cases after LOS exclusions; comparative reference = HMO and fee-for-service combined database*

Diabetes **continued**

Percent Rehospitalized (Rehosp)	**HMO and Fee- for-Service Inpatient Cases* (N = 2,263)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes*™ PredLOS			
0 - 2.763 days	452	20.0%	9.3%
2.764 - 3.568 days	453	20.0%	9.3%
3.569 – 4.603 days	453	20.0%	17.7%
4.604 – 6.192 days	453	20.0%	13.2%
6.193 + days	452	20.0%	22.3%
• Age			
18 – 35 years	420	18.6%	17.9%
36 – 46 years	479	21.2%	16.3%
47 – 53 years	479	21.2%	12.1%
54 – 59 years	446	19.7%	12.1%
60 – 75 years	439	19.4%	13.7%
• Renal Dialysis			
No	2,147	96.1%	13.7%
Yes	89	3.9%	31.5%
• Diabetes Complications—Long Term			
No	1,075	47.5%	11.5%
Yes	1,188	52.5%	16.9%
• Psychological Disorder			
No	2,049	90.5%	13.9%
Yes	214	9.5%	19.2%
• Renal Failure			
No	2,030	89.7%	13.3%
Yes	233	10.3%	23.6%

**Cases after rehospitalization exclusions; comparative reference = HMO and fee-for-service combined database*

LOS	***Rehosp***	***Risk Factors Tested for Length of Stay and % Rehospitalized*** *(S = Significant; NS = Not significant)*
NS	S	• Age
NS	NS	• Age-squared
NS	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes*™ Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
S	NS	• Cardiomyopathy (no, yes; 425.3, 425.4, 425.8, 425.9)
NS	NS	• COPD (491.20, 491.21, 492.0, 492.28, 496, 506.4, 518.2)
—	S	• Diabetes complications—Long term (no, yes; 250.4x – 250.9x)
S	—	• Diabetes complications (long-term: 250.4x – 250.9x; none: 250.00, 250.01, short-term: 250.02, 250.03, 250.1x-250.3x)
S	NS	• Female (no, yes)
S	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• Hypertensive disease (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
NS	NS	• Ischemic heart disease (411 – 414)
S	NS	• Malignant cancer (no, yes; 140.0-208.9, 230.0-239.9)
S	NS	• Median household income (based on zip code)
S	NS	• Lower extremity amputation—non-traumatic (excludes dx codes 895.x, 896.x, 897.x>, p84.10 - 84.17)
S	NS	• Medical DRG
NS	NS	• Poverty rate (based on zip code)
NS	NS	• Obesity (278.00, 278.01)
NS	NS	• Peripheral vascular disease (443.0, 443.1, 443.81, 443.89, 443.9)
NS	S	• Psychological disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
NS	NS	• Race (Black, Other, White)
NS	S	• Renal dialysis (no, yes; V45.1, V56.0, V56.8, p39.95, p54.98)
S	S	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)
NS	NS	• Tobacco use (no, yes; 305.1, V15.82)

Heart Attack (AMI)

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 3,215)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	414	12.9%
45 – 64 years	2,801	87.1%
• Sex		
Female	815	25.3%
Male	2,400	74.7%

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

Average Number of Days Hospitalized (AvgDays)	**Statewide Inpatient Cases* (N = 10,739)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. # Days Hospitalized*
• *Atlas Outcomes*™ PredLOS			
0 - 3.260 days	2,144	20.0%	4.4
3.261 – 3.761 days	2,149	20.0%	5.5
3.762 - 4.282 days	2,151	20.0%	6.1
4.283 - 5.124 days	2,148	20.0%	6.9
5.125 + days	2,147	20.0%	9.7
• Heart Failure			
No	9,181	85.5%	5.9
Yes	1,558	14.5%	10.1
• Renal Failure			
No	10,296	95.9%	6.3
Yes	443	4.1%	10.9
• Race			
Black	745	6.9%	6.8
Other	1,505	14.0%	6.1
White	8,489	79.0%	6.6
• AMI type II (anterior)			
No	8,832	82.2%	6.4
Yes	1,907	17.8%	7.1
• Age			
18 – 46 years	2,118	19.7%	5.5
47 – 51 years	1,933	18.0%	6.0
52 – 56 years	2,441	22.7%	6.4
57 - 60 years	2,282	21.2%	7.1
61 - 64 years	1,965	18.3%	7.5
• Diabetes			
No	8,051	75.0%	6.1
Yes	2,688	25.0%	7.7

**Cases after average number of days hospitalized exclusions; comparative reference = statewide database*

Heart Attack (AMI) continued

In-Hospital Mortality (Mort)	**Statewide Inpatient Cases* (N = 11,286)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Mortality %*
• *Atlas Outcomes*™ PredDeath			
0 - 0.005	1,927	17.1%	0.1%
0.006 - 0.008	1,947	17.3&	0.7%
0.009 - 0.014	3,058	27.1%	1.0%
0.015 - 0.024	2,146	19.0%	1.7%
0.025 +	2,208	19.6%	15.8%
• Renal Failure			
No	10,692	94.7%	3.0%
Yes	594	5.3%	19.2%
• AMI type I (Q-wave)			
No	4,867	43.1%	2.3%
Yes	6,419	56.9%	5.0%
• Cardiomyopathy			
No	10,979	97.3%	3.6%
Yes	307	2.7%	13.7%
• Female			
No	8,233	72.9%	3.1%
Yes	3,053	27.1%	5.8%
• Diabetes			
No	8,394	74.4%	3.3%
Yes	2,892	25.6%	5.4%
• Race			
Black	787	7.0%	3.3%
Other	1,584	14.0%	4.0%
White	8,915	79.0%	3.8%
• Alcohol and Drug Abuse			
No	10,756	95.3%	3.7%
Yes	530	4.7%	5.7%
• Age			
18 – 46 years	2,173	19.3%	2.0%
47 – 51 years	1,992	17.7%	2.3%
52 – 57 years	3,161	28.0%	3.8%
58 - 60 years	1,824	16.2%	4.8%
61 - 64 years	2,136	18.9%	6.4%
• *Age-squared*			

**Cases after in-hospital mortality exclusions; comparative reference = statewide database.*

Mort	*AvgDays*	***Risk Factors Tested for Average # of Days and In-Hospital Mortality** (S = Significant; NS = Not significant)*
S	S	• Age
NS	S	• Age-squared
NS	S	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
NS	S	• AMI type I (no, yes; Q-wave – 410.x1 except 410.71, non-Q-wave – 410.71)
S	NS	• AMI type II (no, yes; anterior – 410.01, 410.11, non-anterior – 410.x1, x=2-9)
S	NS	• *Atlas Outcomes*™ Predicted length of stay (MqPredLOS)
NS	S	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	S	• Cardiomyopathy (no, yes; 425.3, 425.4, 425.8, 425.9)
S	S	• Diabetes (no, yes; 250.0x-250.9x)
NS	S	• Female (no, yes)
S	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• History of CABG (no, yes; V45.81, 414.02, 414.03, 414.04, 414.05, 996.03)
NS	NS	• Hypertensive disease (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
NS	NS	• Median household income (based on zip code)
NS	NS	• Obesity (no, yes; 278.00, 278.01)
NS	NS	• Poverty rate (based on zip code)
NS	NS	• Psychological disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
S	S	• Race (Black, Other, White)
NS	NS	• Renal dialysis (no, yes; V45.1, V56.0, V56.8, p39.95, p54.98)
S	S	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)
NS	NS	• Tobacco use (no, yes; 305.1, V15.82)

Hysterectomy

Cases age 18 through 64

Total Hysterectomy Procedures

Hospitalization Rate	HMO Inpatient Cases* (N = 8,412)	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	4,284	50.9%
45 – 64 years	4,128	49.1%

Cases after hospitalization rate exclusions comparative reference = HMO database

Hysterectomy—Abdominal

Hospitalization Rate	HMO Inpatient Cases* (N = 8,412)	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	2,941	49.7%
45 – 64 years	2,978	50.3%

Cases after hospitalization rate exclusions comparative reference = HMO database

Length of Stay (LOS)	Statewide Inpatient Cases* (N =14,474)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.248 days	2,889	20.0%	2.7
2.249 – 2.350 days	2,796	19.3%	2.7
2.351 – 2.469 days	3,005	20.8%	2.7
2.470 – 2.723 days	2,890	20.0%	2.9
2.724 + days	2,894	20.0%	3.3
• Race			
Black	1,635	11.3%	3.3
Other	1,800	12.4%	3.0
White	11,039	76.3%	2.8
• Renal Failure			
No	14,448	99.8%	2.9
Yes	26	0.2%	5.2
• Age			
18 – 37 years	2,598	17.9%	2.8
38 – 41 years	2,488	17.2%	2.8
42 – 46 years	4,277	29.5%	2.8
47 - 50 years	2,679	18.5%	2.9
51 - 64 years	2,432	16.8%	3.0
• Age-squared			
• Poverty Rate			
0 – 4.9157%	2,885	19.9%	2.8
4.9158 - 7.9468%	2,923	20.2%	2.8
7.9469 - 10.8612%	2,881	19.9%	2.8
10.8613 - 15.7390%	2,905	20.1%	2.9
15.7391% +	2,880	19.9%	3.1
• Heart Failure			
No	14,434	99.7%	2.9
Yes	40	0.3%	4.3
• Obesity			
No	13,987	96.6%	2.8
Yes	487	3.4%	3.1
• Radical Hysterectomy			
No	14,458	99.9%	2.9
Yes	16	0.1%	3.5
• Principal Diagnosis Group			
Bleeding/Other	4,871	33.7%	2.9
Fibroids/Hyperplasia/Endometriosis/ Uterine prolapse	9,603	66.3%	2.9
• Alcohol and Drug Abuse			
No	14,413	99.6%	2.9
Yes	61	0.4%	3.4

Cases after LOS exclusions comparative reference = statewide database

Hysterectomy—Abdominal *continued*

In-Hospital Complications (Compl)	Statewide Inpatient Cases* (N = 14,523)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Complications %*
• *Atlas Outcomes*™ PredLOS			
0 – 2.251 days	2,900	20.0%	9.6%
2.252 – 2.350 days	2,793	19.2%	9.7%
2.351 – 2.470 days	3,060	21.1%	9.2%
2.471 – 2.727 days	2,871	19.8%	12.3%
2.728 + days	2,899	20.0%	14.6%
• Race			
Black	1,645	11.3%	16.9%
Other	1,813	12.5%	12.0%
White	11,065	76.2%	10.0%
• Age			
18 – 37 years	2,604	17.9%	10.8%
38 – 41 years	2,496	17.2%	11.3%
42 – 46 years	4,291	29.5%	11.1%
47 - 50 years	2,686	18.5%	11.1%
51 - 64 years	2,446	16.8%	11.0%
• Heart Failure			
No	14,476	99.7%	11.0%
Yes	47	0.3%	36.2%
• Poverty Rate			
0 - 4.9326%	2,904	20.0%	10.4%
4.9327 - 7.9468%	2,924	20.1%	11.1%
7.9469 - 10.8761%	2,884	19.9%	9.6%
10.8762 - 15.7390%	2,915	20.1%	9.9%
15.7391% +	2,896	19.9%	14.3%

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

LOS	*Compl*	***Risk Factors Tested for Length of Stay and Complications %*** *(S = Significant; NS = Not significant)*
S	S	• Age
S	NS	• Age-squared
S	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes*™ Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	NS	• Diabetes (no, yes; 250.0x-250.9x)
S	S	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• History of female reproductive cancer (no, yes; V10.40-10.44)
NS	NS	• Hypertensive disease (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
		• Laparoscopic procedure (no, yes; 68.51)
NS	NS	• Median household income (based on zip code)
S	NS	• Obesity (no, yes; 278.00, 278.01)
S	S	• Poverty rate (based on zip code)
S	NS	• Principal diagnosis groupings (fibroids/hyperplasia/endometriosis/uterine prolapse – 218.x, 621.2, 621.3, 617.x, 618.1-618.4, bleeding abnormalities & other principal diagnosis – 626.2-626.9, 627.0, 627.1)
NS	NS	• Psychological disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
S	S	• Race (Black, Other, White)
S	NS	• Radical hysterectomy (no, yes; 68.6, 68.7)
S	NS	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)

Hysterectomy—Vaginal

Hospitalization Rate	**HMO Inpatient Cases***	**(N = 2,493)**
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	1,343	53.9%
45 – 64 years	1,150	46.1%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases***	**(N =6,337)**	
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Age			
18 – 36 years	1,254	19.8%	1.8
37 – 40 years	1,040	16.4%	1.8
41 – 45 years	1,565	24.7%	1.8
46 - 51 years	1,327	21.0%	1.9
52 - 64 years	1,145	18.1%	2.1
• Laparoscopic Procedure			
No	4,445	70.2%	2.0
Yes	1,886	29.8%	1.7
• Principal Diagnosis Group			
Bleeding/Other	2,187	34.5%	1.8
Fibroids/Hyperplasia/Endometriosis/ Uterine prolapse	4,144	65.5%	1.9
• Age-squared			
• Race			
Black	396	6.3%	2.0
Other	687	10.9%	1.9
White	5,248	82.9%	1.9
• *Atlas Outcomes™* PredLOS			
0 – 2.092 days	1,251	19.8%	1.9
2.093 – 2.248 days	1,279	20.2%	1.8
2.249 – 2.350 days	1,271	20.1%	1.8
2.351 – 2.513 days	1,270	20.1%	1.9
2.514 + days	1,260	19.9%	2.0
• Hypertensive Disease			
No	5,670	89.6%	1.9
Yes	661	10.4%	2.0
**Cases after LOS exclusions comparative reference = statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases***	**(N = 6,337)**	
Significant Variable	*Number of Cases*	*Percent of Total*	*Complications %*
• Poverty Rate			
0 - 4.9079%	1,266	20.0%	6.1%
4.9080 - 7.5823%	1,264	19.9%	5.6%
7.5824 - 10.2538%	1,266	20.0%	5.8%
10.2539 - 14.0143%	1,274	20.1%	6.4%
14.0144% +	1,267	20.0%	9.6%
• Principal Diagnosis Group			
Bleeding/Other	2,188	34.5%	5.1%
Fibroids/Hyperplasia/ endometriosis/uterine prolapse	4,149	65.5%	7.5%
• *Atlas Outcomes™* PredLOS			
0 – 2.093 days	1,267	20.0%	6.7%
2.094 – 2.248 days	1,264	19.9%	5.4%
2.249 – 2.351 days	1,322	20.9%	5.1%
2.352 – 2.513 days	1,221	19.3%	6.8%
2.514 + days	1,263	19.9%	9.5%
• Race			
Black	397	6.3%	11.3%
Other	689	10.9%	5.4%
White	5,251	82.9%	6.5%
**Cases after in-hospital complications exclusions; comparative reference = statewide database*			

Hysterectomy—Vaginal *continued*

LOS	***Compl***	***Risk Factors Tested for Length of Stay and Complications %*** *(S = Significant; NS = Not significant)*
S	NS	• Age
S	NS	• Age-squared
NS	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes*™ Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	NS	• Diabetes (no, yes; 250.0x-250.9x)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• History of female reproductive cancer (no, yes; V10.40-10.44)
S	NS	• Hypertensive disease (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
S	—	• Laparoscopic procedure (no, yes; 68.51)
NS	NS	• Median household income (based on zip code)
NS	NS	• Obesity (no, yes; 278.00, 278.01)
NS	S	• Poverty rate (based on zip code)
S	S	• Principal diagnosis groupings (fibroids/hyperplasia/endometriosis/uterine prolapse – 218.x, 621.2, 621.3, 617.x, 618.1-618.4, bleeding abnormalities & other principal diagnosis – 626.2-626.9, 627.0, 627.1)
NS	NS	• Psychological disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
S	S	• Race (Black, Other, White)
NS	NS	• 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

Cases age 18 through 64

Total Breast Cancer Procedures

Hospitalization Rate	HMO Inpatient Cases* (N =2,832)	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	622	22.0%
45 – 64 years	2,210	78.0%

Cases after hospitalization rate exclusions; comparative reference = HMO database

Breast Cancer Procedures—Lumpectomy

Hospitalization Rate	HMO Inpatient Cases* (N = 2,049)	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	429	20.9%
45 – 64 years	1,620	79.1%

Cases after hospitalization rate exclusions; comparative reference = HMO database

Length of Stay (LOS)	Statewide Inpatient Cases* (N =945)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Reconstruction--Concurrent			
No	935	98.9%	1.2
Yes	10	1.1%	2.4
• *Atlas Outcomes*™ PredLOS			
0 – 1.689 days	189	20.0%	1.2
1.690 – 1.797 days	180	19.0%	1.1
1.798 – 1.904 days	204	21.6%	1.1
1.905 – 2.055 days	185	19.6%	1.2
2.056 + days	187	19.8%	1.3
• Median Household Income			
$0 – 32,069	189	20.0%	1.3
$32,070 – 39,139	189	20.0%	1.2
$39,140 – 49,300	181	19.2%	1.2
$49,301 – 58,870	198	21.0%	1.1
$58,871 +	188	19.9%	1.1
• Subtotal Mastectomy			
No	535	56.6%	1.2
Yes	410	43.4%	1.1
• Age			
18 – 43 years	169	17.9%	1.2
44 – 48 years	192	20.3%	1.1
49 – 54 years	233	24.7%	1.2
55 – 59 years	181	19.2%	1.2
60 – 64 years	170	18.0%	1.2

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

In-Hospital Complications (Compl)	Statewide Inpatient Cases* (N = 951)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Complication %*
• *Atlas Outcomes*™ PredLOS			
0 – 1.692 days	190	20.0%	2.1%
1.693 – 1.797 days	179	18.8%	1.7%
1.798 – 1.904 days	205	21.6%	2.9%
1.905 – 2.059 days	187	19.7%	2.7%
2.060 + days	190	20.0%	4.2%
• Breast Cancer Type			
In situ	41	4.3%	9.8%
Malignant Neoplasm	604	63.5%	1.8%
Metastatic Cancer	306	32.2%	3.6%
• Reconstruction--Concurrent			
No	940	98.8%	2.6%
Yes	11	1.2%	18.2%

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

Breast Cancer Procedures—Lumpectomy *continued*

LOS	*Compl*	***Risk Factors Tested for Length of Stay and In-hospital Complications*** *(S = Significant; NS = Not significant)*
S	NS	• Age
NS	NS	• Age-squared
NS	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes*™ Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	S	• Breast Cancer Type (malignant – 174.0-174.9, 238.3, 239.3, in situ – 233.0, metastatic – 196.3, 198.2, 198.81)
NS	NS	• Diabetes (no, yes; 250.0x-250.9x)
NS	NS	• Family history of breast cancer (V16.3)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• History of breast cancer (V10.3)
NS	NS	• Hypertensive disease (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
S	NS	• Median household income (based on zip code)
NS	NS	• Obesity (no, yes; 278.00, 278.01)
NS	NS	• Poverty rate (based on zip code)
NS	NS	• Procedure type (lumpectomy - p85.20-85.22, 19112, 19120, 19125, 19126, subtotal mastectomy – p85.23, 19160, 19162)
NS	NS	• Psychological Disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
NS	NS	• Race (Black, Other, White)
S	S	• Reconstruction—concurrent (p85.50-85.54, 85.7, 85.82-85.87, 85.93, 85.96)
NS	NS	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)
S	NS	• Subtotal Mastectomy (no, yes; p85.23, 19160, 19162)

Breast Cancer Procedures—Mastectomy

Hospitalization Rate	**HMO Inpatient Cases* (N =783)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	193	24.6%
45 – 64 years	590	75.4%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 2,120)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Reconstruction--Concurrent			
No	1,498	70.7%	1.8
Yes	622	29.3%	3.9
• *Atlas Outcomes™* PredLOS			
0 – 1.712 days	417	19.7%	2.0
1.713 – 1.823 days	426	20.1%	2.4
1.824 – 1.942 days	429	20.2%	2.3
1.943 – 2.142 days	425	20.0%	2.6
2.143 + days	423	20.0%	2.9
• Race			
Black	177	8.3%	2.9
Other	305	14.4%	2.4
White	1,638	77.3%	2.4
• Age			
18 – 43	391	18.4%	2.7
44 – 49	448	21.1%	2.6
49 – 53	438	20.7%	2.4
54 – 58	423	20.0%	2.3
59 – 64	420	19.8%	2.2
• Family History of Breast Cancer			
No	2,020	95.3%	2.4
Yes	100	4.7%	2.8
• Breast Cancer Type			
In situ	325	15.3%	2.5
Malignant Neoplasm	1,130	53.3%	2.4
Metastatic Cancer	665	31.4%	2.4
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 2,127)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Complication %*
• Reconstruction--Concurrent			
No	1,502	70.6%	4.1%
Yes	625	29.4%	9.4%
• Age			
18 – 43	391	18.4%	3.6%
44 – 49	449	21.1%	6.9%
49 – 53	444	20.9%	5.6%
54 – 58	423	19.9%	5.9%
59 – 64	420	19.7%	6.2%
• Median Household Income			
$0 – 32,549	424	19.9%	6.1%
$32,550 – 38,539	427	20.1%	6.1%
$38,540 – 46,520	431	20.3%	6.0%
$46,521 – 54,470	423	19.9%	4.5%
$54,471 +	422	19.8%	5.7%
** Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

Breast Cancer Procedures—Mastectomy *continued*

LOS	*Compl*	***Risk Factors Tested for Length of Stay and In-hospital Complications*** *(S = Significant; NS = Not significant)*
S	S	• Age
NS	NS	• Age-squared
NS	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	NS	• *Atlas Outcomes™* Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes™* Predicted probability of death (MqPredDeath)
S	NS	• Breast Cancer Type (malignant – 174.0-174.9, 238.3, 239.3, in situ – 233.0, metastatic – 196.3, 198.2, 198.81)
NS	NS	• Diabetes (no, yes; 250.0x-250.9x)
S	NS	• Family history of breast cancer (no, yes; V16.3)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• History of breast cancer (no, yes; V10.3)
NS	NS	• Hypertension (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
NS	S	• Median household income (based on zip code)
NS	NS	• Obesity (no, yes; 278.00, 278.01)
NS	NS	• Poverty rate (based on zip code)
NS	NS	• Procedure groupings (simple mastectomy – p85.41-85.44, 19180, radical mastectomy – p85.45-85.48, 19200, 19220, 19240)
NS	NS	• Psychological Disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
S	NS	• Race (Black, Other, White)
S	S	• Reconstruction – concurrent (no, yes; p85.50-85.54, 85.7, 85.82-85.87, 85.93, 85.96)
NS	NS	• 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

Cases age 18 through 64

Total Neck and Back Procedures

Hospitalization Rate	HMO Inpatient Cases* (N =5,322)	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	2,291	43.0%
45 – 64 years	3,031	57.0%
• Sex		
Female	2,596	48.8%
Male	2,726	51.2%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Neck and Back Procedures With Fusion

Hospitalization Rate	HMO Inpatient Cases* (N = 1,810)	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	712	39.3%
45 – 64 years	1,098	60.7%
• Sex		
Female	987	54.5%
Male	823	45.5%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	Statewide Inpatient Cases* (N = 6,064)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Fusion Location			
Cervical/atlas-axis	4,132	6	1.7
Dorsal & dorsolumbar	62	1.0%	4.9
Lumbar & lumbosacral	1,870	30.8%	3.9
• *Atlas Outcomes*™ PredLOS			
0 – 1.662 days	1,212	20.0%	1.7
1.663 – 1.918 days	1,211	20.0%	1.9
1.919 – 2.258 days	1,219	20.1%	2.1
2.259 – 2.634 days	1,212	20.0%	2.5
2.635 + days	1,210	20.0%	3.7
• Poverty Rate			
0 – 4.8334%	1,216	20.1%	2.4
4.8335 – 7.7658%	1,216	20.1%	2.3
7.7659 – 10.6063%	1,203	19.8%	2.3
10.6064 – 13.3082%	1,214	20.0%	2.3
13.3083% +	1,215	20.0%	2.7
• Fusion Technique			
Anterior	4,334	71.5%	1.8
Multiple	276	4.6%	3.3
Posterior/Lateral	1,454	24.0%	4.0
• Race			
Black	284	4.7%	3.1
Other	719	11.9%	2.6
White	5,061	83.5%	2.3
• Psychological Disorder			
No	5,504	90.8%	2.4
Yes	560	9.2%	2.8
• Procedure Groupi			
Both discetomy and laminectomy	146	2.4%	3.7
Discectomy	5,441	89.7%	2.2
Laminectomy	477	7.9%	3.9
• Diabetes			
No	5,632	92.9%	2.3
Yes	432	7.1%	3.0
• Alcohol & Drug Abuse			
No	5,988	98.7%	2.4
Yes	76	1.3%	3.3
• Principal Diagnosis Groupi			
Disc degeneration	531	8.8%	3.4
Disc displacement	3,324	54.8%	2.0
Narrowing of the spinal canal	1,703	28.1%	2.9
Other disc disorders	506	8.3%	2.5
**Cases after LOS exclusions; comparative reference = Statewide database*			

Neck and Back Procedures With Fusion continued

In-Hospital Complications (comp)	**Statewide Inpatient Cases* (N = 6,091)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Complication %*
• Fusion Location			
Cervical/atlas-axis	4,144	68.0%	2.8%
Dorsal & dorsolumbar	65	1.1%	21.5%
Lumbar & lumbosacral	1,882	30.9%	14.9%
• Age			
18 – 37 years	1,149	18.9%	6.8%
38 – 42 years	1,121	18.4%	5.2%
43 – 48 years	1,499	24.6%	5.2%
49 – 54 years	1,177	19.3%	7.0%
55 – 64 years	1,145	18.8%	9.8%
• *Poverty Rate*			
0 – 4.8334%	1,223	20.1%	5.9%
4.8335 – 7.7658%	1,219	20.0%	6.0%
7.7659 – 10.6063%	1,206	19.8%	6.8%
10.6064 – 13.3601%	1,227	20.1%	6.3%
13.3602% +	1,216	20.0%	8.6%
• *Atlas Outcomes*™ PredLOS			
0 – 1.662 days	1,212	19.9%	4.0%
1.663 – 1.921 days	1,221	20.0%	5.2%
1.922 – 2.263 days	1,222	20.1%	4.7%
2.264 – 2.638 days	1,220	20.0%	6.9%
2.639 + days	1,216	20.0%	12.7%
• COPD			
No	5,956	97.8%	6.5%
Yes	135	2.2%	14.8%
• Age-squared			

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

LOS	*Comp*	***Risk Factors Tested for Length of Stay and In-hospital Complications** (S = Significant; NS = Not significant)*
NS	S	• Age
NS	S	• Age-squared
S	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes*™ Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	NS	• Cancer (malignant/in situ – 140.0-208.9, 230.0-239.9, history – V10.00-10.9)
NS	S	• COPD (yes, no; 491.20, 491.21, 492.0, 492.28, 496, 506.4, 518.2)
S	NS	• Diabetes (no, yes; 250.0x-250.9x)
NS	NS	• Female (no, yes)
S	S	• Fusion Location (cervical/atlas-axis – p81.00, 81.01, 81.02, 81.03, dorsal & dorsolumbar – p81.04, 81.05, lumbar & lumbosacral – p81.06, 81.07, 81.08)
S	NS	• Fusion Technique (anterior – p81.00, 81.01, 81.02, 81.04, 81.06, posterior/lateral – p81.03, 81.05, 81.07, 81.08, multiple – 2 or more codes)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• Hypertension (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
NS	NS	• Median household income (based on zip code)
NS	NS	• Musculoskeletal disorders (no, yes; 274.xy, 710.0x, 712.xy, 713.x, 714.xy, 715.xy, 733.0x, V43.6x)
NS	NS	• Obesity (278.00, 278.01)
S	S	• Poverty rate (based on zip code)
S	NS	• 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)
S	NS	• Procedure group (discectomy – p80.50, 80.51, 80.59, laminectomy – p03.09, discectomy & laminectomy – p80.50, 80.51 or 80.59 & 03.09)
S	NS	• Psychological Disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
S	NS	• Race (Black, Other, White)
NS	NS	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)
NS	NS	• Tobacco use (no, yes; 305.1, V15.82)

Neck and Back Procedures Without Fusion

Hospitalization Rate	**HMO Inpatient Cases* (N = 3,512)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	1,579	45.0%
45 – 64 years	1,933	55.0%
• Sex		
Female	1,609	45.8%
Male	1,903	54.2%

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

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 11,080)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes*™ PredLOS			
0 – 1.576 days	2,209	19.9%	1.2
1.577 – 1.778 days	2,220	20.0%	1.3
1.779 – 2.033 days	2,228	20.1%	1.4
2.034 – 2.491 days	2,209	19.9%	1.7
2.492 + days	2,214	20.0%	2.9
• Age			
18 – 35 years	2,149	19.4%	1.4
36 – 41 years	2,075	18.7%	1.6
42 – 48 years	2,493	22.5%	1.6
49 – 55 years	2,171	19.6%	1.8
56 – 64 years	2,192	19.8%	2.2
• Race			
Black	464	4.2%	2.5
Other	1,568	14.2%	1.7
White	9,048	81.7%	1.7
• Female			
No	6,368	57.5%	1.6
Yes	4,712	42.5%	1.8
• Procedure Group			
Both discetomy and laminectomy	698	6.3%	1.9
Discectomy	7,941	71.7%	1.6
Laminectomy	2,441	22.0%	2.2
• Psychological Disorder			
No	10,364	93.5%	1.7
Yes	716	6.5%	2.2
• Principal Diagnosis Group			
Disc degeneration	112	1.0%	2.4
Disc displacement	8,335	75.2%	1.6
Narrowing of spinal canal	2,363	21.3%	2.2
Other disc disorders	270	2.4%	2.4
• Poverty Rate			
0 – 4.5651%	2,197	19.8%	1.6
4.5652 – 7.6401%	2,231	20.1%	1.8
7.6402 – 10.2106%	2,219	20.0%	1.6
10.2107 – 13.2726%	2,219	20.0%	1.7
13.2727% +	2,214	20.0%	1.9
• Diabetes			
No	10,199	92.0%	1.7
Yes	881	8.0%	2.4
• Musculoskeletal Disorders			
No	10,639	96.0%	1.7
Yes	441	4.0%	2.2

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

Neck and Back Procedures Without Fusion *continued*

In-Hospital Complications (comp)	Statewide Inpatient Cases* (N = 11,097)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Complication %*
• *Atlas Outcomes*™ PredLOS			
0 – 1.576 days	2,209	19.9%	2.1%
1.577 – 1.779 days	2,228	20.1%	3.3%
1.780 – 2.033 days	2,223	20.0%	3.5%
2.034 – 2.493 days	2,218	20.0%	5.5%
2.494 + days	2,219	20.0%	6.9%
• Median Household Income			
$0 – 32,669	2,221	20.0%	5.3%
$32,670 – 37,209	2,186	19.7%	4.3%
$37,210 – 44,020	2,260	20.4%	4.8%
$44,021 – 52,620	2,109	19.0%	3.9%
$52,621 +	2,231	20.9%	3.0%
• Procedure Groupings			
Both discetomy and laminectomy	700	6.3%	5.7%
Discectomy	7,948	71.6%	3.4%
Laminectomy	2,449	22.1%	6.7%
• Age			
18 – 35 years	2,150	19.4%	2.5%
36 – 41 years	2,076	18.7%	4.0%
42 – 48 years	2,497	22.5%	3.8%
49 – 55 years	2,174	19.6%	4.7%
56 - 64 years	2,200	19.8%	6.3%

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

LOS	*Compl*	***Risk Factors Tested for Length of Stay and In-hospital Complications*** *(S = Significant; NS = Not significant)*
S	S	• Age
NS	NS	• Age-squared
NS	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	S	• *Atlas Outcomes*™ Predicted length of stay (MqPLOS)
NS	NS	• *Atlas Outcomes*™ Predicted probability of death (MqPredDeath)
NS	NS	• Cancer (malignant/in situ 140.0-208.9, 230.0-239.9, history – V10.00-10.9)
NS	NS	• Chronic Obstructive Pulmonary Disorder - COPD (no, yes; 491.20, 491.21, 492.0, 492.28, 496, 506.4, 518.2)
S	NS	• Diabetes (no, yes; 250.0x-250.9x)
S	NS	• Female (no, yes)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• Hypertension (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
NS	S	• Median household income (based on zip code)
S	NS	• Musculoskeletal disorders (no, yes; 274.xy, 710.0x, 712.xy, 713.x, 714.xy, 715.xy, 733.0x, V43.6x)
NS	NS	• Obesity (278.00, 278.01)
S	NS	• Poverty rate (based on zip code)
S	NS	• 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)
S	S	• Procedure group (discectomy – p80.50, 80.51, 80.59, laminectomy – p03.09, discectomy & laminectomy – p80.50, 80.51 or 80.59 & 03.09)
S	NS	• Psychological Disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
S	NS	• Race (Black, Other, White)
NS	NS	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)
NS	NS	• Tobacco use (no, yes; 305.1, V15.82)

Prostatectomy

Cases age 18 through 64

Hospitalization Rate	HMO Inpatient Cases* (N = 855)	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	6	0.7%
45 – 64 years	849	99.3%
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	Statewide Inpatient Cases* (N = 2,163)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 –2.507 days	424	19.6%	3.2
2.508 – 2.646 days	440	20.3%	3.1
2.647 – 2.746 days	437	20.2%	3.1
2.747 – 2.924 days	435	20.1%	3.3
2.925 + days	427	19.7%	3.7
• Median Household Income			
$0 – 32,599	431	19.9%	3.4
$32,600 – 38,589	437	20.2%	3.4
$38,590 – 46,440	431	19.9%	3.2
$46,441 – 52,020	434	20.1%	3.3
$52,021+	430	19.9%	3.1
• Race			
Black	178	8.2%	3.7
Other	420	19.4%	3.2
White	1,565	72.4%	3.3
• Diabetes			
No	1,979	91.5%	3.3
Yes	184	8.5%	3.6
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	Statewide Inpatient Cases* (N = 2,167)		
Significant Variable	*Number of Cases*	*Percent of Total*	*Complication %*
• Median Household Income			
$0 – 32,599	433	20.0%	11.1%
$32,600 – 38,539	434	20.0%	10.6%
$38,540 – 46,440	435	20.1%	11.0%
$46,441 – 55,020	434	20.0%	9.9%
$55,021 +	431	19.9%	8.8%
** Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

LOS	*Comp*	***Risk Factors Tested for Length of Stay and In-hospital Complications*** *(S = Significant; NS = Not significant)*
NS	NS	• Age
NS	NS	• Age-squared
NS	NS	• Alcohol & drug abuse (no, yes; 291.x, 292.0, 292.82, 303.xy, 304.xy, 305xy except 305.1, 357.5, 425.5, 535.3x, 571.0-571.3, 980.0, 980.9, V11.3)
S	NS	• *Atlas Outcomes™* Predicted length of stay (MqPredLOS)
NS	NS	• *Atlas Outcomes™* Predicted probability of death (MqPredDeath)
NS	NS	• COPD (no, yes; 491.20, 491.21, 492.0, 492.28, 496, 506.4, 518.2)
S	NS	• Diabetes (no, yes; 250.0x-250.9x)
NS	NS	• Female (no, yes)
NS	NS	• Heart failure (no, yes; 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0-428.9)
NS	NS	• Hypertension (no, yes; 401.x, 402.x0, 403.x0, 404.x0, 405.xy)
S	S	• Median household income (based on zip code)
NS	NS	• Musculoskeletal disorders (274.xy, 710.0x, 712.xy, 713.x, 714.xy, 715.xy, 733.0x, V43.6x)
NS	NS	• Obesity (no, yes; 278.00, 278.01)
NS	NS	• 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)
NS	NS	• Poverty rate (based on zip code)
NS	NS	• Psychological Disorder (no, yes; 295.xy, 296.xy, 297.x, 298.x, 299.xy, 300.xy, 301.xy, 309.xy, 310.x, 311, 312.xy)
S	NS	• Race (Black, Other, White)
NS	NS	• Renal failure (no, yes; 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5 – 584.9, 585, 586)